

# The Economics and Psychology of Personality Traits in China: Evidence from a Longitudinal Twin Study in Yunnan Province

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## **Abstract**

This paper explores the unique structures, formation mechanism, and economic impacts of personality traits in China. Using a longitudinal twin dataset in Yunnan Province, we reach the following conclusions: (1) We find evidence for orthogonality in reporting socially desirable and undesirable traits in China, leading to a failure of the Five Factor Model. We detect a unique dialectical 6-factor personality structure in which three desirable and three undesirable traits coexist in an orthogonal manner. Desirable traits can be decomposed into Social Desirability, Extraversion and Openness, and undesirable traits into Disorderliness, Neuroticism and Introversion. (2) The genetic heritability of personality trait is significantly lower in China than Western countries, and the effect of shared environment is much larger. Nurture may dominate nature in Chinese personality. (3) Using a within-twin design, we show that personality has a significant causal effect on individual economic outcomes and preferences, including education performance, income, subjective well-being and risk attitudes. Specifically, we find evidence that Social Desirability is associated to lower income and Extraversion is associated to higher income, especially for women.

*"Whether a man is Junzi (Superior) or Xiaoren (Inferior) is not constant. Doing good makes him Junzi and doing bad makes him Xiaoren."* – Li Shimin, Founder of Tang Dynasty

*"Man on earth, good at birth. The same nature, varies on nurture."* – The Three-Character Canon, Chinese Classic

*"Character is destiny."* – Heraclitus, Greek Philosopher

*"Their hearts being rectified, their personalities were cultivated. Their personalities being cultivated, their families were regulated. Their families being regulated, their states were rightly governed. Their states being rightly governed, the whole kingdom was made tranquil and happy."* – The Great Learning, Chinese Classic

# 1 Introduction

Is personality a key determinant of lifelong economic outcomes? Though having been asked for thousands of years in both the West and the East, the question about how personality impacts life outcomes remains a fresh topic. With the development of interdisciplinary methodology, economists have now taken personality into increasingly serious account and gained intense interest in studying the intersection of personality and economic behaviors. <sup>1</sup>

Systematic study on this topic, as related literature (Borghans et al., 2008; Almlund et al., 2011; Heckman et al., 2019) suggest, involves progress on the following issues:

- (1) Understanding personality structure, including measurements of personality, separation of personality from cognitive skills, reliability and validity tests, etc.
- (2) Understanding personality formation and development, including studying the life-long stability and genetic heritability of personality, and to what extent personality can be influenced by investment and interference.
- (3) Understanding the "ceteris paribus" causal effect of personality on economic behaviors, including preferences, choices and outcomes, and therefore quantifying the importance of personality-related enrichment for current economic models and policy.

These three aspects can be briefly summarized as "structures, formation and impacts" of personality. In this paper, we study these questions in China. We are the first to comprehensively study the economics of personality traits in China, and the first to incorporate cultural psychology to the economic research of personality traits.

This paper studies the economics and psychology of personality traits in China with a cross-cultural perspective. Previously, most personality studies, especially the intersection of personality and economics, were taken place in "WEIRD" (Western, Educated, Industrialized, Rich and Democratic) countries, and it is widely argued that such findings may be less universal in Eastern culture or developing countries (Nisbett et al., 2001; Henrich et al., 2010a,b; Heine, 2015; Laajaj et al., 2019). Therefore, when studying personality problems in China, we expect various cultural, psychological and economic

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<sup>1</sup>As Nobel Prize Laureate James Heckman and peers documents, *"There is a lot of room for cooperation and exchange of findings and methods between personality psychology and economics, ... , Personality traits are predictive of socioeconomic success. They can be influenced by interventions and investment more readily than IQ, at least after the early years. A deeper understanding of personality traits promises to enrich economic theory and to understand the sources of, and solutions for, human inequality,"* (Borghans et al., 2008; Almlund et al., 2011)

reasons to doubt that typical Western findings and models <sup>2</sup> will still hold in China. Even current studies in Japan or Korea is not sufficient; when we come to the intersection of personality and economics, the crucially different economic development level, political institutions and social expectations may still make China distinctive. Furthermore, personality data is much less prevalent and systematically measured in China than the West or Japan, resulting in a large gap on understanding of this topic.

The importance of enriching economic models by personality psychology, the lack of local studies, and the crucial cultural and socioeconomic distinction, jointly highlight the necessity of a comprehensive study of personality and economics in China. <sup>3</sup>

Conceptually, personality structures in China might differ substantially between China and other countries, especially the WEIRD ones. First, self construal in China is interdependent (Markus and Kitayama, 1991; Kitayama and Markus, 1999), meaning that self-concepts are built by social roles and relationships, in contrast to the independent self that is typical in Western culture. The interdependent self comes from social expectations and conditions that expect people's behaviors are highly flexible, fitting in different scenarios. This is fundamentally different from the West where people are expected to have self-consistency across situations (Nisbett et al., 2001; Nisbett, 2004; Kanagawa et al., 2001), and systematically impacts the formation of personality structures and response to assessments (Schmitt et al., 2007). <sup>4</sup> Specifically, Nisbett (2004) argues that, Barnum effects (the tendency to report high in all questions) are much more prevalent for East Asians than Western people. This is because East Asians may comfortably report high in questions that have some opposite meaning, but similar responses will "appear improbable, illogical, or even irrational in most Western nations" (Spencer-Rodgers et al., 2004, 2010b). In other words, East Asians' self concepts are relatively flexible; they do not see a necessary contradiction between "A" and "not A" in themselves. In self-reports of esteem (Choi and Choi, 2002), self-concepts (Spencer-Rodgers et al., 2004, 2009; Boucher, 2011), and emotions (Spencer-Rodgers et al., 2010a; Miyamoto and Ryff, 2011; An et al., 2017), the dialectical thoughts are relatively common for East Asians. Dialectical responses will significantly impact the correlation structures of the items; for instance, if people reply to a regular item (such as "I am talkative") and a reversed item (such as "I am quiet")

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<sup>2</sup>These parts will be summarized in the following parts of the paper.

<sup>3</sup>Details of historical perspectives are discussed in the appendix.

<sup>4</sup>This social expectation effect fits in the theory of Rosenthal Effect, or Pygmalion Effect (Rosenthal and Rubin, 1982))

with zero or even positive correlation, the personality constructs are essentially different. These cultural psychological properties are crucial to understand the dynamics of personality in China, and leads to the first part of our study in which we assess the use of existing tools for personality assessments from a cross-cultural perspective.

Lay beliefs of ancient China also advocate for dialectical personality. Chinese people believe that the elements of "Junzi" (Good) and "Xiaoren" (Bad) may exist simultaneously in every person, and whether an individual is "Junzi" or "Xiaoren" is dependent on her choice at certain situations. A famous quote by Li Shimin (The first Emperor of Tang Dynasty) says: "Whether a man is Junzi or Xiaoren is not constant. Doing good makes him Junzi and doing bad makes him Xiaoren." This indicates that in ancient China, it is widely perceived that the elements of positive and negative traits are dwelling in the same individual, and they can coexist in harmony. This is a typical representation of a more flexible, situation-based self concept versus a consistent, situation-independent one in the West ([Kanagawa et al., 2001](#); [Spencer-Rodgers et al., 2009](#)).

In the developed world, The Five Factor Model (FFM) <sup>5</sup> is the most well accepted methodology to describe personality. These factors are often referred to as the Big Five Personality Traits. The FFM states that human personalities can be characterized using five relatively independent factors: Openness to Experience, Conscientiousness, Extraversion, Agreeableness and Neuroticism (Emotional Stability). In the past few decades, most research in the West and Japan suggests a consistent validity of the Big Five Personality structure. However, deviance from the Big Five is not a anomaly in developing countries. ([Yoon et al., 2002](#); [Laajaj et al., 2019](#)).

In China, evidence favoring and challenging the Big Five is mixed. [Yang et al. \(1999\)](#) studied the NEO-PI-R (a typically used version of the Big Five questionnaires), and found that the five-factor structure is recovered within a large psychiatric sample in China, and many projects follow this setup and keep using the Big Five in China. However, there exist considerably many studies showing that the Big Five structures are missing, or it is necessary to add China-specific traits ([Cheung and Leung, 1998](#); [Cheung et al., 2001, 2003](#); [Zhou et al., 2009](#); [Wang et al., 2005](#)). It is worthwhile to specifically mention [Carciofo et al. \(2016\)](#). This study uses the same inventory (BFI-44) as we do, and ends up with generally supporting the Big Five while finding relatively low internal consistency

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<sup>5</sup>Costa and McCrae (1985); McCrae and Costa (1987); Goldberg (1990); Costa Jr and McCrae (1992); McCrae and Costa Jr (1997); Digman (1990); Wiggins (1996); Allik and Allik (2002)

within the Big Five factors and suggesting that most *reversed items* do not perform well. Indeed, the "missing reversed items" is *not* likely to be a coincidence and seems a typical result of dialectical personality, despite that [Carciofo et al. \(2016\)](#) does not go further. In our study, we explore deeply into this pattern and resolve the current conflicts in the literature by formally reinterpreting personality in China with a dialectical perspective.

Given the rich literature and social beliefs about dialectical thinking in China/East Asia, it is surprising that in the FFM literature in Asia, no formal research has discussed about the role of dialectical thinking, and this is what this paper does. In this paper, we derive a dialectical personality model from the Big Five Inventory and show the similarities and discrepancies of this model from traditional FFM. We find that we need to independently treat "good" and "bad" traits as two orthogonal categories, each of which includes three factors. The combination of "good" traits are denoted as General Confidence, including *Social Desirability*, *Extraversion* and *Openness*; and the combination of "bad" traits as General Weakness, including *Disorderliness*, *Neuroticism* and *Introversion*. We discuss about details of this construction, test the reliability and validity, and compares with the FFM model in terms of predictive power. We find that a dialectical model generally performs better than the FFM.

We next turn to personality formation. Current research on personality formation studies how genes, shared family environments, education, life events, and exogenous interference influence personality development. Also, it studies the stability of traits over a lifespan. In the personality psychology community, researchers have been reaching a consensus which may surprise economists and other practitioners; personality is mostly genetic (the genetic heritability is around 50%, and the effect of family environment is very limited, even close to 0. <sup>6</sup>). This conclusion are mainly reached through behavioral genetics, especially twin studies. ([Tellegen et al., 1988](#); [Polderman et al., 2015](#); [Vukasović and Bratko, 2015](#); [Plomin, 2019](#)). However, behavioral genetics studies are surprisingly rare in the East. In Japan there are a few findings showing that the heritability of personality is slightly lower than that in the West ([Yamagata et al., 2006](#); [Ono et al., 2000](#); [Kawamoto and Endo, 2015](#)) but the inheritance processes are indeed comparable to the West.

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<sup>6</sup>"We would essentially be the same person if we had been adopted at birth and raised in a different family. Environmental influences are important, accounting for about half of the differences between us, but they are largely unsystematic, unstable and idiosyncratic"— in a word, random." Says Robert Plomin, in a recent book on behavioral genetics ([Plomin, 2019](#))

In China, however, there is literally no existing behavioral genetics study of personality, and due to the potential uniqueness of China, we have no reason to believe that all Western stories and even the Japanese ones will automatically apply in China.

First, compared to countries where behavioral genetics studies are done, most regions in China (especially before 2015) are still in a relatively underdeveloped socioeconomic status, leading to a large variance of socioeconomic status across families. This is fundamental for behavioral genetic studies, since socioeconomic status is proven to be a crucial moderator for trait inheritance. As [Roberts and Jackson \(2008\)](#) suggests, how biological factors function is not unchangeable, and the heritability is not always 50% ([Krueger et al., 2008](#)). Shared environmental effects can be larger in families that are less developed or experiencing more conflicts. Indeed, there is a larger literature suggesting that in underdeveloped areas or poorer families, traits, such as IQ, has a much lower heritability and a higher shared environmental effect ([Rowe et al., 1999](#); [Turkheimer et al., 2003](#); [Henrich et al., 2010b](#)), and the major reason is that family environments have much larger variances ([Nisbett, 2009](#)). Specifically, [Henrich et al. \(2010b\)](#) explicitly argues that a high heritability of IQ is a typical WEIRD conclusion, which is a fair analogy with personality.

Furthermore, historical and cultural reasons may also significantly impact formation of personality in China. In China, personality has been long regarded as a nurture thing, and especially, family environment is what matters. The family pushes the child to develop according to social expectations.<sup>7</sup> The uniform social belief of the impact of strict and conscientious family education on personality development have formed a culture of heavy parental intervention during the childhood, which may lead to a higher variance due to nurture. On the contrast, in the West where "Always be yourself, express yourself, have faith in yourself, do not go out and look for a successful personality and duplicate it" is encouraged, we have more reason to believe that personality is developed more freely by nature.

Finally, the highly interdependent thinking style and collectivist culture in China may

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<sup>7</sup>For instance, the "Three-Character Canon" is one of the entry-level classics that is a requirement for almost all Chinese students who want to pursue further studies. It begins with this: "Man on earth, good at birth. The same nature, varies on nurture." These quotes indicate three important beliefs of the ancient Chinese about personality formation: the nature-based variance of personality is thin; the nature of personality is good; and the nurture-based variance is relatively large. Specifically, the Chinese culture emphasizes the primary importance of family environments. This motivates families to favor an authoritative parent-child relationship ([Kelley and Tseng, 1992](#); [Chao, 1994](#); [Chen et al., 1997](#)). "A tough father fosters a dutiful son but a kind mother makes a wastrel. "

make personality a societal concept rather than an individual one (Markus and Kitayama, 1998). This may also lower the heritability estimates of personality because it is found that social interaction styles are a less heritable trait (Polderman et al., 2015).

All the information above leads to our expectation that personality may largely rely on shared environmental effects (nurture) in China. For many traits, the genetic component is almost 0, while the shared environmental effect is substantially larger at 40%-60%. These findings robustly suggest a crucial role of shared environmental effect in personality formation in China.

Last but not least, we go to personality impacts, especially on economic outcomes and behaviors. The economic impacts of personality are a recently emerging topic driven by economists and psychologists. Generally, these studies are divided into two categories: personality-preference, and personality-outcomes. The first category focuses on studying how personality traits are related with economic preferences. The current literature trying to link them generates mixed results (Almlund et al., 2011; Becker et al., 2012; Jagelka, 2019; Dean and Ortoleva, 2019), suggesting that personality may be valuable to be separated out as distinctive aspects to enrich economic models and better understand human decisions (Heckman et al., 2019). The other category is about causal inference of personality traits on economic outcomes. Like for other topics, reversed causality, measurement error and omitted variable problems are three important endogeneity problems for economists to establish causal relationships between personality and economic outcomes. The problem of reversed causality lies in self-reports: it is possible that the economic outcomes are influencing subjective welfare, and therefore report differently. Measurement errors are also typical in self-reports. To minimize this error, any construction of psychometric indicators requires careful psychometric methods. Omitted variable problem is also typical, since personality may be correlated with some unobserved heterogeneity of family backgrounds or intellectual endowments. In this paper, twin data allows us to do within-twin analysis to better test how personality impacts economic outcomes and get rid of many potential sources of omitted variable biases.

The effect of personality traits on economic outcomes is also mediated by culture. One important pathway is through social expectations. In traditional Chinese culture, conscientiousness and agreeableness are regarded as socially desirable traits; while extraversion and openness are not emphasized. In Confucianism, self-control (Ke Ji), ritual



obedience (Fu Li), and altruism or philanthropy (Ai Ren) are regarded as fundamental for any social achievements, whether in family, in career development, or in political success. We can reasonably hypothesize that these traits (captured by *Social Desirability* in the dialectical personality model) may lead to better economic outcomes; however, these traits may also represent a tendency of sticking with Chinese traditions and beliefs, making the aggregated economic effect ambiguous.

In this part, we test the impacts of personality traits on many economic behaviors and outcomes. Most of our findings are comparable with Western findings; *Disorderliness* is bad for academic outcomes, *Openness* decreases risk aversion, and *Extraversion* leads to better subjective well-being. However, in contrast to previous Western findings, we find that *Social Desirability* leads to *lower* temporary income, especially for women. Detailed mechanisms are discussed.

This paper systematically studies the structures, formation, and economic impacts of personality traits in China, and we detect robustly large difference in China from widely acknowledged Western findings. The major difference lies in personality formation and structures. First, the lack of genetic component of personality formation is mostly likely due to the large variance of socioeconomic status across families, strong parental and social intervention, and the interdependence style of self formation. Second, the unique structures of personality may come from various mechanisms. Synthesizing our results with the current literature, we propose that: the independence of positive and negative items, and contradictory descriptions come from dialectical thinking (Peng and Nisbett, 1999; Choi and Choi, 2002; Spencer-Rodgers et al., 2004); the difficulty to separate Conscientiousness, Agreeableness and Neuroticism may come from social expectations about a "Desirable Personality"; and the significantly low representation of genetic components in personality formation may also contribute to the disappearance of the Big-Five structure.

Our paper has significant contribution to the literature in both methodological and empirical senses. Methodologically, we are the first to incorporate perspectives and concepts from cross-cultural psychology to explore the economics of personality and non-cognitive skills. This motivates future researchers on development economics, labor economics and behavioral economics to consider cross-cultural factors in approaching relevant problems in the developing world. Also, we are among the first to use twin study

method to evaluate causal relationships between personality traits and economic variables. Empirically, we provide a systematic evaluation of the economics of personality in China and elaborates why it can be fundamentally different from that in the West, and offer many implications for research and policy. Personality structures suggests that it may be necessary to better localize the personality assessments in China for relevant studies applications. The difference in heritability suggests that Chinese parents may influence personality formation much more significantly than their Western counterparts, highlighting the importance of family-level personality education and development in China. The correlations and causality between personality and economic outcomes further support the implications above. Furthermore the fundamental difference of the Eastern and Western thinking sheds light on practice and research about development, international relations and political economy.

The remainder of this paper will be organized as follows. Section 2 discusses about our data and methodological framework. Section 3 discusses results in the order of personality structure, formation and impacts. Section 4 discusses about policy and application implications and future perspectives. Section 5 concludes.

## 2 Data and Methodological Framework

### 2.1 Data Source

In this paper, we mainly rely on Longitudinal Chinese Child Twin Survey (LCCTS). This survey has a large sample with around 4,000 people measuring personality. Also, this survey includes twins from both urban and rural residence, all born after one-child policy ([Hong Chew et al., 2017](#)). Having twin data allows us to fully explore the heritability of traits and use within-twin estimations to causally test the economic effects of personality traits.

Conducted by the Urban Survey Unit of the National Bureau of Statistics, the LCCTS is a two-wave, census-type longitudinal household survey, including data from both twin and non-twin families. The survey was first conducted from late 2002 to early 2003 in Kunming and surrounding areas in Yunnan Province, China. The age cohort of the twins was then 6 to 18. Then, a second wave was conducted from 2012 to 2014, with twins between 17 to 29 years old. Some of the twins had gotten a full time job by the time of

second wave, and some were still students.

In the part of personality structures, we include all four categories of samples (twins, non-twins, and the parents of these groups). The total sample size is 3977. In the part of personality formation and impacts, we focus on same-sex twins (Tellegen et al., 1988; Vukasović and Bratko, 2015). The total sample size is N=902 (456 pairs). Following (Li et al., 2010), we treat children with the same hair color, eye color, and appearance as Monozygotic (MZ). Accordingly, 192 pairs of twins are denoted as MZ and 264 pairs Dizygotic (DZ). In both samples, the sex ratio is close to 1:1.

## 2.2 Measurements of Personality Traits and Economic Variables

There are various self-reported measurements and outcomes in this paper, and it is necessary to fully explain how they are conducted and what they measure, especially for the self-reports.

### 2.2.1 Personality Inventory

This paper uses a standard Chinese version of 44-item Big Five Inventory (BFI-44) (John et al., 1991; Benet-Martinez and John, 1998; John et al., 2008). As said on the official website of this test, "The Big Five Inventory (BFI) is a self-report inventory designed to measure the Big Five dimensions. It is quite brief for a multidimensional personality inventory (44 items total), and consists of short phrases with relatively accessible vocabulary." The original construction and item denotations of this inventory is shown as follows, and we will use the same denotation set in the following parts of this paper. All the questions are assessed based on a 5-point Likert scale, with (1) *strongly disagree* and (5) *strongly agree*.

Table 1: Original Construction of BFI-44

Dimension	Items	Regular Items	Reversed Items
Openness	10	8(O5,O10,O15,O20,O25,O30,O40,O44)	2(O35R,O41R)
Conscientiousness	9	5(C3,C13,C28,C33,C38)	4(C8R,C18R,C23R,C43R)
Extraversion	8	5(E1,E11,E16,E26,E36)	3(E6R,E21R,E21R)
Agreeableness	9	5(A7,A17,A22,A32,A42)	4(A2R,A12R,A27R,A37R)
Neuroticism	8	5(N4,N14,N19,N29,N39)	3(N9R,N24R,N34R)
Total	44	28	16

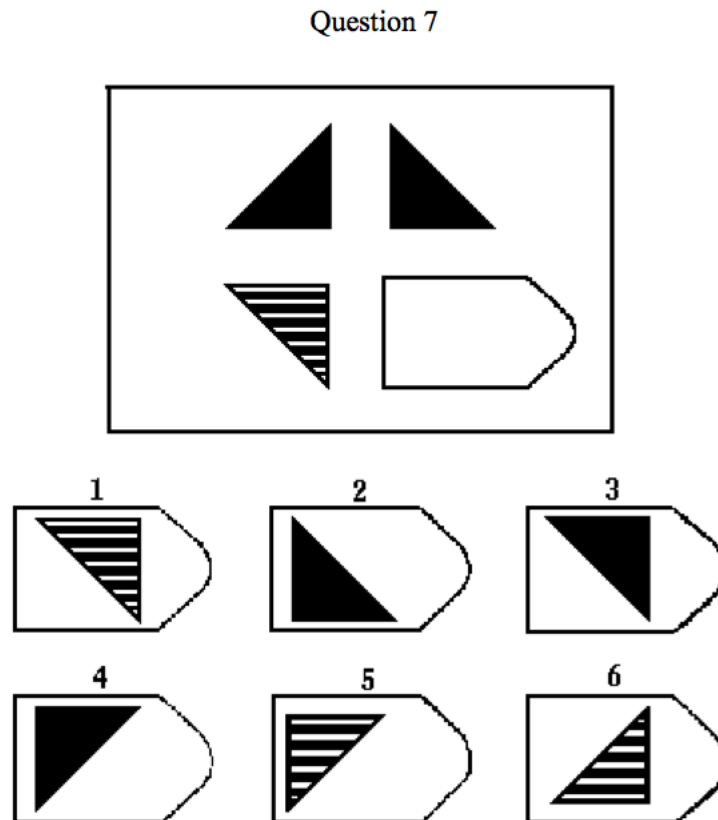
The full English and Chinese versions of this inventory can be retrieved in the appendix. The summary statistics will be discussed in detail in the personality structure part of this paper.

In the first-wave survey, parents are also asked to elicit their belief on children's strengths and weaknesses in a 20-item questionnaire. Questions include descriptions about agreeableness, attention, internalizing behaviors and externalizing behaviors.

### 2.2.2 Cognitive Ability Measurements

In LCCTS, cognitive abilities are measured in two distinctive tests: a basic 6-question arithmetic test containing questions of elementary-school difficulty (For instance, "Two bottles of wine cost 3.1 yuan. How much do 12 bottles of wine cost?"), and a 10-question logical test asking subjects to identify the missing element which would complete the pattern. An example is shown here:

Figure 1: An Example of Logical Testing



The arithmetic test is only taken by the children, while the logical test is taken by both children and parents. The Cronbach's alphas for the arithmetic test and the logical test are respectively 0.88 and 0.85, suggesting a very high internal consistency, so we use the sum of the scores as the standard measurements for cognitive ability in this paper. Besides, the arithmetic test is incentivized with monetary reward for every right answer, while the logical test is not. After the interviewer computes the monetized reward for each twin in a pair, one is asked how much she will contribute to her twin sibling. This transfer is used as a measurement for altruism (Yi, 2019).

### 2.2.3 Subjective Well-being and Economic Preferences

Defined as a combination of happiness, life satisfaction and positive affections (Diener, 1984), subjective well-being is an important measurement about welfare. In LCCTS, the team uses a slightly modified subset of the Gallop World Poll (details seen in <http://www.gallupworldpoll.com/content/24046/About.aspx>). Yet, basic psychometric tests of this inventory find that the positive items and negative items are pretty independent, so we will use two factors "Positive Feelings" and "Negative Feelings" distinctively in the following part of the paper. The Cronbach's alpha within each factor is respectively 0.71 and 0.65.

The LCCTS also uses three self-report questions to measure risk and time preferences. The risk preference question is: "Y6. Which do you prefer? (1) Suppose there is a business, you can earn a profit of 10,000 yuan. (2) Suppose there is a business, the possibility that you can earn a profit of 20,000 yuan is 50%, and 50% you will earn nothing. (3) The above two make no difference to me." And the time preference questions are: "Y7. Suppose you can get 100 yuan tomorrow, or 120 yuan 8 days later, you would (1) get 100 yuan tomorrow (2) get 120 yuan 8 days later.", and "Y8. Suppose you can get 100 yuan 100 days later, or 120 yuan 108 days later, you would (1) get 100 yuan 100 days later (2) get 120 yuan 108 days later."

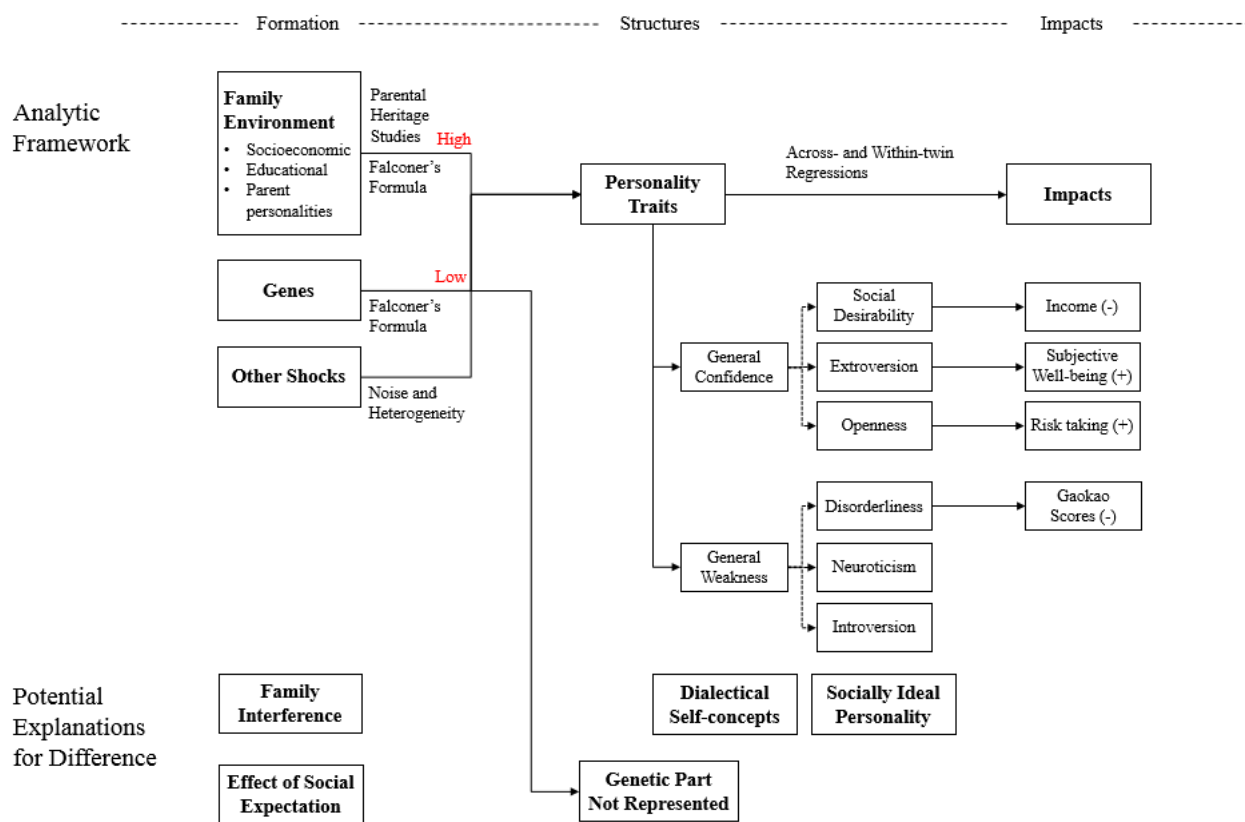
For the risk question, we mark the subject risk averse if she chooses (1), risk neutral if (3) and risk loving if (2). The risk attitude value is marked 3 with risk loving, 2 with risk neutral and 1 with risk averse. Also we generate a risk aversion dummy to match the original paper (Hong Chew et al., 2017). For the time preference question, we mark the subject to be a hyperbolic discounter if she chooses (1) in Y7 but (2) in Y8.

Despite the subjective nature of these items, [Hong Chew et al. \(2017\)](#) formally links this risk preference measure to family resource allocation, justifying that the measurement does have reasonable validity.

## 2.3 Analytic Roadmap and Empirical Strategy

The whole framework of this paper is slightly complicated. So we show a roadmap to demonstrate the logic and basic methodologies we are using in this paper.

Figure 2: Roadmap of this Paper



### 2.3.1 Personality Structure

We follow the canonical psychometric techniques to test the property of the BFI-44 in China. We use Exploratory Factor Analysis with varimax rotation to detect the factor structure of the BFI-44 and test the reliability of our construction using standard measures such as Cronbach's alpha and split-half reliability tests.

### 2.3.2 Personality Formation

This part contains two categories of methodologies; in the first part, we use the standard twin study design to compute the heritability of personality traits in China; in the second part, we study the mechanism of personality formation by a within-twin regression design to study how different parental treatments may impact children’s behaviors.

There are various models for standard twin design. Usually, we start with computing the intraclass correlations within monozygotic (MZ) twins and dizygotic (DZ) twins respectively.

In the prospectus we are mainly providing the results computed from the standard ACE model and heritability coefficients based on the Falconer’s formula. In the final version, we will show robustness checks with different methods, and formally build a framework of genetic influence model of personality.

### 2.3.3 Personality Impacts

The empirical identification of causal effects of personality impacts is generally tricky. In [Borghans et al. \(2008\)](#); [Almlund et al. \(2011\)](#); [Heckman et al. \(2019\)](#), detailed discussion is made about potential identification problems if we just regress economic outcomes with personality. Potential problems may include:

(1) Omitted variable problems. In most correlational personality-outcome studies, researchers are just putting outcomes at the left hand side, and personality and other controls at the right hand side. These regressions may be problematic even with detailed structural setups, because there might be some unobserved heterogeneous attributes. For instance, they may reflect some certain family backgrounds, such as partisanship and local connections, which may instead be the fundamental attributes that determine economic performances.

(2) Reverse causality. This is crucial when we try to link personality and economic outcomes, such as income. Economic outcomes may influence people’s subjective well-being and emotional status, and therefore impacting personality reports. Some literature chooses to avoid this problem with earlier measurements of traits instead of contemporaneous ones, yet this may magnify another important problem: measurement error, because earlier measurements may be poor proxies of the current ones.

(3) Measurement error problems. The literature discussing measurement errors of per-

sonality and non-cognitive skills is huge. In this paper, we have to use the subjective reports of personality and well-being. However, we can assist our analysis by controlling the objectively measured items, such as arithmetic and logical abilities.

(4) Situationist view, as in [Mischel \(2013\)](#). Mischel (and some economists) believe that there is nothing such as "Stable Personality Traits". Their view is that behaviors are usually just responses to certain scenarios, and is highly variable across situations. Indeed, in Asia this concern is even stronger because East Asian people care less about self-consistency ([Kanagawa et al., 2001](#)). We use a within-twin design model with a variety of techniques, trying to minimize the influence of endogeneity problems.

With twin studies, we can specifically look at within-twin difference to avoid omitted variable biases. This will cancel out the shared environmental effect, which is mainly family's socioeconomic backgrounds and most of the nurturing styles. If we look at the MZ twins, genetic differences are also canceled out. However, the unobserved heterogeneous nonshared environmental effect cannot be canceled out; it is difficult to capture all the shocks that the children have faced separately. To deal with this, we (1) need controls for observed heterogeneous characteristics that may be significant, such as grades, cognitive abilities, and other non-personality traits; and (2) may want information about their personality in their early age, although relevant measurements within this paper have many limitations.

Reversed causality problems are also not naturally mitigated by a within-twin design. However, one way to deal with this is to look at heterogeneous effects: we try to find stories about why for different groups of people (for instance, male and female), the coefficients may be very different because of certain socioeconomic reasons. If so, we can add evidence to say that reversed causality is not that severe because it is counter-intuitive that the influence of outcomes on personality report will vary hugely across groups.

For measurement error problems, standard psychometric tools come to mitigate this problem. As [Borghans et al. \(2008\)](#) suggests, measurements for a lot of economic variables should be obtained from a psychometrically solid way. If the measurement has good psychometric properties, then we will be more confident to say that the measurement error problem is not crucially exacerbating our results.



# 3 Results

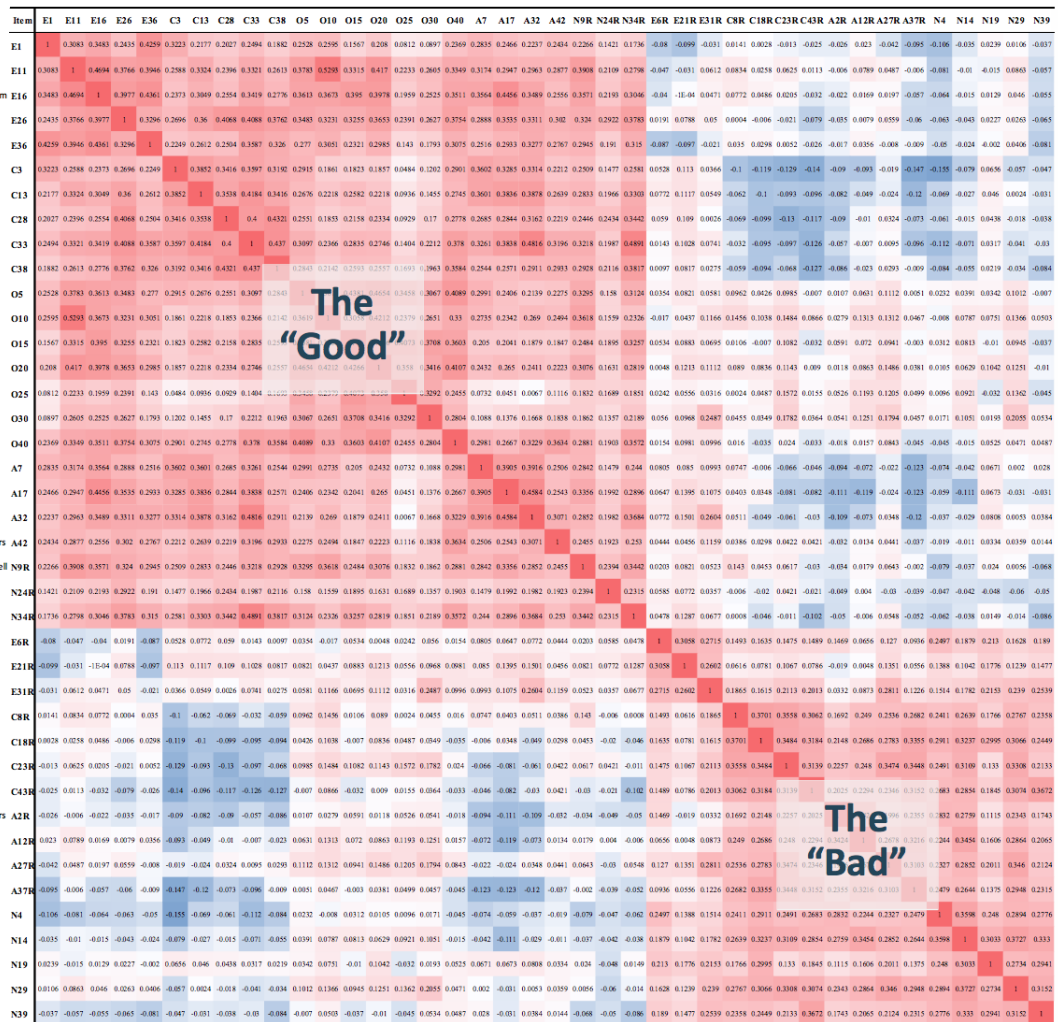
## 3.1 Personality Structure

Since the computation of genetic heritability values rely on proper construction of personality factors, we report the results of personality structures first.

### 3.1.1 Correlation Structure

Before doing a factor analysis, it is most intuitive to show the correlation structures of all 44 items.

Figure 3: Correlation Structure of BFI-44 in China, N=3,977



This is a distinctive correlation structure in the following senses:

(1) "The Good" and "The Bad" in the correlation matrix have distinctive patterns. "The Good" includes all regular items designed for measuring Openness (O), Conscientiousness (C), Extraversion (E), Agreeableness (A) and reversed items for Neuroticism (N). "The Bad", on the contrary, includes all reversed items for O, C, E and A, and regular items for N. The definition of "Good" and "Bad" are consistent with the concept of social desirable traits and their opposite in the literature ([Peterson et al., 2006](#); [Erdle and Rushton, 2011](#); [Laaajaj et al., 2019](#)).

(2) The correlations are relatively large within the two clusters, and have relatively low absolute values across them.

(3) Even within a designed dimension of a Big Five Factor, the cross-correlations of regular and reversed items are close to 0. This is a crucially different feature of our results from a typical Western BFI-44 sample. This feature leads to low Cronbach's alpha's for C, E, A and N if we follow the original Five-Factor setup.

This unique correlation structure motivates us to treat social desirable and undesirable traits independently. This is a #1 important feature of Chinese Personality Structures: people tend to be dialectical in self-perception about their advantage and disadvantages. They can comfortably evaluate them as both good and bad, or neither, which would "appear improbable, illogical, or even irrational in most Western nations" ([Spencer-Rodgers et al., 2004, 2010b](#)). This finding is also consistent with the finding in ([Carciofo et al., 2016](#)), in which they find that reversed items in BFI-44 tend to have bad psychometric properties. Thus in the following parts of the paper, we will consistently treat them separately. These two factors are respectively denoted as "General Confidence (GC)" and "General Weakness (GW)".

In the final version we will try to attach a Western dataset with the same BFI-44 inventory and show its correlation structure as a contrast.

### 3.1.2 Factor Construction and Interpretation

Based on the dialectical self-concept, we run exploratory factor analysis separately for the 26 social desirable items and the 18 undesirable items.<sup>8</sup> The factor analysis results with principle component method and varimax rotation are shown here respectively.

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<sup>8</sup>The results generated from a pooled factor analysis can be retrieved in appendix. Generally things are similar, yet the predictive power of indicators generated this way is slightly weaker.

Figure 4: Factor Structure for Desirable Items in BFI-44 in China, N=3,977

Item	Description	Factor 1	Factor 2	Factor 3
E1	is talkative	0.179	<b>0.658</b>	-0.082
E11	is full of energy	0.171	<b>0.665</b>	0.262
E16	generates a lot of enthusiasm	0.252	<b>0.622</b>	0.223
E26	has an assertive personality	<b>0.507</b>	0.276	0.307
E36	is outgoing, sociable	0.299	<b>0.580</b>	0.091
C3	does a thorough job	<b>0.548</b>	0.301	-0.061
C13	is a reliable worker	<b>0.583</b>	0.229	0.026
C28	perseveres until the task is finished	<b>0.685</b>	0.070	0.112
C33	does things efficiently	<b>0.703</b>	0.215	0.123
C38	makes plans and follows through with them	<b>0.669</b>	0.105	0.209
O5	is original, comes up with new ideas	0.255	0.427	<b>0.483</b>
O10	is curious about many different things	0.042	<b>0.624</b>	0.312
O15	is ingenious, a deep thinker	0.237	0.259	<b>0.626</b>
O20	has an active imagination	0.149	0.456	<b>0.531</b>
O25	is inventive	0.033	0.121	<b>0.698</b>
O30	values artistic, aesthetic experiences	0.131	0.065	<b>0.660</b>
O40	likes to reflect, play with ideas	<b>0.417</b>	0.336	0.365
O44	is sophisticated in art, music, or literature	-0.001	-0.065	<b>0.631</b>
A7	is helpful and unselfish with others	0.376	<b>0.447</b>	-0.040
A17	has a forgiving nature	<b>0.440</b>	0.384	-0.053
A22	is generally trusting	0.025	0.070	0.075
A32	is considerate and kind to almost everyone	<b>0.552</b>	0.297	-0.055
A42	likes to cooperate with others	<b>0.357</b>	0.255	0.137
N9R	is relaxed, handles stress well	0.303	<b>0.430</b>	0.192
N24R	is emotionally stable, not easily upset	0.324	0.060	0.193
N34R	remains calm in tense situations	<b>0.623</b>	0.127	0.268

Figure 5: Factor Structure for Undesirable Items in BFI-44 in China, N=3,977

Item	Description	Factor 1	Factor 2	Factor 3
E6R	is reserved	-0.029	0.272	<b>0.647</b>
E21R	tends to be quiet	0.009	-0.005	<b>0.709</b>
E31R	.is sometimes shy, inhibited	0.355	-0.101	<b>0.617</b>
C8R	can be somewhat careless	<b>0.619</b>	0.121	0.072
C18R	tends to be disorganized	<b>0.542</b>	0.268	0.087
C23R	tends to be lazy	<b>0.685</b>	0.145	0.092
C43R	is easily distracted	<b>0.537</b>	0.162	0.093
O35R	prefers work that is routine	0.153	-0.242	<b>0.355</b>
O41R	has few artistic interests	-0.019	0.005	-0.041
A2R	tends to find fault with others	0.143	<b>0.704</b>	-0.074
A12R	starts quarrels with others	0.385	<b>0.517</b>	-0.099
A27R	can be cold and aloof	<b>0.581</b>	0.175	0.205
A37R	is sometimes rude to others	<b>0.623</b>	0.192	-0.047
N4	is depressed, blue	0.164	<b>0.610</b>	0.255
N14	can be tense	0.310	<b>0.580</b>	0.187
N19	worries a lot	0.120	0.317	<b>0.440</b>
N29	can be moody	<b>0.482</b>	0.363	0.227
N39	get nervous easily	0.303	0.279	0.308

As is seen in the figures, we see three main factors in both categories, and the other factors only cover 1 or 2 items, such as trusting others or not in GC, and lacking of artist interests in GW. Dropping these singleton items, we get the  $2 \times 3$  factor structure, briefly summarized by the following table:

Table 2: Factor Structure of BFI-44 in China

Dimension	Items	Tones	Items
Social Desirability	11	Desirable	E26,C3,C13,C28,C33,C38,O40,A17,A32,A42,N34R
Extraversion	7	Desirable	E1,E11,E16,E36,O10,A7,N9R
Openness	6	Desirable	O5,O15,O20,O25,O30,O44
Disorderliness	7	Undesirable	C8R,C18R,C23R,C43R,A27R,A37R,N29
Neuroticism/Hostility	4	Undesirable	A2R,A12R,N4,N14
Introversion	5	Undesirable	E6R,E21R,E31R,O35R,N19
Miscellaneous	4	//	A22, N24R, O41R, N39
Total	40	//	//

This  $2 \times 3$  structure has the following features:

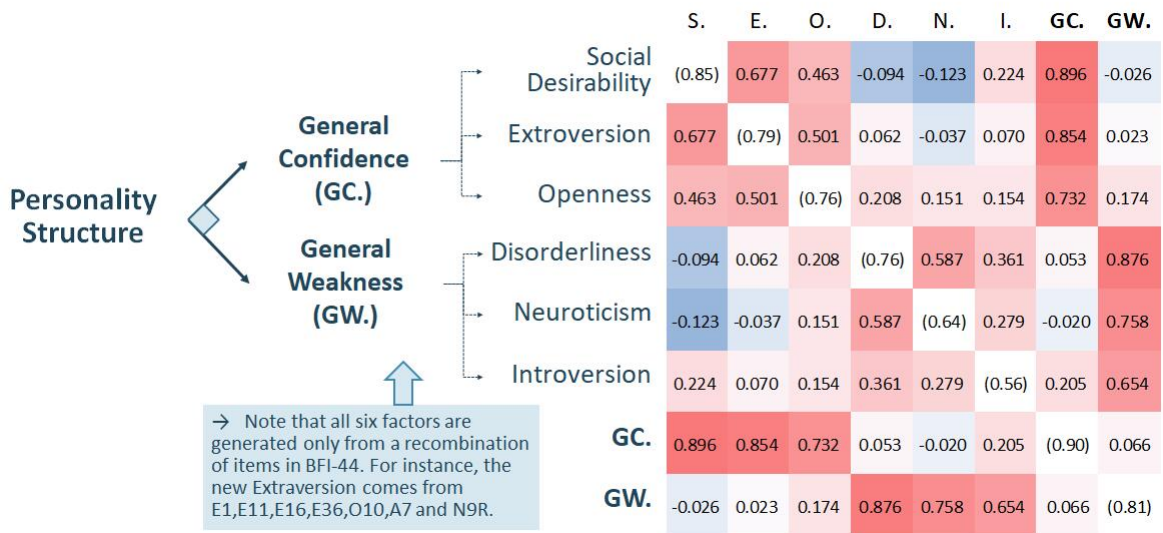
- (1) Chinese people seem to be orthogonal about desirable and undesirable traits. Even within those traits with the "opposite" meanings, Chinese people do not necessarily give responses with negative correlations. For instance, in Extraversion and Introversion, their pairwise correlation is even slightly positive (though not significant).
- (2) Within the desirable traits, E and O seem to resemble the E and O in Big 5; yet Social Desirability is mainly a combination of Conscientiousness and Agreeableness in Big 5.
- (3) Within the undesirable traits, Disorderliness is likely the "opposite" of social desirability.
- (4) The Neuroticism/Hostility factor seems to be composed of some items of Neuroticism and some reversed items of Agreeableness. And specifically, if we look at the description of these items, they compose a tendency of being hostile and unfriendly with other people. This factor is an important negative trait in a society with high emphasis on interpersonal harmony.
- (5) The Introversion factor is mainly composed of items that describe a tendency of being alone and stay with the status quo. It is therefore slightly narrower than the "Introversion" in Big Five.

In the final version we will attach more robustness checks on the construction part, including using confirmatory factor analysis(using both FFM and the 3+3 model), item response theory (IRT) models and more structured analysis.

### **3.1.3 Reliability and Validity**

In this section, we use standard psychometric methods to justify our  $2 \times 3$  factor structure and its superiority over directly taking the Big Five constructs.

Figure 6: Reliability Test



Generally, using the new model generates better validity than the Five Factor model in behavioral prediction. For prediction of “positive” behaviors (abilities, positive feelings, etc), factors in the GC are much more significant, and for “negative” feelings vice versa. This implicates a "dual self" or dialectical self concept in various senses. Below is a table for a brief validity test of our construction and a comparison with the construction of FFM.



Figure 7: Validity of Construction and Comparison with Using the FFM

	General Confidence			General Weakness			Big Five Traits					#Obs
	S	E	O	D	H	I	E	C	O	A	N	
Risk Preference	0.054	0.073	0.133	0.121	0.055	0.042	0.032	-0.045	0.138	-0.011	0.021	3977
Hyperbolic Discounting	0.070	0.046	0.074	0.093	0.041	0.073	0.006	-0.014	0.077	-0.009	0.018	3977
Delayed Gratification	0.009	-0.007	0.022	-0.072	-0.045	-0.073	0.046	0.061	0.017	0.017	-0.052	3977
Math Test	0.005	0.098	0.176	0.089	0.023	-0.023	0.059	-0.071	0.198	-0.023	-0.009	3977
Logical Test	0.057	0.114	0.215	0.004	-0.033	-0.017	0.091	0.014	0.226	0.040	-0.066	3977
Positive Feelings	0.210	0.255	0.220	0.034	-0.031	0.037	0.195	0.093	0.211	0.099	-0.135	3753
Negative Feelings	0.012	-0.014	0.054	0.203	0.188	0.173	-0.084	-0.105	0.041	-0.094	0.209	3702
Donation	0.172	0.156	0.142	0.049	-0.034	0.015	0.102	0.069	0.166	0.147	-0.080	1114

The tables above shows that these personality indicators do act as good predictor for various types of behaviors, while they are not necessarily the same. Also, we find that for positive behaviors, items in GC are much more predictive, and vice versa. This adds further evidence about the dialectical structure of personality in China. Nevertheless, the correlations in the table above do not fully capture the relationships between personality and behaviors since there are non-linear effects. Thus, introducing data-driven clustering methods improves the prediction. For instance, “Traditionalists” is associated with strong risk aversion.

### 3.1.4 Typing Chinese People: a Cluster Analysis and Validity Checks

In the reliability and validity checks above, we are mainly looking at linear relationships. To better justify the implications of newly constructed personality indicators, we can use an alternative method: cluster analysis. The idea of clustering is based on [Gerlach et al. \(2018\)](#), which uses a data-driven clustering to find that in general (of course, most data

are drawn from Western samples), people can be classified into five categories, each of which has important real-world implications.

The current progress is a typical K-means clustering method and we find five important types. Their features are summarized in the following tables. If we increase the number of clusters, we still find that the five types systematically exist. Also, this classification is very predictable about certain cognitive, economic preference factors and economic well-being. This justifies the validity of this classification methodology, and in the future we will do further robustness checks and see the *causal* effects of personality type.

These types are named according to the values of personality traits and related real-world behavioral tendencies:

(1) The Entrepreneur reports high in both GC and GW terms. They seem to be confident in their desirable traits, but they also report relatively high in undesirable traits, showing a highly dialectical self-concept. An Entrepreneur has the highest level of risk preference and hyperbolic discounting, showing a tendency of being aggressive and risky. They account for 15-20% of the whole whole population.

(2) The Traditionalist reports medium scores in GC terms (with SD/E above average and O below average), and very low in GW terms. These people seem to stick to traditions and a stable lifestyle, justified by the lowest tendency to take risks and a relatively low tendency to show present bias. They account for about 25-30% of the whole population.

(3) The Role Models resembles the same type in ([Gerlach et al., 2018](#)), showing high in all GC and low in all GW terms. Their personality is mostly single-factored and show less dialectical self concepts. They have the best logical abilities and highest subjective well-being. They account for about 10% of the whole population.

(4) The Silent Feeler reports low in GC terms but medium in GW terms. They seem to have the lowest openness to experience and stay in their comfort zones. The key behavioral patterns are low cognitive ability, low risk attitudes and low subjective well-being. They account for slightly more than 10% of the whole population.

(5) The Golden Mean ("Zhongyong") type reports around "Neutral" in most items, thus leading to a very low variance in their responses. Also, their behavioral patterns (even in objective tests) tend to stay in the middle. This means for this group, scores in personality may be less predictive about behaviors than other for. They account for about 1/3 of



the whole population.

Figure 8: Personality Classification and Other Traits, N=3,977

ITEMS(Mean)	Whole	Personality Types				
		The Entrepreneur	The Traditionalist	The Role Model	The Silent Feeler	The Golden Mean
		Group A	Group B	Group C	Group D	Group E
Social Desirability	<b>3.44</b>	<b>3.87</b>	3.55	<b>4.30</b>	2.88	3.14
Extraversion (in GC)	<b>3.40</b>	<b>3.91</b>	3.48	<b>4.17</b>	2.73	3.14
Openness (in GC)	<b>2.84</b>	<b>3.31</b>	2.66	<b>3.60</b>	1.94	2.87
Disorderliness	<b>2.61</b>	<b>3.24</b>	2.06	2.17	2.31	<b>2.94</b>
Hostility	<b>2.39</b>	<b>2.85</b>	1.87	1.89	2.18	<b>2.73</b>
Introversion	<b>3.03</b>	<b>3.46</b>	2.77	2.93	2.84	3.10
Basic Arithmetic Ability	<b>1.44</b>	<b>1.83</b>	1.35	1.52	0.83	1.53
Logical Inference Score	<b>9.45</b>	9.67	9.58	<b>9.94</b>	<b>8.13</b>	9.62
Risk Attitudes	<b>0.73</b>	<b>0.89</b>	0.53	0.85	0.62	0.80
Hyperbolic Discounting	<b>24%</b>	<b>30%</b>	20%	25%	16%	26%
General Confidence	<b>3.27</b>	<b>3.72</b>	3.29	<b>4.04</b>	2.62	3.08
General Weakness	<b>2.70</b>	<b>3.19</b>	2.28	2.32	2.50	<b>2.94</b>
Openness (in Big 5)	<b>2.95</b>	<b>3.32</b>	2.83	<b>3.62</b>	2.25	2.93
Conscientiousness (in Big 5)	<b>3.43</b>	3.37	<b>3.75</b>	<b>4.13</b>	3.25	3.10
Extraversion (in Big 5)	<b>3.25</b>	3.41	3.43	<b>3.79</b>	2.87	3.04
Agreeableness (in Big 5)	<b>3.49</b>	3.52	<b>3.73</b>	<b>4.02</b>	3.37	3.20
Neuroticism (in Big 5)	<b>2.66</b>	<b>2.90</b>	2.30	2.07	2.76	2.90
Variance in GC Items	<b>0.79</b>	0.89	0.85	0.88	0.88	0.63
Variance in GW Items	<b>0.86</b>	1.00	0.91	<b>1.08</b>	0.92	0.68
Variance in all items	<b>0.91</b>	0.99	1.02	<b>1.31</b>	0.91	0.67
Observations	3977	631	919	438	547	1442

Note: Numbers in red/blue are those higher/lower than the whole level.

Figure 9: Personality Classification and Subjective Well-being, N=3,977

ITEMS(Mean)	Whole	Entrepreneur	Traditionalist	Role Model	Silent Feeler	Golden Mean
Life Satisfaction	<b>5.72</b>	5.87	5.87	<b>6.43</b>	<b>5.06</b>	5.59
Feeling happy	<b>85%</b>	90%	87%	<b>93%</b>	<b>71%</b>	86%
Feeling Satisfied	<b>59%</b>	64%	57%	<b>75%</b>	<b>43%</b>	58%
Feeling Angry	<b>13%</b>	<b>19%</b>	6%	<b>9%</b>	<b>11%</b>	17%
Feeling Sad	<b>11%</b>	<b>17%</b>	4%	<b>7%</b>	<b>10%</b>	13%
Feeling Stressed	<b>49%</b>	57%	<b>41%</b>	<b>52%</b>	<b>44%</b>	52%
Feeling Worried	<b>43%</b>	51%	<b>36%</b>	<b>33%</b>	<b>42%</b>	47%
Observations	3683	570	873	400	507	1333

Note: Sample size is smaller because some people missed some items.

## 3.2 Personality Formation

This part contains three subsections. The first subsection uses the ACE model and the Falconer’s formula to document that in China, genetic heritability of personality traits is relatively low, and the shared and non-shared environmental effects are both very high. The second subsection shows that in China, couples resemble each other much more than the Western findings, and parents resemble children less but still more than the Western findings. The third subsection shows effort in causal analysis of how parental interventions influence personality. We find suggestive evidence that intervention under parent-child discrepancies may have permanent effect on personality development.

### 3.2.1 Computing Heritability from Twin Study

The baseline message of this part is about low heritability of personality traits in China. In the following table, heritability is measured by the difference of intercorrelation coefficients of monozygotic and dizygotic twins. In the final version of this paper we will include robustness checks using different methods, and detailed representations of the genetic structures of personality traits in China.

### 3.2.2 Within-family Similarities

To study the robustness of the findings above, we test the correlation structures of personality traits and other cognitive/non-cognitive skills within a family. In general, we find

Figure 10: Genetic Heritability of Personality Traits

Item	MZ (Corr %)	DZ (Corr %)	Heritability
Social Desirability	44	60	-0.32
Extroversion (in 6)	53	42	0.22
Openness(in 6)	58	54	0.08
Disorderliness	64	60	0.08
Hostility/Neuroticism	58	61	-0.06
Introversion	52	36	0.32
General Confidence	54	62	-0.16
General Weakness	69	63	0.12
Positive Feelings	61	56	0.10
Negative Feelings	59	54	0.10
Risk Preference	47	30	0.34
Participation in Gaokao	84	60	0.48

Figure 11: Personality Similarities Within Families

Item	Within-Parent	Father-Child	Mother-Child
Social Desirability	0.48	0.35	0.33
Extroversion (in 6)	0.43	0.20	0.18
Openness(in 6)	0.52	0.26	0.33
Disorderliness	0.50	0.44	0.38
Hostility/Neuroticism	0.43	0.33	0.31
Introversion	0.33	0.19	0.17
Positive Feelings	0.68	0.47	0.47
Negative Feelings	0.59	0.36	0.38
Logical Ability	0.67	0.51	0.43
Risk Preference	0.34	0.32	0.24

that the similarities are larger than the findings in the West (Troll et al., 1969; Glicksohn and Golan, 2001; Little et al., 2006). Specifically, the intraclass correlation within couples is surprisingly high, comparable to that of monozygotic twins. This suggests a strong tendency of either assortative matching before marriage or a large convergent effect after marriage. Unfortunately, due to the lack of pre-marriage personality data, it is hard to test which is the key mechanism.

### 3.2.3 Further Evidence on Family Intervention

In this part we focus on studying how family intervention impacts personality. Despite the importance of this part, the causal identification is subject to various challenges according to the discussions above. The major reason is that if we look at within-twin differences, we have to rely on the assumptions that the "shared environmental effect"

is no longer fully shared. In other words, when family education turns to the nonshared effect, things get complicated. Another challenge is that the difference in treatments is actually a *consequence* of their personality differences. This reverse causality problem is nonnegligible. One way to deal with this is linking the temperament reports made by a parent in the 2002 wave of this sample as a proxy of the earlier personality of the children. Unfortunately, the within-twin variance is extremely low for MZ twins. Further versions of this paper will try to deal with these problem formally.

Another way is to look at events that may be more "random". One thought is to only consider the education style when the children have conflicts or discrepancies with parents because this may not happen extremely often. However, this setup is still open to question because if the conflicts happen more than a few times, the different will cancel out due to Law of Large Numbers. These difficulties really call for better identification strategies in the final version of this paper.

### **3.3 Personality Outcomes**

#### **3.3.1 Baseline Results**

In this part, we use a within-twin difference method to study how personality impacts economic preferences and outcomes. This allows us to cancel out shared unobserved heterogeneity effects. The basic results, gaokao (college entrance exams score), 12-month average income, measured risk attitudes and subjective well-being are presented here, and in the final version we will attach all robustness checks with more controls in the appendices.

Figure 12: Personality and Economic Outcomes

	(1)		(2)		(3)		(4)	
	Gaokao Score		Income		Risk Attitude		Subjective Wellbeing	
	Across	Within	Across	Within	Across	Within	Across	Within
Age	3.54*** (2.73)		0.05*** (3.81)		0.00 (-0.21)		0.03* (1.81)	
Social Desirability	-9.42 (-0.72)	-18.3 (-1.30)	-0.45** (-2.31)	-0.60** (-2.18)	0.02 (0.19)	-0.20* (-1.76)	0.21 (1.06)	0.02 (0.11)
Extroversion	1.91 (0.16)	14.8 (1.11)	0.18 (0.90)	0.08 (0.37)	-0.07 (-0.82)	-0.05 (-0.50)	0.51*** (2.72)	0.53** (2.50)
Openness	5.85 (0.59)	-1.38 (-0.12)	0.20* (1.65)	0.26 (1.46)	0.19*** (2.98)	0.35*** (3.93)	0.17 (1.00)	-0.08 (-0.45)
Disorderliness	-22.51** (-2.28)	-25.93** (-2.18)	-0.06 (-0.51)	-0.26 (-1.18)	0.14** (1.99)	0.02 (0.17)	-0.05 (-0.36)	-0.23 (-1.13)
Hostility	9.16 (1.08)	21.41* (1.77)	-0.11 (-0.95)	0.08 (0.36)	-0.05 (-0.79)	-0.07 (-0.89)	-0.19 (-1.41)	-0.22 (-1.27)
Introversion	12.67 (1.24)	22.45** (2.23)	-0.11 (-0.84)	-0.24 (-1.44)	-0.16*** (-2.60)	-0.12 (-1.57)	0.07 (0.40)	0.02 (0.11)
_cons	7495.77*** (2.92)	421.02*** (7.39)	111.92*** (4.22)	12.12*** (14.02)	-2.76 (-0.17)	1.11** (2.58)	69.24* (1.90)	5.08*** (5.74)
N	229	249	222	263	802	900	752	850
R2		0.12		0.13		0.04		0.03

9 t stats in parentheses, \* p<0.10, \*\* p<0.05, \*\*\* p<0.01

Among the results above <sup>10</sup>, we can see that most results are consistent with our prediction and the current literature, while the most surprising result is that Social Desirability seems to negatively affect income. As is discussed above, SD is definitely an indicator that makes people better fit in the Chinese society, and most literature suggests that such properties will lead to more successful economic outcomes. Yet as a combination of Conscientiousness, Agreeableness and (somewhat) Emotional Stability, Social Desirability is expected to have mixed economic impacts based on the Western literature, because Conscientiousness is generally associated with better financial outcomes, while Agreeableness is the opposite. Thus, there may be mixed mechanisms about this negative relationship, and we need to look into it further.

<sup>10</sup>The "Across" regressions are random effect models, and the "Within" regressions have family fixed effects.

### 3.3.2 Heterogeneous Effects and Further Insights

To study the mechanism of the "horse races" for Social Desirability, we separate the children into two categories based on their family income in 2002. Since we are mainly looking into within-twin differences, this standard does not lead to a self-selection problem. Here is a table in which we look at different regression coefficients within twins coming from richer and poorer families, and of different genders.

Figure 13: Personality and Income: Heterogeneous Effects

	(1)		(2)		(3)		(4)	
	Backgrounds		Gender		Male		Female	
	Poorer	Richer	Male	Female	RB	PB	RB	PB
Social Desirability	-1.61*** (-3.62)	-0.16 (-0.43)	-0.58* (-1.86)	-0.13 (-0.22)	-1.00* (-2.09)	-0.07 (-0.16)	-3.55** (-3.02)	0.47 (0.64)
Extroversion	0.87** (2.53)	-0.19 (-0.67)	0.04 (0.16)	-0.02 (-0.05)	0.41 (1.01)	0.1 (0.31)	1.26** (2.89)	-0.97 (-1.24)
Openness	0.33 (1.33)	0.24 (0.86)	0.14 (0.64)	0.51 (1.34)	-0.02 (-0.06)	0.03 (0.09)	1.34** (2.40)	0.64 (1.16)
Disorderliness	-0.45 (-1.48)	-0.21 (-0.71)	-0.03 (-0.12)	-0.74* (-1.71)	-0.02 (-0.06)	-0.02 (-0.06)	-0.76 (-1.49)	-0.79 (-1.31)
Neuroticism	-0.16 (-0.54)	0.33 (0.97)	0.39 (1.45)	-0.47 (-1.07)	0.32 (1.00)	0.56 (1.45)	-1.56*** (-3.61)	0.01 (0.02)
Introversion	-0.02 (-0.07)	-0.25 (-1.03)	-0.40* (-1.80)	-0.28 (-0.94)	-0.73** (-2.37)	-0.2 (-0.63)	1.07** (2.83)	-0.42 (-0.76)
_cons	13.36*** (13.93)	10.75*** (7.70)	11.70*** (11.42)	12.80*** (8.49)	13.46*** (14.61)	8.99*** (5.08)	16.88*** (8.00)	12.83*** (5.08)
N	110	153	138	125	56	82	54	71
R2	0.46	0.06	0.19	0.19	0.74	0.09	0.71	0.25

t statistics in parentheses

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01

Sexual heterogeneity effects is also an interesting point to look at. In the Western countries, it is generally found that males with higher agreeableness tend to have worse financial outcomes, and this effect is very thin for females (Judge et al., 2012; Matz and Gladstone, 2018), because "agreeable men disconfirm (and disagreeable men confirm) conventional gender roles, agreeableness was expected to be more negatively related to

income for men (i.e., the pay gap between agreeable men and agreeable women would be smaller than the gap between disagreeable men and disagreeable women)". However, if we put the same logic in China, things may get reversed: agreeable (high SD) women confirm conventional the gender role in China – which is not encouraged to work hard outside at all, but stay at home and take care of the family. As the saying goes, “Men are breadwinners; women are homemakers.”, women conforming to the gender role may result in the opposite income impact in China, and we study this hypothesis in this paper.

These sexually asymmetric heterogeneous effects sign that the major channel about our integrative regression may come from female career participation. This result is interesting because it shares very similar channel (social conformation) with the Western findings, but leads to the opposite outcomes. Also, it is valuable to mention that this finding can largely mitigate the potential reverse causality problem. The logic is: if the personality is reported because of income difference or shocks, this effect is very unlikely to show the above mentioned patterns across the four groups we look at; it does not make a lot of sense to say that only women who came from richer families are influenced by this channel; nor they seem to report *lower*, but not higher, social desirability when they have a good mood resulted from higher income. Also, the complementary assortative matching (a socially desirable woman matches an undesirable man who earns more money) is also unlikely to be true, because we have observed extremely strong evidence for similarity-based assortative matching within their parents. In the final version of this paper I will try to set up a toy theory model about this, and look deeper into further evidence.

### **3.3.3 Future Work**

The discussion above is still not complete. In the process of completing this whole research, we will study further of the various sources of heterogeneous effects and try to come up with a structural model.

## **4 Discussions and Literature Review**

In this part, we specifically link the surprising results from Western observations to the current literature in economics and psychology. We explain why these results are not as surprising as the first impression.



## 4.1 Personality Structures

We detect a personality structure that resembles the Big Five but has two important differences; (1) We need to treat desirable (GC) and undesirable (GW) traits independently; (2) Within the desirable traits, which are measured with a higher reliability, it is hard to distinguish agreeableness, conscientiousness and emotional stability, which altogether generate a China-specific factor, Social Desirability, or "Ren". In fact, there exist rich cultural psychology and personality studies literature supporting this results.

The GC-GW structure is a typical and a bit extreme case of flexible and dialectical self-concept.

The inseparability of agreeableness, conscientiousness and emotional stability mainly comes from social expectation. The ideal personality image of ancient China is likely to have a permanent effect. As is mentioned above, most part of personality in China comes from nurture, and the child can determine to conform to or go against the Confucian education. Those people who are inclined or educated to conform with the society will show both Conscientiousness and Agreeableness, and vice versa. However, it leads to an inconsistency if one shows high Conscientiousness but low Agreeableness, or the opposite. This is supported by simply looking at the correlation of Conscientiousness and Agreeableness in China. In our paper, if we assume that the FFM is *suitable*, this correlation will be 0.52; in [Carciofo et al. \(2016\)](#), this correlation is 0.37; while in the most cited study using this inventory in the West ([Benet-Martinez and John, 1998](#)), this correlation are 0.27 and 0.17 respectively within Spanish and American samples. In other countries, literature also shows that this number is usually smaller in Western countries and larger in Eastern countries ([Denissen et al., 2008](#); [Plaisant et al., 2010](#); [Yoon et al., 2002](#); [Namikawa et al., 2012](#)). This adds further evidence on the correlation of C as A special cultural feature, and in China, this relationship is extreme.

Furthermore, the literature of GFP (General Personality Factor) ([Musek, 2007](#)) also gives support to the validity of our finding. Specifically, some researchers believe that there is an alpha-beta structure within personality: the former includes E and O, and the latter includes C, A and N ([Rushton and Irwing, 2008](#); [Van der Linden et al., 2010](#)). To some extent, our results within the GC range fits well in this literature; and it is likely that the cultural cultivation has strengthened the unity of C, A and Emotional Stability as a whole factor.



Nevertheless, the discussions above may still be subject to questions because the discussion above is mainly based on the positive side: our construction of E, O and SD only include positive items, and the structures within the negative side is not exactly symmetric. However, because the BFI-44 *does not* have enough number of reversed items for extraversion and openness, it is less confident for us to establish the inner structure of GW than that of GC in this paper. Yet, the fact that the constructed within-GW factors still has good predictive powers in certain behaviors still necessitates the inclusion of these indicators in a Chinese personality model.

## 4.2 Personality Formation

The major finding in our paper can be summarized in two sentences; (1) In China, the genetic heritability of personality traits are much lower than that in Western countries and Japan, and the family education (shared environment effect) plays a significantly larger role. (2) In China, the major channel through which family education influences personality is how parents treat Children when they have discrepancies or conflicts. These results have their positions in the literature about behavioral genetics and development psychology.

Typically, we observe a genetic heritability between 0.4-0.6 for personality traits measured with Big Five. Why China is so different? One possible piece of evidence is the relatively authoritative ("strict and warm") and authoritarian ("strict and cold") parenting style in China, especially in areas which are far from the more liberal, coastal provinces (Chao, 1994; Chen et al., 1997; Xu et al., 2005). These two types of parenting styles are very different from the permissive style prevalent in the West. The typical difference of an Eastern parenting style (Authoritarian and Authoritative) is that parents have strict rules about children's behaviors out of their expectation. In the final version we will make a systematic review on the studies of parenting styles and personality outcomes. Also we will test this story within our data.

Another interesting coherence with the current literature hides in (Polderman et al., 2015). Although this paper suggests that most behaviors are seriously genetic heritable, there are two traits for which the MZ and DZ correlations are very close: social interaction ( $r_{MZ} = 0.34$ ,  $r_{DZ} = 0.27$ ); and social values ( $r_{MZ} = 0.49$ ,  $r_{DZ} = 0.41$ ). This coincides our finding of an extremely low heritability (even negative) for behaviors that relate to

social norm, but a relatively considerable heritability for Introversion/Extraversion. As we discussed above, a large part of personality is rather social than individual. These results together may give more support of our findings in this paper.

### 4.3 Personality Impacts

In this part, we have found robust relationships between personality indicators and economic outcomes, and it is very likely that these relationships are causal. The most interesting question remains here: why Social Desirability is a negative trait for income? Summarizing our results, the current literature and the socioeconomic backgrounds of Yunnan province in China, we have the following discussions:

(1) How social desirability may impact income is a horse race. On the one hand, higher SD means higher conscientiousness, and therefore better grit to stick to goals and work efficiently; also, higher SD means a better fit in the society, leading to a potentially better social capital and better income. On the other hand, higher SD also means less tendency to take risks and be aggressive, and less tendency to refuse unreasonable requests and bargain for their wage actively. A too high agreeableness/SD may be the "curse of lovely", and this is observed in our data, especially for women.

(2) The gender gap may come from the social norms and social stereotypes about women. In traditional Confucian values, women are encouraged to be family-oriented and inactive in pursuing their own careers. In Yunnan province, a rather underdeveloped region in early 21st Century, such values are strong for the Han-ethnic groups there. The women who have a higher SD may likely to stick to traditional social roles and do not pursue an active career path. On the contrary, Extraversion contributes to a higher income, indicating that "going out" is really important for improving the income status.

(3) There are two important limitations about the effect we detect. First, what we detect is a temporary income. The children are rather young at the survey time (<30 years old), and we cannot arbitrarily refuse that people with higher SD may have a lifespan potential of higher income. This channel can be partially studied by looking at the career choice of different people. Second, the higher SD for women may help them perform better in marriage markets. They may be more caring and tender, thus making them better spouses and able to attract a partner with higher income. There is suggestive evidence in this paper that this mechanism is not likely to be true, and in the final version we will

make more discussion about this channel.

These discussions are not exactly based on rigorous evidence. In the final version this part will be enriched with more robustness checks and choice modeling.

## 5 Conclusion

### 5.1 Policy and Application Implications

In the final version we will carefully discuss about these implications on various fields: applied psychology, education, international relations and others.

### 5.2 Some Words to Future Related Studies

We expect that this paper will proceed a number of personality studies in China, and will provide some new insights about psychologists and economists.

*To Psychologists:*

(1) We need to localize psychometric tools in China, especially those with reversed items. As (Peng and Nisbett, 1999; Spencer-Rodgers et al., 2004, 2010b; Sims et al., 2015) and our research suggest, the dialectical thinking problem is a common phenomenon in measuring emotions, preferences and personality in China. Future research that includes inventories with reversed terms are therefore encouraged to replace the reversed items into regular ones, in case they would have to drop these items because keeping them leads to a bad internal consistency and difficulty in explaining the results.

(2) We need to carefully review the currently popular view of "Parents, but not parenting matter" in the developing world, especially countries with an interdependent thinking style. In an interdependent culture, as Markus and Kitayama (1991); Kitayama and Uchida (2005); Nisbett et al. (2001); Choi et al. (2007) and many other studies suggest, personality and the self image is a highly socially dependent thing. This, plus the similarly low genetic heritability of social interactions and values in (Polderman et al., 2015) may lead to warnings about looking at the "nature vs nurture" problem in the non-WEIRD world. Cross-cultural awareness and studies should be introduced in behavioral genetics studies.

(3) We call for further study of the cultural and historical backgrounds of cognitive style

formation. Like the rice theory and the pathogen theory, we need more systematic studies that may fit in a larger scale of world. It will be also valuable to do such twin studies in other parts of China, especially those provinces in the North, which may generate results more resembling the West because it is believed that Northern China has less holistic thinking than Southern China.

*To Economists:*

(1) We call for future intervention studies in China to further study the differences about personality in China. Despite the novel findings, our paper, even using twin data, is still potentially influenced by endogeneity problems. And as in ([Almlund et al., 2011](#); [Heckman et al., 2019](#)), the safest way of studying a causal relationship between personality and economic outcomes is to design random controlled trials, or intervention studies.

(2) The definition and application of personality skills may need to be considered from a cross-cultural perspective. Some personality traits (such as agreeableness) are skills in one cultural setup, but burdens in others. This implies that training programs focusing on certain skills should be adjusted to fit better in target cultures.

(3) In future surveys for economic research purposes, it may be marginally inexpensive but really useful to add personality assessments and pair them with a few incentivized small experiments. Such tests will lead to better chances for us to study how individual-level mental differences impact economic decision making and outcomes.

## Appendix A.

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