
A Tale of Hardships: Genes, Family Background, and Children's Response to Negative Shocks

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Abstract

Early negative shocks (e.g., diseases and malnutrition) have been widely believed to cause a long-term negative effect on children's later achievements. However, the abundant evidence in the literature may only present the partial truth. Overlooked is another important fact that human beings have the subjective initiative to deal with crisis, and children's response to negative shocks may play a critical role in determining future outcomes. In this study, we argue that children's personality trait of resilience to adversity can mitigate or even reverse the impacts of negative shocks and provide the first empirical analysis of this hypothesis. We use survey data on twins in urban China to investigate the effect of the "send-down" experience during China's Cultural Revolution on children's later social success. We find that children with undesirable personality traits who likely respond to the hardships negatively or passively are harmed by the send-down experience, whereas children with desirable personality traits who tend to respond to the sufferings positively benefit from the rustication experience, and we also find significant gender differences in such effects. We further investigate the determinants of children's such personality traits and find that both genes and family background seem to play important roles in the formation of resilience in children's future lives. In other words, some children are born optimistic, whereas some children could develop optimism through the support of their parents.

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Suffering, for the weak is the tomb of death, and for the strong is the soil of germinal ambition.

—— Jean Jacques Rousseau (*The Dream of a Lonely Walker*)

When heaven is about to confer a great office on any man, it first exercises his mind with suffering, and his sinews and bones with toil. It exposes his body to hunger, and subjects him to extreme poverty. It confounds his undertakings. By all these methods it stimulates his mind, hardens his nature, and supplies his incompetencies.

—— Mencius¹ (*The Works of Mencius, Gao Zi, Part 2*)

1. Introduction

A large body of literature has studied the effect of early negative shocks (e.g., diseases and malnutrition) on child development and concludes that these shocks have a long-lasting negative effect on children's human capital accumulation and later achievements (e.g., Case et al., 2005; Strauss and Thomas, 2007; Smith, 2009; Currie et al., 2010; Almond and Currie, 2011; Currie and Vogl, 2013). Given that efficiently building relevant life skills critical for later achievements in adulthood could be difficult for children who face disadvantages in early life, such conclusions are reasonable and highlight the importance of high-quality early childhood programs, which protect children from such negative shocks, particularly in developing countries.

However, this analysis may only present the partial truth. As illustrated in the opening quotations, conventional wisdom shows that hardships in early life stages could strengthen individuals. We hear tales of many great people throughout history who experienced unimaginable sufferings when they were young yet endured. Therefore, children could be resilient to such shocks and even use the induced disadvantages as an impetus to succeed in life. Although the existing literature constantly stresses that the disadvantages induced by negative shocks could prevent the

¹Mencius or Mengzi (371–289 BC) was a Chinese philosopher who has often been described as the “Second Sage” in China, only after the most influential Confucius.

affected children from building crucial life skills, another less evident point has been overlooked: positively responding to negative shocks, in itself, may be an important life skill.

Stoltz (1997) first proposes the concept of the adversity quotient (AQ) to measure people's ability to deal with adversity in their lives, and he argues that AQ is one of the probable indicators of a person's success in life and may be as important as the other more common indicators, such as intelligent quotient (IQ) and emotional quotient (EQ). However, prior research does not pay adequate attention to the potential importance of AQ. Although some evidence of resilience exists, the effect appears fairly limited, and no substantial evidence shows that individuals could fully recover from the initial disadvantage induced by negative shocks (Francesconi and Heckman, 2016). Nevertheless, the nature of resilience and the reason for its limited overall effect are not thoroughly understood. Based on a notion of personality trait akin to AQ, we attempt to provide the first empirical analysis and test of the hypothesis conveyed in the opening quotations.

Previous studies generally link the negative shocks that children experience in early life with their later achievements and identify a reasonable negative relationship, thereby further assuming it as the evidence for the negative effect of the shocks. Although the described research route appears reasonable, another important factor has been ignored: human beings have a subjective initiative to deal with crisis; thus, their responses to negative shocks may play an important role in determining future outcomes. Obviously, people with various personality traits may have distinctive responses to negative shocks, and their varying responses could produce different outcomes. Individuals do not necessarily always bear their sufferings passively when facing negative shocks. They could also positively respond to the shocks and strengthen themselves in the process.

In brief, previous studies generally investigate the effect of negative shocks on the entire population and obtain a point estimate of the relevant parameter. However, the distribution of such a parameter also matters, and it may be a critical factor for us to understand the essence of the truth. As an extreme example, suppose the individuals of Group A are severely harmed by an extreme shock, whereas those in Group B positively respond to such a shock and become stronger. Although we may obtain an overall zero estimate of the effect of the shock on the entire population, concluding categorically that, "on average", the shock has no effect on the population would be misleading.

Therefore, to fully understand the effect of negative shocks on child development, we must consider children's potentially heterogeneous responses to the shocks.

In this study, we empirically identify children's heterogeneous responses to negative shocks and further identify the causality between such responses and the later outcomes. This endeavor presents an extremely challenging task because children's responses to the shocks are usually unobservable. Given that our knowledge is limited only to the observation of children experiencing the shocks and their later outcomes, we must infer their responses to the shocks on the basis of available information. Although making such inferences is generally difficult, we can reasonably infer that children with certain desirable character traits (e.g., optimism and tolerance) are likely to respond to negative shocks positively and benefit from, rather than forever be harmed by their sufferings, and vice versa for those with undesirable traits.

We use the survey data on twins in urban China to investigate the effect of early hardship experiences on children's later social success and identify the role of the personality trait and heterogeneous response in such a case. Many of those urban twins were affected by the forced mass rustication movement during the Chinese Cultural Revolution and were sent down to the countryside to "be educated from living in rural poverty" (Lu, 2007). The forced rustication or "send-down" movement is among one of the most far-reaching social experiments in modern China, and almost all urban families in the country were affected at the time. In the 1966–1976 period, approximately seventeen million urban youth (mostly aged 16–19), or 10.5% of the urban population at the time, were sent down to rural areas to perform manual labor for from one or two years to as many as ten years (Pan, 2002). The rustication experience was extremely difficult for the youth affected. Not only were they forced to leave their hometowns for relocation to remote, backward villages; they also inevitably suffered considerably from the lack of material supplies and harsh physical labor. In our survey data, many pairs of twins were affected by the "send-down" movement: for some sets, only one twin was sent down; for others, both twins were sent down but for different durations. These facts provide a unique opportunity to study the effect of the send-down experience on those affected youth.

As shown in the literature (Ashenfelter and Krueger, 1994; Behrman and Rosenzweig, 1999; Li et al., 2010), monozygotic (MZ) twins can be considered genetically identical and are also raised in the same family. Thus, the effects of unobservable factors (e.g., endowments and family background) could be reduced on the basis of the estimates of within-twin differences, which facilitates the identification of the causality between the send-down experience and the later social success of affected youth.

We first identify a (within-twin) stable personality trait of children to predict their responses to negative shocks and further estimate the effect of the rustication on children with different traits. Thereafter, we further investigate the determinants of such traits in children or their responses to negative shocks. Given that the trait is within-twin stable, we infer that it is determined by common factors shared by both MZ twins, namely, genes or family background. As the only difference between MZ and DZ twins (fraternal twins) lies in that the former have more similar genes than the latter, we compare the traits of MZ and DZ twins to identify the role of genes. Finally, we compare the family backgrounds of MZ twins with different traits to identify the role of family background.

The survey includes questions related to the respondents' emotional experiences and attitudes toward life, which can be utilized to infer their personalities or specific character traits. For instance, question 1 (Q1) asks the respondents whether they frequently experience sad and angry emotions, while question 2 (Q2) asks them whether they could control or maintain these emotions at the proper expression level when experiencing them. Both questions provide the respondents with four options ("very often," "sometimes," "rarely," and "never"). We deduce that individuals who seldom feel sad or angry or those who can largely control these negative emotions, are likely to be optimistic and thus positively respond to the hardships, and vice versa. We must confirm that the relevant measured traits used to predict children's response to negative shocks are stable rather than variable over time.

We divide the entire sample into several subsamples ("positive," "neutral," and "passive") on the basis of twins' answers to those questions. We find that for the "positive" twins, the send-down experience significantly promotes their later social success, whereas for the "passive" twins, the rustication experience has a considerable negative effect on their later achievements. We also uncover a significant gender gap in such an effect. "Positive" males and females both benefit

significantly from the send-down experiences. By contrast, “passive” males are considerably harmed by the rustication experiences, whereas such negative effect is nearly negligible for “passive” females. In brief, females are more resilient to the hardships than males.

We further investigate the determinants of children’s response to negative shocks and find that both genes and family background seem to be crucial determinants of children’s AQ or resilience. In other words, resilience not only occurs through nature but also can be nurtured by family education. We interpret that there is a crucial period for children to develop some important personality traits after they are born, during which children are primarily under the care of their parents and thus family education plays a dominant role.

As shown in Heckman et al. (2006), Borghans et al. (2008), and Kniesner and Weel (2008), non-cognitive skills (e.g., personality and social and emotional traits) are as important as cognitive ability (e.g., IQ) in determining individuals’ social and economic success. Evidently, resilience is also one of these non-cognitive skills. Although the importance of non-cognitive skills gains extensive acceptance, what determines such skills in children and whether and how these skills could be nurtured have not been well understood.

In the latest experimental studies, scholars find that certain non-cognitive skills are malleable in childhood and can be fostered in the classroom environment, which is broadly consistent with our findings. Alan et al. (2019) design a randomized educational intervention experiment in two independent elementary school that aims to promote students’ grit. They find that treated students are more likely to reattempt a task and succeed better after failing. Our studies differ from the experimental literature in many ways. First, we study the effect of children’s heterogenous responses to negative shocks and demonstrate that similar shocks can generate completely different outcomes for children with different personality traits. Second, the implications of our results significantly differ from theirs. Specifically, failing a specific task in an experiment is hardly comparable to the hardship experience in one’s real life. For instance, an individual may be willing to try again after failing a task in an experiment, but he could still be frustrated and fragile when experiencing an extremely negative shock. Last but not the least, the experimental studies can only examine the short-term effect of a small failure on student’s performance in classroom; by contrast, empirical

investigations with rich data allow us to analyze the comprehensive effects of early negative shocks on individuals' adult life.

Our results also suggest that children from disadvantaged families are likely to respond to negative shocks passively rather than positively. Given that most of the children in developing countries who suffered from negative shocks are from disadvantaged families, we can explain why previous literature has found abundant and strong evidence for the overall detrimental effect of negative shocks on affected children: many of them passively respond to the shocks.

However, our interpretation of the negative effect of such shocks on child development differs significantly from that of the existing literature, and our findings also have dissimilar policy implications. The most decisive disadvantages such children encounter may not be the negative shocks they experience but the poor family education they receive, which hinders them from forming crucial non-cognitive skills, such as resilience. Therefore, improving the family education those children receive may be as important as or even more important than protecting them from potential negative shocks.

Nevertheless, although the governments of the civilization era have invested considerable funds toward school education for centuries and compulsory school attendance has become codified in law in most countries, insufficient attention is given to family education. Notably, the latter is also critical for child development. Despite the undeniable importance of school education for children in developing their cognitive skills, family education is indicated to be more important in the formation of children's non-cognitive skills, such as resilience, which are also crucial for their later achievements.

2. Cultural Revolution and Send-Down Movement

On May 16, 1966, the Central Committee of the Chinese Communist Party chaired by Mao Zedong issued a circular that outlined Mao's ideas on the cultural revolution. It marks the start of the 10-year long "great proletarian Cultural Revolution" in China.

The Cultural Revolution is a colossal catastrophe for China. During this period, human rights, democracy, the rule of law, and the Chinese civilization itself were unprecedentedly crushed (Yan

and Gao, 1996). Many leading cadres of the government were persecuted, and numerous intellectuals and ordinary people were also attacked and maltreated. Song (2011) estimates that during this period, several million people were persecuted to death and hundreds of millions received cruel and inhumane treatment. The economy was also on the verge of collapse, and large segments of the Chinese population, particularly residents of rural areas, lived in extreme poverty. The literature has documented the traumatic impact of this period, such as the disruption of social stability, breakdown of social norms, economic stagnation, unnecessary deaths owing to violence and persecution, physical and emotional suffering in certain sectors, and lost life opportunities for an entire generation of youth who grew up during the period (Xie et al., 2008). In brief, such a turbulent decade brought immense sufferings to the people of China.

Shortly after the beginning of the Cultural Revolution, a large-scale send-down movement campaign was launched at the national level, which affected nearly all urban families. This campaign sought to send the urban youth, after graduation from junior or senior high school, “up to the mountains and down to the countryside.” Lu (2007) comprehensively records the send-down movement. Small-scale send-down movements started in the 1950s. After the People’s Republic of China was established, the youth from urban areas were organized to relocate to the rural countryside, especially remote towns, to cultivate virgin land and/or work in farms as solutions to the employment problems in the cities. In 1953, the *People’s Daily* published the editorial “Organize school graduates to participate in agricultural production labor.” In 1955, Mao Zedong asserted that “the countryside is a vast expanse of the heaven and earth where we can flourish,” which later served as the slogan for the movement. In 1966, under the influence of the Cultural Revolution, university entrance examinations were suspended. Until 1968, many students were unable to be admitted into universities or gain employment. In 1969, thousands of youth were rusticated. Secondary school students were organized and sent to the countryside.

Xie et al. (2008) summarize the multiple factors that motivated such a nationwide policy of the Chinese government at the time: the desire to alleviate urban unemployment, the desire to cultivate Marxist ideology and communist ethics in the youth, and the need to develop China’s rural areas and frontiers. Perhaps more fundamentally, Chairman Mao always stressed that it was necessary for

educated young people to go to the countryside to be reeducated by the poor and lower middle-class peasants, and the government believed that the sent-down urban intellectual youth could promote themselves in many ways through experiencing hardships in rural areas. Such mentality is consistent with the desire to cultivate Marxist ideology and communist ethics in the youth.

Although some urban youth were inspired by the revolutionary and patriotic propaganda and voluntarily went down to the countryside, most were reluctant to separate from their parents and go to the backward rural areas to perform harsh manual labor. Thus, coercion was used and parents were threatened with job loss. In many cases, parents were permitted to send only one child (twin) down, and even if all children (twins) were sent down, the children stayed in the countryside for different durations. As one sent-down young person recounted:

I was only 15 when I was sent down. No one wanted to go, but no one could resist. When I refused to go, those in charge of the residential committee came to our home every day and asked us to study Chairman Mao's instructions. A member of the worker's propaganda team came to live in our home and organized a study team for my family. My father was a cadre. He was locked up in a study team in his workplace and was not allowed to return home until his children agreed to go to the rural area. In the end, my mother begged me to go to the rural area (Deng, 1993, p. 60).

For most youth, the send-down experience was traumatic and among the most difficult incidents in their lives. They suffered not only removal from their families but also lack of material supplies, an unfamiliar environment, and harsh physical labor. As shown in Zhou and Hou (1999), vast disparities in living environments were present between the rural and urban areas, and most urban youth had never lived in rural areas prior to their sent-down experience; they were sent to designated rural areas far from their home cities and were allowed to visit their families for only a few weeks in every three years; they also endured harsh manual work in the field, often for more than 10 hours a day, 7 days a week.

From 1966 until the send-down movement ended in 1978, approximately 17 million people, or 10.5% of the urban population at the time, were sent down to rural areas (Pan, 2002). Some sent-down youth returned to the cities during the Cultural Revolution, but only a small number had such opportunities. In October 1978, the Community Party issued a document to end forced rustication

and begin arranging for the sent-down people to return to the cities. Only about a million sent-down youth, or approximately 5% of the total number never returned to the urban areas because they were married to local farmers or were assigned non-agricultural local jobs (Li et al., 2010).

The send-down movement is a unique social experiment in modern China, and tens of millions youth were affected. Studying the effect of such a historical event on the youth who experienced the movement in the context of the Cultural Revolution remains of great interest.

3. Data

The data used in the present study are derived from the Chinese Twins Survey, which was conducted by the Urban Survey Unit of the National Bureau of Statistics (NBS) in June and July 2002 in five cities in China. The survey was funded by the Research Grants Council of Hong Kong. Some influential papers published in prestigious journals also employed this data set (e.g., Li et al., 2007; Huang et al., 2009; Li et al., 2010; Li et al., 2012) and confirmed the high quality of the data. This is the first socioeconomic twin data set in China and perhaps the first in Asia. The data set includes rich information on the socioeconomic situation of the respondents in the five cities of Chengdu, Chongqing, Harbin, Hefei, and Wuhan. Altogether, 4,683 respondents participated, of which 2,990 were twins. For the sample of twins, care was taken to distinguish whether the twins are identical (monozygotic, or MZ) or non-identical (fraternal, or DZ) twins on the basis of standard questions used in prior twin surveys. We consider a pair of twins to be identical if both respond that they have identical hair color, looks, and gender. Completed questionnaires were collected from 919 matched pairs of MZ twins (1,838 respondents) and 576 matched pairs of DZ twins (1,152 respondents). However, for each variable, a slightly different number of observations may occur because of missing values. Table 1 reports the summary statistics of MZ and DZ twins. For each variable reported, we restrict the sample such that it is non-missing for both twins in a pair.

Column 1 shows that 56% of the identical twins are male; on average, the twins were 37 years old and had 11 years of schooling. For the entire MZ twin sample, the twins had been sent down for an average of 0.7 year. For those in the affected cohorts (born in the period 1946–1961 or aged 41–56 in 2002), however, 51% were sent down for rustication; those sent down stayed in the countryside

for 3.5 years on average. The MZ twins in our sample had monthly average earnings of 888 yuan in 2002, where earnings include wages, bonuses, and subsidies.

Given that we rely on estimates based on the variation within the pairs of twins in the duration of forced rustication, an important feature of the data is the extent of within-twin pair variation in the send-down time. In total, 363 pairs of MZ twins and 156 pairs of DZ twins are in the affected cohorts (aged 41–56 in 2002). Table 2 shows that for 34% of the affected MZ twin pairs, neither twin was sent down; for 30% of the twin pairs, one was sent down; and for the remaining 36% of the twin pairs, both were sent down. The within-twin variation in send-down years is even larger. In 48% of the MZ twin pairs, the twins spent a different number of years in the countryside: 23% had 1–2 years' difference in send-down years, 21% had 3–5 years' difference, and the remaining 4% had a difference of over 5 years. The within-twin pair differences for DZ twins are also substantial and have a similar distribution.

4. Effect of the Send-Down Experience on Later Social Success of the Youth

4.1. Empirical Specifications

We estimate the effect of the rustication experience on children's later earnings based on the fixed-effect method, and obtain the estimates based on the variation in send-down years within MZ twin pairs, which identifies the economic returns to rustication. We estimate the following earning equation:

$$w^{ij} = X^j \alpha + Z^{ij} \beta + \mu_j + e^{ij} + \varepsilon^{ij},$$

(1)

where superscripts i and j refer to child i and family j , respectively; w^{ij} is the logarithm of earnings (wage) for child (twin) i in family j ; X^j represents a set of observed family characteristics, and Z^{ij} is a set of observed child-specific variables that affect earnings, in which the number of send-down years (r^{ij}) are included; μ_j is a family effect; e^{ij} denotes the child-specific endowment; and ε^{ij} is the disturbance term, which we assume to be independent of the Z^{ij} and μ_j .

The ordinary least squares (OLS) estimate of the effect of send-down years in Equation (1) is likely biased. Such bias results from the fact that μ_j and e^{ij} are usually correlated with Z^{ij} ; normally, we cannot control the effect of these two unobservable factors. For instance, if those sent-down youth are generally from disadvantaged families or have low endowment or ability (which cannot be measured accurately in general), then the OLS estimate of β would pick up the negative effect induced by these unobservable factors. However, we substantially eliminate such biases by obtaining a fixed-effect estimate for the MZ twin sample. MZ twins can be considered genetically identical and thus the endowment differences within MZ twins are normally small.² Moreover, the twins are also brought up in the same family. Thus, we could eliminate the effect of family background and endowment by taking a first difference of earning Equation (1) across the MZ twin sibling pairs. We obtain the first difference earning equation as follows:

$$w^{1j} - w^{2j} = (Z^{1j} - Z^{2j})\beta + \varepsilon^{1j} - \varepsilon^{2j},$$

(2)

where the superscripts 1 and 2 refer to twins 1 and 2 in a pair. The family background and endowment effects are all eliminated by differencing. The estimate β_{MZ} based on Equation (2) provides an unbiased estimate of children's send-down experiences on their earnings as adults.

We hypothesize that the effects of the send-down experience on heterogeneous individuals are different. To empirically test this hypothesis, we divide the sample into "positive" and "passive" subgroups on the basis of respondents' stable personality traits and further estimate Equation (2) for each group respectively. We will discuss the choice and stability of relevant traits in the next section.

4.2. Choice and Stability of Relevant Traits

We use respondents' traits as reflected by their answers to the relevant survey questions to predict their responses to negative shocks. The survey includes questions such as Q1 and Q2 (see below), the

²MZ twins may not be identical at birth. Differences in nutrient intake in the womb across MZ twins may matter for their later outcomes. As shown in Behrman and Rosenzweig (2004), a considerable variation exists in birth weight across MZ twins, and this variation is closely related to differences in their educational outcomes and earnings. Li et al. (2010) further find that parents exhibited favoritism toward the abler child and choose the low-endowment twin child to be sent down. In Section 4.4, we also investigate the potential difference within MZ twins and its implications on our empirical results.

answers to which may indicate respondents' personality traits that could predict their responses to negative shocks. For instance, if a respondent answers that she experiences the sad or angry emotion "very often," then, we can infer that she may be highly pessimistic and is also likely to respond to the shocks negatively or passively, and vice versa.

Q1. Do you ever experience the following emotions?

	Very often	Sometimes	Rarely	Never
Sad	1	2	3	4
Angry	1	2	3	4

Q2. If you experience the following emotions, can you successfully control it in the proper expression level?

	Very often	Sometimes	Rarely	Never
Sad	1	2	3	4
Angry	1	2	3	4

Such inference is supported by the psychology literature, which shows that high levels of positive emotion promote well-being (Seligman and Csikszentmihalyi, 2000). Specifically, positive emotion promotes creative thinking (Isen et al., 1987), social connection with others (Fredrickson, 1998), and resilience to stressors (Folkman and Moskowitz, 2000). In brief, higher levels of positive feelings are extremely important for individuals' social success, including overcoming significant difficulties in their lives.

Subtle differences occur between people's experiences of sad and angry emotions, and the latter may be more relevant to the present study than the former. According to appraisal theories of emotion, the appraisal that other people are responsible for one's misfortune is central to the experience of anger, whereas the appraisal that one's misfortunes are due to impersonal circumstances beyond anyone's control is central to the experience of sadness (Smith and Ellsworth, 1985; Ellsworth and Smith, 1988). Intuitively, if the parents selected one twin to be sent down to the countryside, the selected child might be more angry than sad because she felt that her

parents' decision was unfair. Therefore, individuals who often experience angry emotions may also respond negatively to such man-made sufferings.

However, we must confirm that the relevant trait used to predict individuals' response to negative shocks should be stable over time. Specifically, the trait should be unaffected by other factors (particularly the send-down experience) that affect respondents' earnings. For instance, if the respondents' experience of anger or sadness is significantly affected by the send-down experience and is used as the dividing line between "positive" and "passive" subsamples, then, individuals' send-down experiences would be correlated with which of the two subsamples they belong to. Thus, the estimate in Equation (2) would be biased.

To avoid such problems, we could assume that the relevant trait should be absolutely stable. That is, when children are born, these traits are determined and are thus entirely unaffected by their subsequent experiences. This notion is a perfect assumption for our identification, but it is also too strong. Children's personality traits are highly likely to be affected by their later experiences to some extent, and identifying an absolutely stable trait may be very difficult. Fortunately, we do not need such an extremely strong assumption. Actually, if the trait is only within-twin stable, then, it could be used to predict twins' responses to the shocks. Specifically, even if the traits of both twins are affected by shared common factors (e.g., family background), the within-twin difference in the trait could remain consistently small; thus, such a trait is within-twin stable over time. If both twins always share a common trait (e.g., optimism), then, they consistently belong to the same group ("positive" or "passive") and are thus completely comparable.

A large body of psychology literature studies the stability of personality traits over time. As shown by Costa and McCrae (1991), stability is seen in two ways: the mean levels of the traits of the same birth cohorts change little with age (mean-level stable), and retest correlations³ show stability of individual differences (rank-order stable). The first concept of stability is similar to absolute stability over time; the second one refers to the extent to which individuals maintain their rank order

³In practice, researchers test the correlation of the relevant traits among individuals at intervals to investigate whether these traits are stable over time.

in the distribution of a trait, e.g., whether introverts remain introverts, or become extraverts (Costa and McCrae, 1991).

Personality traits are expected to be possibly affected by environment and experiences to some extent. However, some earlier studies demonstrate that personality traits showed a much larger degree of long-term stability than expected (e.g., Block, 1977; Leon et al., 1979; Siegler et al., 1979). Some later research confirms that personality traits are remarkably stable in adulthood (Costa and McCrae, 1980; McCrae and Costa, 1990). However, such findings are far from conclusive, and other investigations find evidence of changes in some personality traits in adolescence (e.g., Haan et al., 1986; Siegler et al., 1990). Although these personality traits may not be absolutely stable over time, Costa and McCrae (1991) verify that such evidence actually underestimates the true stability of personality traits as seen by peer raters, which are extremely stable in adulthood (stable in individual differences).

Roberts et al. (2006) further reveal that rank-order stability and mean-level change are better regarded as independent and can exist simultaneously. Specifically, rank-order stability refers to the relative placement of individuals within a group over time, whereas mean-level change denotes whether a group of people increases or decreases on trait dimensions over time. The existence of stability, at least as defined in terms of rank-order stability, does not preclude the existence of change, especially a mean-level change over time. Ample empirical evidence proves that rank-order stability and mean-level change coexist in the same longitudinal study (e.g., Roberts et al., 2001; Robins et al., 2001; Roberts et al., 2002).

Our concept of within-twin stability is similar to the rank-order stability (or stability of individual differences). Given that twins are more similar to each other than other people in many ways, the former concept is a weaker assumption than the latter. Naturally, within-twin stability can also coexist with mean-level change. Specifically, even if a personality trait is within-twin stable in adulthood, it does not indicate that such a trait is absolutely stable and could not be affected by environment and experiences. Some psychologists also reveal that people's response to adversity is formed through the influences of their parents and other key people in childhood (Stoltz, 1997). Evidently, MZ twins sharing similar genes are often brought up in the same family and are primarily

under the care of their parents in childhood. Consequently, they are likely to develop similar personality traits, such as resilience, during this period. Furthermore, after these traits are formed, they are probably (within-twin) stable over time in adulthood. Therefore, even if the trait could be affected by common factors (e.g., family background) shared by MZ twins, such a trait could also be within-twin stable over time.

Given that MZ twins are born genetically identical, if they still share some specific traits several decades later when they grow up as adults, we can infer that those traits are (within-twin) stable to a great extent. Specifically, during these decades, these MZ twins may have had numerous different experiences; if such experiences do not affect those traits, then, we could conclude that those traits are surely (within-twin) stable.

We focus on four relevant variables probably reflecting the respondents' specific trait, which could predict their response to negative shocks, namely, their answers to question Q1 related to their "sad" and "angry" emotion experiences (i.e., E-sad and E-angry) and question Q2 related to whether they could successfully control their sad and angry emotions (i.e., C-sad and C-angry). All these questions have four options: 1 ("very often"), 2 ("sometimes"), 3 ("rarely"), 4 ("never"). We first investigate whether these potential traits are stable. Table 3 shows the summary statistics for the within-MZ and -DZ twin variations in the four variables. The upper panel shows that the mean of the within-MZ-twin difference for the four variables are between 0.5 and 0.7 and that the corresponding standard deviations are between 0.6 and 0.8. Furthermore, the lower panel indicates that over 50% of MZ twins exactly have the same answers to these questions (with the difference being 0), and nearly 40% of the twins have slightly different answers to these questions (with the difference being 1), whereas only approximately 2% or less of the twins have significantly different answers to these questions (with the difference being 3). Given the potential measurement error and that the smallest unit of these variables is 1, these MZ twins only show relatively small difference in their answers to these questions. This finding provides a first impression that these four traits are within-twin stable to some extent.

We now further verify whether these traits are stable on the basis of a fixed-effect estimation for the MZ twin sample. If a specific trait is within-twin stable, then it is determined by genes and

common factors and would be unaffected by other factors. We estimate Equation (2), with the dependent variables being these four traits (“E-sad”, “E-angry”, “C-sad”, and “C-angry”) respectively, to check whether these traits are affected by the respondents’ experiences, particularly their send-down experiences. We also include other variables in the regressions that may affect these traits, such as wage or family income, work experience, and years of schooling.⁴ The estimation results are shown in Table 4.

Table 4 shows that the traits “E-sad,” “C-sad,” and “C-angry” are significantly affected by at least one variable, whereas “E-angry” is not significantly affected by any of the independent variable. Specifically, Columns 1 and 2 indicate that “E-sad” is significantly affected by the send-down years, work experience, and family income. The send-down experience has a significant negative effect on the respondents’ tendencies to experience sad emotions, but the magnitude of the effect is fairly small. An additional year of send-down experience only reduces “E-sad” by approximately 0.03, that is, it slightly increases the respondents’ tendencies to experience sad emotion to “very often.”⁵ Work experience significantly increases “E-sad,” and the magnitude of the effect is even smaller. An additional year of work experience only increases “E-sad” by 0.02, indicating that respondents who work more years are slightly less likely to experience sad emotions frequently. Unsurprisingly, family income significantly reduces the respondents’ tendencies to experience sad emotions, but the magnitude of the effect is modest. An increase of 10,000 Yuan in family income only increases “E-sad” by approximately 0.06. Although Column 1 shows that wage has a positive effect on “E-sad,” it is not significant. As we know, wage can measure individuals’ social success to a certain extent, while family income is more relevant for measuring individuals’ material quality of life. If a respondent’s wage is low but her spouse’s income is high (making her family income high), then she would still be satisfied with her current life and would not experience sad emotions frequently. Therefore, family income is a more relevant factor in experiencing the sad

⁴As wage is part of family income, we include the two variables separately in the regression to examine the effect of each variable on the dependent variables.

⁵The variables “E-sad” and “E-angry” take four values, namely, 1 (“very often”), 2 (“sometimes”), 3 (“rarely”), and 4 (“never”). Thus, if the send-down experience reduces “E-sad,” then it indicates that the send-down experience increases the respondents’ tendencies to experience sad emotions “very often.”

emotions than wage. These findings indicate that the trait “E-sad” is unstable because it is closely related to whether an individual is satisfied with the current state of her life.

Similarly, as shown in Columns 5-8, “C-sad” and “C-angry” are also significantly affected by wage or family income. Specifically, the respondents with higher family income are more able to control their sad emotions, and the respondents with higher wages could control their angry emotions to a greater extent. Again, the magnitude of these effects is not very large. By contrast, Columns 3 and 4 indicate that “C-angry” is not significantly affected by all the independent variables (with the estimates of all coefficients being very small and insignificant). Therefore, the variable “C-angry” seems to reflect the respondents’ stable personality trait.

Intuitively, “E-angry” measures whether individuals often experience anger and reflects whether they can keep a positive frame of mind, which is likely to indicate a stable personality. By contrast, individuals’ ability to effectively control their angry emotions may be affected by their social success. That is, individuals who have achieved higher social success may have likewise nurtured their ability to control their angry emotions in the process. Therefore, the trait “C-angry” is likely to be less stable.

In sum, individuals with higher family income not only experience sad emotions less frequently, but are also more able to control such emotions effectively; individuals with higher wages can also control their angry emotions to a larger extent; whereas their experiences of angry emotions are unaffected by their wages, family income, and other factors. Thus, the trait “E-angry” is likely to reflect individuals’ stable character trait.

Table 3 also confirms these inferences. “E-angry” has the smallest mean and standard deviation of within-MZ-twin difference. Moreover, approximately 92% of MZ twins only show a slight difference in “E-angry” (with the difference being equal or less than 1), whereas only less than 1% of MZ twins show significant difference in it (with the difference being 3). It will later be presented that, among these four traits, the trait “E-angry” is more determined by genes than the other three.

Our preceding discussions are consistent with the psychology literature. Boman et al. (2003) show that individuals’ tendencies to experience angry emotions are closely related to their optimistic

and pessimistic expectations, which are relatively stable traits and play an important role in their response to hardships, setbacks, and stressful circumstances.

4.3. Empirical Results on the Send-Down Experience

According to the previous analysis, we select “E-angry” as the classification criterion of the “positive” and “passive” subsamples. Specifically, if both twins answer that they experience angry emotions “very often” or “sometimes,” we include them in the “passive” group, and if both twins answer that they “rarely” or “never” experience angry emotions, we include them in the “positive” group. Besides these two groups, in the case of some twins, one may answer “sometimes” and the other may answer “rarely” regarding experiencing angry emotions. Given the subtle difference between “sometimes” and “rarely,” it is very likely that, although these twins’ answers are not exactly the same, they actually show minimal difference in their tendencies to experience angry emotions. Therefore, we include these twins in a third subsample, which is the “neutral” group. These respondents’ responses to the send-down experience should be between the two extremes (“positive” and “passive”), which should reflect the effect of the send-down experience on their future social success. We now use Equation (2) to estimate the effect of the send-down experience on the respondents’ later earnings for the entire MZ twin sample and each subsample.

The estimation results are demonstrated in Panel A in Table 5. Column 1 of Panel A shows that for the entire MZ twin sample, the send-down experience has a significantly positive effect on the respondents’ earnings. Specifically, an additional year of send-down experience increases the respondents’ earnings by approximately 3.5%. Furthermore, when we divide the entire sample into “positive,” “neutral,” and “passive” subsamples, we find that the effect of the send-down experience on the respondents’ earnings shows considerable differences across the three subsamples. Specifically, Column 2 shows that for the “positive” subsample, the send-down experience has a much larger positive effect on the respondents’ earnings than that for the entire sample, that is, an additional year of send-down experience increases the respondents’ earnings by as much as 9.0%,⁶

⁶ $e^{0.086} - 1 = 0.090$.

and the estimate is significant at the 5% level. Conversely, for the “neutral” subsample, Column 3 indicates that the estimate falls by more than half and becomes insignificant. By contrast, Column 4 reveals that, for the “passive” subsample, the estimate even becomes negative, and an additional year of send-down experience reduces the respondents’ earnings by approximately 6.3%. Although this estimate is not significant and the p-value is approximately 0.13, it is still surprising and is in sharp contrast with the significantly positive estimate for the “positive” subsample. Furthermore, the t-test result (Column 5 of Panel A) verifies that the estimates for the “positive” and “passive” subsamples significantly differ (with the p-value being approximately 0.016), which indicates that a significant gap exists in the effect of send-down experience on individuals’ adult wage across positive and passive groups.

The huge gap in the effect of the send-down experience on the respondents’ later wage across subsamples is not difficult to explain. If individuals experience angry emotions very often, then they do not have a calm frame of mind and may be angry with everything they deem unfair, and they are also likely to respond to negative shocks (e.g., being sent down to remote rural areas) passively rather than positively, thereby resulting in a negative effect on their future achievements. By contrast, individuals who rarely experience angry emotions are likely to respond to the send-down experience positively and improve themselves in the process and thus benefit from their hardships.

Although “E-angry” can be used to predict the respondents’ responses to the send-down experience to a large extent, such predictions may not be 100% accurate. The “positive” subgroup may also include a few individuals who actually respond to hardships passively, which would underestimate the actual effect of the rustication experience on the positive individuals’ future wages. Conversely, the “passive” groups may include some individuals who respond to negative shocks positively, which would underestimate the actual harm of the rustication experience on the passive individuals. In other words, the actual gap in the effect of the rustication experience between the “positive” and “passive” subgroups may be much larger than our previous estimates.

The above classification of the three subsamples (Classification I) is intuitive but not unique, and an alternative classification can be created utilizing the available information to a greater extent. Specifically, if both twins answer that they “never” experience angry emotions, we include

them in the “Positive I” subsample, which is actually the extremely positive group; if both twins “rarely” experience angry emotions, we include them in the “Positive II” subsample, which can be considered as the modestly positive group. Similarly, if both twins answer that they “sometimes” experience angry emotions, we include them in the “Passive II” subsample, which is the modestly passive group; if both twins experience angry emotions “very often,” we include them in the “Passive I” subsample, which is the most passive group. This classification (Classification II) is more specific than Classification I and identifies the extremely positive and passive groups respectively, and we expect the gap in the effect of the send-down experience across these subgroups would significantly widen. Of course, we only keep the sample in which both twins provide exactly the same answer to the question, at the price of having less than 60% of the entire sample left.⁷

Panel C of Table 5 presents the within-MZ-twin estimates of the effect of the send-down experience for the four subsamples. The gap in the estimates across the subgroups becomes considerably larger. Column 1 presents that for the most positive group (“Positive I”), an additional year of send-down experience increases the children’s earnings in adulthood by more than 48.6%, and the estimate is significant at the 5% level. Column 2 indicates that for the less positive group (“Positive II”), the effect becomes much smaller and less significant. By contrast, such an effect becomes negative for the passive groups. Column 3 presents that for the modestly passive group (“Passive II”), an additional year of send-down experience reduces children’s earnings in adulthood by approximately 6%, though the estimate is not significant. Finally, Column 4 shows that for the most passive subgroup (“Passive I”), the effect becomes extraordinarily larger, and an additional year of send-down experience decreases the children’s earnings in adulthood by almost 70%. Given that there are only eight pairs of twins in this subsample, it is not surprising that the coefficient is not precisely estimated. Again, Column 5 presents that the estimates for the “positive I” and “passive I” subsamples significantly differ (with the p-value being approximately 0.001).

⁷As shown in Panel B of Table 3, for all the four questions, more than 50% of MZ twins’ answers are exactly the same (with the within-twin difference being 0).

In summary, the results in Table 5 presents a clear pattern wherein individuals' personality traits may play a vital role in determining the effect of the send-down experience on their future social success. From the most positive to the most passive subgroups, such an effect decreases monotonously and sharply, which is consistent with our expectation.

4.4. Potential Differences within MZ Twins

In this section, we examine the effect of the potential differences within the MZ twins on our empirical results by comparing the within-MZ and within-DZ twin estimates. As shown in the previous section, the within-MZ twin estimate identifies the economic returns to rustication, and as revealed by Li et al. (2010), the difference between the within-MZ and within-DZ twin estimates reveals the sign of the correlation between rustication and endowment.

We have obtained the estimates of the effect of the send-down experiences on children's adult earnings based on the MZ twin sample with Equation (2). We can also obtain similar estimates for the DZ twin sample. As $e^{1j} \neq e^{2j}$ for DZ twins, the fixed-effect estimator cannot remove the endowment effects; thus, the estimator is likely biased. For the DZ twin sample, the first difference becomes

$$w^{1j} - w^{2j} = (Z^{1j} - Z^{2j})\beta + e^{1j} - e^{2j} + \varepsilon^{1j} - \varepsilon^{2j}. \quad (3)$$

Given that the endowments $e^{1j} - e^{2j}$ are unobservable, if $\text{corr}(Z^{1j} - Z^{2j}, e^{1j} - e^{2j}) \neq 0$, then β_{DZ} will be biased.

As shown in Li et al. (2010), if $\beta_{DZ} > \beta_{MZ}$, then the cross-child difference in the unobserved endowment ($e^{1j} - e^{2j}$) is positively correlated with the cross-child difference in send-down years ($r^{1j} - r^{2j}$), that is, the child with higher endowments in a family was sent down for a longer time; similarly, if $\beta_{DZ} < \beta_{MZ}$, parents show favoritism and choose to have the better-endowed child stay in the household. Li et al. (2010) further suggest that the sign of the difference between the within-DZ and the within-MZ estimates of β also indicates the direction of any bias in the within-MZ estimate β due to any remaining differences in endowments across MZ twins, under the assumption that parents respond in the same way to child endowment differences across the two

types of twin pairs. Thus, if $\beta_{DZ} < (>)\beta_{MZ}$, then parents exhibit favoritism toward the stronger (weaker) child, and any bias in the within-MZ estimate must be negative (positive).

Panel B of Table 5 presents the estimation results for the DZ twin sample. Column 1 shows that the estimate for the entire DZ twin sample is only slightly larger than 0 and is not significant. Columns 2 and 3 show that for the “positive” and “neutral” subsamples, the estimates are slightly larger than 0 and are not significant, whereas Column 4 suggests that for the “passive” group, the estimate becomes negative and is still not significant. In addition, the t-test result indicates that the estimates for the “positive” and “passive” subsamples are not significantly different.

Furthermore, by comparing the estimates of Panels A and B, we find that for the “positive” groups, the estimate for the MZ twin sample is much larger than for the DZ twin sample. This condition indicates that for the “positive” DZ twin sample, parents exhibit favoritism toward the stronger child and choose the less able child to be sent down for a longer time. In addition, if parents in the corresponding “positive” MZ twin sample respond in the same way, then the estimate in Column 1 of Panel A would be the lower bound of the effect of the send-down experience on the “positive” subgroup. By contrast, for the “neutral” and “passive” subgroups, the MZ-twin and DZ-twin estimates are not significant and exhibit minimal differences; thus, the parents in these groups exhibit no obvious favoritism toward the abler or less able child.

We can interpret the preceding estimates for the MZ- and DZ-twin samples in a different way. The gap in the effect of the send-down experience between “positive” and “passive” DZ twins is relatively small (i.e., Columns 2 and 4 of Panel B of Table 5 are 0.0156 and -0.0799, respectively), but the gap for the corresponding two MZ groups is much larger (i.e., Columns 2 and 4 of Panel A of Table 5 are 0.0864 and -0.0607, respectively). Thus, if we would hypothetically eliminate the within-DZ twin differences to obtain a MZ twin sample, such a gap would increase considerably. Therefore, any potential within-twin differences can reduce the gap in the effect of the send-down experience across heterogeneous groups. Furthermore, even if some differences still exist between MZ twins, if we continue to reduce such differences and finally obtain a perfect sample in which both twins were completely similar, we could probably obtain a larger estimate of the gap in the effect of the send-down experience between the “positive” and “passive” groups.

4.5. Further Investigation: The Gender Difference

We find strong evidence that the effect of the send-down experience on the children's adult wages differs significantly across heterogeneous subsamples. It is interesting to determine whether males and females respond to the send-down experience differently and we now examine the gender difference in the effect of early hardships on people's future social success.

Panel A of Table 6 shows the within-MZ-twin estimates of the effect of the send-down experience on the males' and the females' wages in adulthood under Classification I. The estimates differ significantly for the male and female subsamples.

Column 1 presents that for the entire male sample, the estimate is only slightly larger than 0 and is not significant. By contrast, Column 5 reveals that for the entire female sample, the estimate is much larger and is significant at the 5% level. Surprisingly, the send-down experience generally has a significant positive effect on the females' future earnings and has almost no effect on the males' earnings. Therefore, the significant positive estimate for the entire MZ twin sample we determined previously (Column 1 of Panel A in Table 5) is mainly due to the positive effect of the send-down experience on females. Furthermore, though the estimate for the entire male sample is nearly zero and not significant, such finding does not signify that the send-down experience has no effect on the males' earnings. Column 2 indicates that for the "positive" male subsample, the send-down experience has a positive effect on the children's future earnings, and an additional year of send-down experience increases their earnings by approximately 9.0%. The estimate is not significant (with the p-value of about 0.13) but much larger and more significant than the estimate for the entire male sample. For the "neutral" male subsample, Column 3 reveals that the estimate becomes much smaller and less significant. For the "passive" subsample, Column 4 shows that the estimate becomes negative and significant at the 1% level, and an additional year of send-down experience reduces individuals' earnings by as much as 33%, which is an extremely large negative effect. Again, the t-test result confirms that the estimates for the "positive" and "passive" male subsamples are significantly different.

By contrast, for the female sample, Columns 6 and 7 show that the estimates for the "positive" and "neutral" subgroups are similar, and an additional year of send-down experience increases the

respondents' earnings by more than 8%. Again, the estimates are not significant (with the p-value of about 0.13). Column 8 indicates that for the "passive" female subsample, the estimate is only slightly smaller than 0 and not significant, which stands in sharp contrast to the significant and substantial negative estimate for the male "passive" subsample in Column 4. The t-test result shows that the estimates for the "positive" and "passive" female subsamples differ significantly, which indicates a significant gap exists in the effect of send-down experience on individuals' adult wage across positive and passive females.

Panel B of Table 6 presents similar estimates for male and female subsamples under Classification II. For the male sample, Column 1 presents that for the "Positive I" subsample, the send-down experience has a huge positive effect on their earnings. An additional year of the send-down experience increases their earnings by as much as 82%, and the estimate is significant at the 10% level. Column 2 reveals that for the "Positive II" subsample, the estimate becomes much smaller and insignificant. Conversely, for the "Passive II" subsample, Column 3 presents that the estimate becomes very negative and significant at the 1% level, and an additional year of send-down experience decreases the respondents' earnings by as much as 31.7%. Finally, for the "Passive I" subsample, as we only have five observations, we cannot obtain a meaningful estimate. By contrast, the estimates for the female sample differ in many ways. Column 5 presents that for the "Positive I" subsample, the send-down experience also has a large positive effect on the respondents' earnings, and an additional year of send-down experience increases their earnings by about 62%, and the estimate is significant at 1% level. Column 6 presents that for the "Positive II" subsample, the estimate becomes much smaller and is not significant. On the contrary, for the "Passive II" subsample, Column 7 presents that the estimate becomes negative but is only slightly smaller than 0 and is not significant, which stands in sharp contrast to the significant and substantially negative estimate for the male "Passive II" subsample in Column 3. Finally, for the "Passive I" subsample, as we only have one observation, we cannot obtain a meaningful estimate. However, we can deduce that even if the effect of the send-down experience on this group is negative, it should be relatively modest.

In summary, our results indicate that the effect of the send-down experience on the respondents' later earnings shows much larger variation for males than for females. For positive males, the send-down experience has a large positive effect on their future social success, whereas for passive males, the send-down experience significantly reduces their future earnings. By contrast, though the send-down experience also has a sizable positive effect on the positive females' future earnings, it has almost no effect on the passive females' earnings. Therefore, the effect of negative shocks on males goes to two extremes, while females generally seem to be more resilient than males.

Such a significant gender difference in the effect of negative shocks is not difficult to explain. Compared with females, males exhibit much larger variation in job performances and excel in many industries. For instance, a majority of artists, scientists, and statesmen are males. Meanwhile, most criminals are also males. Thus, males may also go to two extremes when faced with negative shocks. By contrast, females differ from males in physical structure and many other traits. Females play a crucial role in producing offspring, enduring immense suffering in the process. Therefore, for females, a greater resilience to negative shocks may result from the division of duty arising from nature.

5. Nature or Nurture?

In the previous section, we provide strong evidence that children's heterogeneous responses to negative shocks produce completely different outcomes. Perhaps a more fundamental question is why children respond to negative shocks differently and what determines such responses. Is the trait that determines such responses a nature, or could it be nurtured? We now provide suggestive answers and interpretations to these challenging issues.

Given that the trait "E-angry" is within-twin stable, we infer that it is determined by genes or common factors (e.g., family background), or both. To identify the roles that genes and family background play in determining children's response to negative shocks, we compare the within-pair differences for the trait "E-angry" of three samples (MZ twin, DZ twin, and mixed pair). Specifically, we construct a third "mixed-pair" sample in which the two children of each pair are

from different families. We can simply select one child from a family to match with the other one from another family to form a pair and obtain such a new sample.

MZ twins not only share 100% of their genes but are also from the same family. By contrast, DZ twins are also brought up in the same family but only share 50% of their genes. Finally, for the third mixed-pair sample, both children of each pair are from different families and have different genes. Therefore, we can compare the within-pair differences of the trait of the MZ and DZ twin sample to identify the effect of genes, and we can further compare the corresponding differences across the MZ, DZ, and mixed-pair samples to identify the effect of family background. Table 7 presents the within-pair differences in the trait “E-angry” for the three samples.

Given that the only difference between the MZ and DZ twins is that the former have more similar genes than the latter, we first compare the stability of the trait “E-angry” of MZ and DZ twins to examine whether genes are a critical determinant of the traits. Columns 1, 2 and 4 of Table 7 presents that the within-MZ twin difference of the trait “E-angry” is significantly smaller than the corresponding within-DZ twin differences. Given that more similar genes result in a smaller within-twin difference in the trait “E-angry” for MZ twins, we infer that genes constitute an important determinant of this trait.⁸

We further examine the role that family background plays in the formation of the trait “E-angry”. Suppose that family background does not matter, then the difference across the three samples would be that MZ twins have the same genes, and DZ twins only share 50% of their genes, while mixed-pairs children have completely different genes. Under this circumstance, we expect that the gap of the within-pair difference of the trait “E-angry” between MZ and DZ twin samples would be

⁸Some researchers use the “ACE” model to identify the genetic and environmental determinants of individuals’ behavior, where A represents additive genetic effects, C is common environment, and E denotes idiosyncratic environment. However, this model carries strong assumptions that are unlikely to hold, specifically, that the three factors are uncorrelated with one another. For instance, twins from rich families (common environment) may have extremely different individual specific experiences (idiosyncratic environment) from other children who are from poor families. In other words, common environment probably correlates with idiosyncratic environment. Given that these assumptions are unlikely to hold, the model may not be appropriate. Thus, we do not use it for our analysis.

similar to that between DZ twin and mixed-pair samples. However, as shown in Columns 4 and 5 of Table 7, the latter (0.184, Column 5) is almost twice as large as the former (0.098, Column 4). Therefore, we can safely reject the null hypothesis that family background does not matter for the trait “E-angry”. In other words, given that children from different families show much larger difference in the trait “E-angry” than children brought up in the same family, we can infer that family background also plays an important role in the formation of such a trait.

We further compare the family backgrounds of MZ twins across different groups (“Positive I,” “Positive II,” “Passive II,” and “Passive I”) to examine the correlation between children’s family backgrounds and their potential responses to negative shocks. Given that the parental education level is a strong indicator of family income class, we use it to measure family background and divide families into lower, middle, and upper classes. Table 8 presents the education levels of MZ twins’ fathers and mothers for the four subgroups. For children in the extremely passive group (“Passive I”), the average education levels of their fathers and mothers are lowest, indicating that they were brought up in the most disadvantaged families. By contrast, for children belonging to the extremely positive group (“Positive I”), the average education levels of their fathers and mothers are higher than those of the “Passive I” group but lower than those of the other groups, which suggests that they are from middle-class families. Children with the highest parental education levels generally belong to the neutral groups who are neither very positive or very passive.⁹

A potential explanation for such findings is that family background plays an important role in the formation of children’s resilience. Children from lower-class families face numerous disadvantages and do not receive decent family education and attention during their formative years when personality traits and non-cognitive skills, such as resilience, are developed. Therefore, they are not only more likely to experience negative shocks but also tend to respond to them passively. By contrast, children from upper-class families have parents who can provide them with the best environment and family education growing up. However, such children lack the opportunities to receive crisis education and are not well prepared for potential setbacks or hardships and thus are not

⁹The *t*-test results show that fathers’ and mothers’ education levels of “Positive I”, “Neutral” (“Positive II” and “Passive II”), and “Passive I” groups are significantly different.

likely to respond to negative shocks very positively when they occur. Finally, children from middle-class families can receive decent family education and are aware that life is not completely easy. Thus they are less likely to be spoiled by an overly comfortable environment and will generally respond to negative shocks positively.¹⁰

Our interpretation is consistent with the findings in the literature, which provides abundant evidence that family environment has important influence on children's personality traits (e.g., Nakao et al., 2000; Cunha and Heckman, 2007; Deckers et al., 2015). Undoubtedly, parents are their children's first teachers and can exert significant influence on their children's characters and personality traits. Stoltz (1997) reveals that individuals' resilience is formed through the influences of their parents and other key people during childhood. Therefore, unsurprisingly, children from different family backgrounds exhibit great variation in resilience because their parents play a critical role in the formation of their personality traits, include resilience.

However, if children's resilience is determined not only by genes but also by family education, then why is it unaffected by other factors such as formal education? In other words, if such a trait could be nurtured, why could it only be nurtured by family education? As discussed earlier, there is a crucial period in children's lives for forming important traits after they were born, during which they are mainly cared for by their parents, and thus family education plays a dominant role. Such a period is likely to occur before children attend primary school. Furthermore, these traits become stable once they are formed and are thus unaffected by children's subsequent experiences, such as formal education and future work experience.

Given that children's resilience is determined by their genes and the family education they received during childhood, possibly, some individuals are born optimistic, whereas some could develop optimism through the support of their parents. These findings have important policy implications. While genes are determined by nature and little can be done to improve them,

¹⁰Given that the random gene is also an important determinant of individuals' resilience, the considerable variation of parental education for every group is unsurprising. For instance, for children in "Passive P" group (i.e., extremely passive group), although a large share are from lower-class families, it is still possible that some who have the worst genes are from middle- or upper-class families.

policymakers could provide families, especially those from lower-income classes, with public services to improve the family education received by the children.

Our findings are also consistent with the abundant literature that provides evidence on the overall negative effect of negative shocks on children's future achievements. Most children who suffered from the shocks, such as diseases and malnutrition, are from disadvantaged families and, as shown in this study, those children are also likely to respond to the shocks passively rather than positively.

6. Discussions and Conclusions

We investigate the effect of the send-down experience on children's future adult earnings and provide the first rigorous evidence that children's heterogeneous responses to hardships play a vital role. Specifically, children who are likely to respond to hardships positively benefit from the send-down experience, whereas children with a high tendency to respond to sufferings negatively or passively are harmed by the rustication experience. The evidence is consistent with our hypothesis that children's personality traits of resilience to adversities can mitigate or even reverse the impacts of negative shocks. We further examine the determinants of children's such personality traits and find that genes and family education seem to play important roles in the formation of resilience in children's future lives. In other words, some children are born optimistic, whereas some children could develop optimism through the support of their parents.

Our study suggests that resilience is not only a nature but can also be nurtured through family education. Therefore, children are harmed by negative shocks because of their inferior genes and/or inadequate family education, which hinder their formation of resilience. Although genes are random to a large extent and unalterable, parents and educators can guide children to become resilient when faced with negative shocks. Therefore, the most decisive disadvantages that passive children face may not be the negative shocks they experience but the poor family education they receive. Evidently, that a child will never experience any negative shock during her lifetime cannot be guaranteed. If negative shocks are an inevitable part of life, then improving the family education that children receive and assisting them to become more resilient may be as important as or even more important than protecting them from all potential negative shocks. Moreover, how to nurture

children's resilience against negative shocks becomes one of the most vital issues for parents, educators, and policymakers to seriously consider.

Our study also questions the common practice in empirical studies of drawing a conclusion by obtaining an overall point estimate of an effect on the entire population. As revealed by our study, the information provided by the point estimate may be insufficient to reach a meaningful conclusion, and the distribution of the effect may also matter to a large extent. For instance, even if we obtain a point estimate of an effect on the entire population that is not significantly different from 0, some individuals may still be affected positively, whereas others may be affected negatively. Given that considerable heterogeneity exists almost everywhere, despite the general difficulties of estimating the distribution of a specific effect on the population, this study highlights the importance and necessity of such further estimation.

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Table 1: Summary Statistics, by Twin Pair Type

Variable	MZ twins		DZ twins	
	Mean	Standard Deviation	Mean	Standard Deviation
	(1)	(2)	(3)	(4)
Send-down years for the entire sample	0.71	2.11	0.45	1.75
Proportion sent down for affected cohorts (aged 41–56 in 2002)	0.51	0.50	0.45	0.50
Send-down years for affected cohorts	1.74	2.90	1.67	3.04
Age	37.31	10.22	34.80	10.04
Male proportion	0.56	0.50	0.59	0.49
Years of education	11.24	2.96	11.35	3.07
Monthly wage in 2002 (including bonus and subsidies, in yuan)	888.50	517.93	835.33	548.30
Number of twins (pairs)	1,838 (919)		1,152 (576)	

Table 2: Within-Twin Variation in Rustication and Send-Down Years for Affected Cohorts (Aged 41–56 in 2002)

Variable	MZ twins		DZ twins	
	Count	Percent	Count	Percent
A. Within-twin variation in send-down dummy				
Neither sent down	124	34.16	60	38.46
One sent down	108	29.75	51	32.69
Both sent down	131	36.09	45	28.85
Total pairs	363	100	156	100
B. Within-twin variation in send-down years				
0 year	188	51.79	82	52.56
1–2 years	85	23.42	44	28.21
3–5 years	77	21.21	22	14.10
6 years or more	13	3.58	8	5.13
Total pairs	363	100	156	100

Table 3: Summary Statistics for the Within-MZ and Within-DZ Twin Variation in Several Traits

Within-twin differences												
Variables	E-sad			E-angry			C-sad			C-angry		
	MZ	DZ	T-test	MZ	DZ	T-test	MZ	DZ	T-test	MZ	DZ	T-test
Mean	0.602	0.579	0.023	0.562	0.660	-0.098***	0.552	0.614	-0.062	0.629	0.678	-0.049
S.D.	(0.712)	(0.699)	(0.038)	(0.670)	(0.726)	(0.037)	(0.753)	(0.773)	(0.041)	(0.789)	(0.838)	(0.043)
Distribution												
0	474 (51.8%)	305 (53.2%)		487 (53.1%)	272 (47.7%)		526 (57.9%)	306 (53.5%)		485 (53.2%)	297 (51.9%)	
1	343 (37.5%)	210 (36.6%)		353 (38.50%)	228 (40.0%)		290 (31.9%)	199 (34.8%)		310 (34.0%)	187 (32.7%)	
2	86 (9.4%)	52 (9.1%)		69 (7.5%)	62 (10.9%)		67 (7.4%)	49 (8.6%)		87 (9.5%)	63 (11.0%)	
3	12 (1.3%)	6 (1.1%)		8 (0.9%)	8 (1.4%)		26 (2.8%)	18 (3.1%)		30 (3.3%)	25 (4.3%)	
Observations (pair)	915 (100%)	573 (100%)		917 (100%)	570 (100%)		909 (100%)	572 (100%)		912 (100%)	572 (100%)	

Notes: (i) *T*-test is to test the difference between the mean of each variable for MZ and DZ twins. *** $p < 0.01$. (ii) Within-twin difference is an absolute value. For instance, if one twin answers “1” (“very often”) and the other answers “4” (“never”) regarding experiencing one emotion, then the within-twin difference in this variable is 3 (absolute value).

Table 4: Within-MZ Estimates of the Effect of Send-Down Years on Several Traits

Variables	Dependent variables							
	E-sad (1)	E-sad (2)	E-angry (3)	E-angry (4)	C-sad (5)	C-sad (6)	C-angry (7)	C-angry (8)
Send-down years	-0.0304** (0.0153)	-0.0291* (0.0151)	-0.0126 (0.0144)	-0.00721 (0.0142)	-0.0177 (0.0156)	-0.0154 (0.0153)	-0.0170 (0.0167)	-0.0129 (0.0164)
Wage	0.0691 (0.0615)		0.0534 (0.0579)		-0.0319 (0.0630)		-0.130* (0.0667)	
Experience	0.0180** (0.00790)	0.0163** (0.00699)	-0.000753 (0.00743)	0.00200 (0.00659)	0.0150* (0.00834)	0.0124* (0.00722)	0.0148* (0.00859)	0.0121 (0.00764)
Education	0.0299* (0.0173)	0.0342** (0.0158)	0.0166 (0.0163)	0.0122 (0.0146)	-0.00759 (0.0177)	-0.00333 (0.0156)	0.00684 (0.0190)	0.00700 (0.0169)
Family income		0.0547** (0.0263)		0.00364 (0.0248)		-0.0549** (0.0265)		-0.0219 (0.0286)
Constant	2.066*** (0.239)	1.930*** (0.218)	2.450*** (0.225)	2.475*** (0.203)	1.584*** (0.248)	1.721*** (0.220)	1.665*** (0.261)	1.693*** (0.234)
Pairs of twins	854	909	854	909	853	908	853	908

Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Fixed-Effect Estimates of the Effect of the Send-down Years on Log Wage,
by Twin Pair Type and Group Type

Variables	A. MZ twins (Classification I)				p-value
	Entire sample	Positive	Neutral	Passive	(2) - (4)
	(1)	(2)	(3)	(4)	(5)
Send-down years	0.0344** (0.0144)	0.0864** (0.0382)	0.0412 (0.0258)	-0.0607 (0.0401)	0.016
Pairs of twins	986	402	255	267	
Variables	B. DZ twins (Classification I)				p-value
	Entire sample	Positive	Neutral	Passive	(2) - (4)
	(1)	(2)	(3)	(4)	(5)
Send-down years	0.00294 (0.0336)	0.0156 (0.0430)	0.0287 (0.105)	-0.0799 (0.111)	0.52
Pairs of twins	640	260	190	130	
Variables	C. MZ twins (Classification II)				p-value
	Positive I	Positive II	Passive II	Passive I	(1) - (4)
	(1)	(2)	(3)	(4)	(5)
Send-down years	0.397** (0.152)	0.0876* (0.0491)	-0.0602 (0.0491)	-0.529 (0.824)	0.001
Pairs of twins	61	260	225	8	

Notes: (i) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (ii) All regressions include education, experience, and experience squared.

Table 6: Within-MZ Estimates of Effect of Send-Down Years on Log Wage, by Gender and Group Type

Variables	A. Classification I							
	Male				Female			
	Entire sample	Positive	Neutral	Passive	Entire sample	Positive	Neutral	Passive
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Send-down years	0.0120	0.0864	0.0263	-0.283***	0.0419**	0.0842	0.0825	-0.0328
	(0.0250)	(0.0548)	(0.0293)	(0.0957)	(0.0175)	(0.0537)	(0.0495)	(0.0439)
Pairs of twins	423	165	121	105	292	119	71	81
Variables	B. Classification II							
	Positive I	Positive II	Passive II	Passive I	Positive I	Positive II	Passive II	Passive I
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Send-down years	0.602*	0.0456	-0.271**		0.481***	0.119	-0.0195	
	(0.323)	(0.0636)	(0.104)		(0.140)	(0.0796)	(0.0587)	
Pairs of twins	19	109	87	5	25	69	64	1

Notes: (i) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. (ii) All regressions include education, experience, and experience squared.

Table 7: Within-Pair Differences in the Trait “E-angry”, by Pair Type

Within-pair differences for the trait “E-angry”					
	MZ	DZ	Mixed	T-test	
	twin pair	twin pair	pair	(2)–(1)	(3)–(2)
	(1)	(2)	(3)	(4)	(5)
Mean	0.562	0.660	0.844	0.098***	0.184***
S.D.	(0.670)	(0.726)	(0.740)	(0.037)	(0.036)
Observations (pair)	917	570	1487		

Notes: (i) Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Education of MZ Twins’ Parents, by Twins Group Type

Variable	Positive I	Positive II	Passive II	Passive I
Father’s education (year)				
Mean	7.1	8.2	8.5	5.4
S.D.	(4.6)	(4.6)	(4.5)	(3.4)
Mother’s education (year)				
Mean	5.8	6.9	6.8	3.6
S.D.	(4.3)	(4.2)	(3.9)	(1.9)
Observations (pair)	63	220	191	10