Does Money Buy Happiness? Evidence from Twins in Urban China*

Hongbin Li† Pak Wai Liu‡ Maoliang Ye§ Junsen Zhang**

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† Department of Economics, School of Economics and Management, Tsinghua University, Beijing, 100084, China. E-mail: lihongbin@sem.tsinghua.edu.cn.

‡ Department of Economics, The Chinese University of Hong Kong, Shatin N.T., Hong Kong. E-mail: pakwailiu@cuhk.edu.hk.

§ Corresponding author. Hanqing Advanced Institute of Economics and Finance, Renmin University of China, Beijing China 100872. Tel: (+86) 10-62519408. E-mail: maoliang.ye@post.harvard.edu.

** Department of Economics, The Chinese University of Hong Kong, Shatin N.T., Hong Kong. Tel: (+852) 3943-8186. Fax : (+852) 2603-5805. E-mail: jszhang@cuhk.edu.hk.

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Abstract

Whether money makes people happy is a fundamental question in economics. This paper contributes to the literature on the effect of income on happiness, and to the best of our knowledge, it is the first study of this kind that draws on twins data. We control for the crucial genetic factors and family background by using unique Chinese twins data in a within-twin-pair fixed-effects model. We likewise use the instrumental variable fixed-effects method to correct the measurement error bias. The results are robust after we consider the potential biases of within-twin-pair estimates, the various measures of income and wealth, and the possibility of reverse causality. We find that income has a large positive effect on happiness: Beyond the effect of genes and family background, the pattern that the rich are happier than the poor is partly driven by the higher income of the former *per se*. We further examine the cross effect of the income of twin siblings and find evidence that twins have a preference of inequality aversion towards their siblings. Our findings help us understand the inequality of subjective well-being in the context of economic development and transition, and present important implications for China and for other fast-growing and highly unequal countries.

JEL Classifications: D1, D6, I1, I3, J3

Keywords: Income; Happiness; Twins; Fixed Effects; Instrumental Variables

1. Introduction

One of the fundamental issues in economics is whether money makes people happy. The relationship between subjective well-being (SWB) and socioeconomic status, especially income, has been a focus of attention in "happiness economics" (Easterlin, 1974, 1995, 2001; Deaton, 2008; Di Tella & MacCulloch, 2008; Mayraz & Nickell, 2008; Stevenson & Wolfers, 2008). However, no consensus exists among these studies to date. Easterlin (1974, 1995, 2001) reports that income and self-reported SWB are positively correlated across individuals within a country, but the average SWB within countries does not seem to rise along with their economic growth. In contrast, in examining a panel of 21 countries from 1958 to 1996, Hagerty and Veenhoven (2003) report that the SWB of countries increases along with their national income, although the short-term effect of income per capita on SWB is higher than its long-term effect. Stevensen and Wolfers (2008) employ more data and reveal that the cross-country and time series relationships between SWB and income are similar to their within-country relationship, which reflects the significant role of absolute income and the less significant role of relative income.[1]

The literature on the effect of income on happiness has several limitations. First, the literature generally does not control for endowments that are correlated with income. Therefore, these studies likely confound the effect of income with the effects of genetic factors and family background, and they produce biased estimates even after controlling for the effects of the observed demographic variables: Those individuals endowed with the traits that lead to happiness may likewise happen to be endowed with traits that lead to higher income. Psychologists argue that the happiness of the same individuals tends to be roughly stable over time, which indicates that genetic differences are the major sources of the variations in happiness and subjective well-being. Psychological studies that use twins data report that genes produce a dominant effect on SWB (Tellegen et al., 1988; Lykken & Tellegen, 1996; Nes et al., 2006; Keyes et al., 2010). For example, Tellegen et al. (1988) compare the SWB levels of monozygotic (MZ) and dizygotic (DZ) twins raised together and raised apart, and reveal that 40% (55%) of the variance in their positive (negative) emotionality are attributable to the differences in their genes, whereas shared familial circumstances account for only 22% (2%) of the observed variance. MZ twins experience similar amounts of pleasant and unpleasant effects because they have exactly the same sequence of genes. Lykken and Tellegen (1996) report that 44% to 52% of the variance in SWB is due to genetic variation, while none of the environmental variables such as education,

[1] Easterlin (2005), Veenhoven and Hagerty (2006), Easterlin et al. (2010), and Sacks, Stevenson, and Wolfers (2012, 2013) continue the debate.

socio-economic status, income, marriage and religiosity could account for more than 3% of the variance. In their examination of a subsample of the twins for which longitudinal data were available, Lykken and Tellegen estimate that "the heritability of the stable component of subjective well-being approaches 80%." Nes et al. (2006) investigate a sample of Norwegian twins and report that the long-term SWB of both males and females is mainly attributable to their stable additive genetic factors, which explain approximately 80% of the cross-time correlation. De Neve et al. (2012) indicate that a specific gene is associated with happiness. Second, the measurement error in income is often severe, which attenuates the estimate of the effect of income on happiness. Third, causality may run from happiness to income rather than the other way around. Therefore, ascertaining how much of the empirical association between income and happiness is attributable to the causal effect of income is difficult.

Given these challenges, a thorough methodology must be devised to examine whether income really affects SWB. The most compelling studies to date employ plausibly exogenous lotteries (Gardner & Oswald 2001, 2007; Lindahl, 2005; Apouey & Clarkm, 2010) or institutional changes (Frijters, Haisken-Denew, & Shields, 2004; Frijters et al., 2006),[2] and find a positive causal effect of income. However, these studies have limitations. For instance, the use of lottery winners has several shortcomings, including the potential direct effect of lottery winning on happiness (for the effect of mood on reported well-being, see Schwarz & Clore, 1983), small effective samples, and small income shocks. As for the fixed-effects panel data model used in conjunction with institutional changes, it cannot control for time-varying omitted variables.

This paper presents new evidence on the relationship between income and self-reported happiness using unique twins data from China and addresses two key empirical challenges for the first time in the literature, namely, the omitted genetic factors and family background as well as the measurement error bias. To control for the unobserved genetic factors and family background, we employ a fixed-effects (FE) model for monozygotic (MZ) twin pairs. We likewise use sibling-reported information as an instrumental variable, and employ the instrumental variable fixed-effects (IVFE) model to correct the measurement error bias that is magnified by the fixed-effects model. Our favorite estimate (one IVFE specification) shows that one standard deviation increase in logarithmic income results in an increase of about 72% of the standard deviation of happiness. The comparisons among OLS,

[2] Powdthavee (2010) attempts to solve the endogeneity problem by instrumenting for income and allowing for unobserved heterogeneity, and finds a large effect of income. However, the instrumental variables that are used by Powdthavee, namely, the proportion of respondents who have shown their pay slips to the interviewer and the proportion of respondents who have pay slips but have not shown them to the interviewer, are not well motivated.

within-MZ-twin-pair FE, and IVFE estimates show the existence of both omitted variables and measurement error biases. In this study we use only one measure of happiness, although we discuss the literature on SWB which employs related but different measures such as happiness, life satisfaction and mental well-being.

The results are robust after we consider the potential biases of within-MZ-twin-pair estimates, and alternative measures of income and wealth. In addition, we examine the cross effect of the income of twin siblings and find evidence that twins have a preference of inequality aversion towards their siblings. We address the potential reverse causality concern by instrumenting individual income with industry average income and industry wage growth. The results that are based on these instruments suggest that the direction of causality runs from income to happiness.

Our study is likewise related with the literature on SWB in the context of economic development and transition. The SWB in developing and transition economies as well as its relationship with income and economic growth have attracted increasing attention from economists. Easterlin (2009) examines the transition of Eastern Europe from socialism to capitalism during the 1990s and finds that the life satisfaction of its residents follows the trend of GDP (i.e., collapses and then increases), but does not recover commensurately. Easterlin and Sawangfa (2010) investigate 13 developing countries in a long run and find that higher economic growth rates are not accompanied by more positive SWB trends. A particular puzzle is about China, an important developing and transition economy and the most populous country in the world: Although China has experienced remarkable economic growth for the past three decades, several studies report that the happiness or life satisfaction of the Chinese people has not increased (Burkholder, 2005; Brockmann et al., 2009; Crabtree & Wu, 2011; Knight & Gunatilaka, 2011; Easterlin et al., 2012), which indicates that reference groups (Easterlin, 1974, 1995, 2001; Clark & Oswald, 1996; Ferrer-i-Carbonell, 2005; Fafchamps & Shilpi, 2008; Knight, Song, & Gunatilaka, 2009; Knight & Gunatilaka, 2011), income aspirations (Stutzer, 2004; Knight & Gunatilaka, 2010, 2012), and social safety net (Easterlin et al., 2012) may likewise affect their happiness or life satisfaction. However, this finding does not exclude the effect of income *per se*. Cross-sectional studies observe that richer individuals feel happier or are more satisfied with their lives compared with the poor for a given time (Kahneman et al., 2006; Crabtree & Wu, 2011; Easterlin et al., 2012). Consistent with this observation, the current study focuses on the cross-sectional aspect instead of the time series evidence, but takes a further step to examine the causal effect of income on happiness.

The rest of this paper is organized as follows. Section 2 outlines the econometric specifications. Section 3 describes the data and variables. Sections 4 and 5 report the main results and the robustness checks, respectively. Section 6 concludes the paper.

2. Empirical Strategies

Our study begins with the following conventional cross-sectional estimates:

$$h_{1i} = X_i\alpha + \beta Y_{1i} + Z_{1i}\gamma + \mu_i + \varepsilon_{1i} \quad (1)$$

$$h_{2i} = X_i\alpha + \beta Y_{2i} + Z_{2i}\gamma + \mu_i + \varepsilon_{2i}, \quad (2)$$

where h_{ji} $(j = 1,2)$ is the self-reported happiness of the first and second twin in the pair, X_i is the set of observed variables that vary by family but not across twins (i.e., age, gender, and city dummies), Y_{ji} $(j = 1,2)$ is the income of twin j in family i, Z_{ji} $(j = 1,2)$ is the set of variables that may vary across the twins (i.e., education, marital status, employment status, and self-reported health), μ_i represents a set of unobservable familial variables that likewise affect happiness (i.e., genetic factors and family background), and ε_{ji} $(j = 1,2)$ is an individual-level disturbance that represents the other forces that affect happiness but are not explicitly measured.

The ordinary least squares (OLS) estimate of income effect in Eqs. (1) and (2), which is represented as β, is generally biased. Such a bias arises because normally, we do not have a perfect measure of μ_i, which is likely to be correlated with Y_{ji}.

2.1 The MZ Twins Strategy

A within-MZ-twin-pair fixed-effects estimator for twins is based on the first difference between Eqs. (1) and (2):

$$h_{1i} - h_{2i} = \beta(Y_{1i} - Y_{2i}) + (Z_{1i} - Z_{2i})\gamma + (\varepsilon_{1i} - \varepsilon_{2i}). \quad (3)$$

The first difference removes both observable and unobservable family effects, or X_i and μ_i. As μ_i has been removed, we can apply the OLS method to Eq. (3) without worrying about the bias that may be caused by the omitted variables of genetic factors and family background. We do this by taking advantage of the fact that MZ twins have the same genetic endowments at birth[3] and have similar innate abilities, personalities, and family backgrounds. MZ twins have more similarities than a randomly selected pair of individuals in terms of socioeconomic measures. These similarities arise from several sources, including their common physical and cultural heredity, similar access to financial resources, exposure

[3] To be scientifically accurate, the MZ twins are not identical at birth. The differences in the nutrient intake of MZ twins in the womb can affect their adult outcomes. We address this concern by controlling for their birth weights.

to similar influences from their communities (i.e., from friends, neighbors, and schools), and their likelihood to reside within the same location even during their adulthood, hence exposing them to the same regional economic environment (in our sample, the MZ twins from the same family all live within the same city). For more details on the methodology of twins data, see Gorseline (1932), Behrman and Taubman (1976), Griliches (1979), Behrman et al. (1980), Ashenfelter and Krueger (1994), Miller, Mulvey, and Martin (1995), Ashenfelter and Rouse (1998), Behrman and Rosenzweig (1999), and Bonjour et al. (2003).

Given the abovementioned similarities between a pair of MZ twins, the within-MZ-twin-pair strategy may provide two additional advantages for happiness studies. First, the similarity in the feelings toward the sources of happiness is higher between a pair of MZ twins than between a pair of random respondents, which provides more credence to interpersonal comparison. Second, the reference group of MZ twins is supposed to have more similarities than that of a pair of random respondents, which is especially important because reference groups may affect happiness (Clark & Oswald, 1996; Ferrer-i-Carbonell, 2005; Luttmer, 2005; Rayo & Becker, 2007; Clark, Frijters, & Shields, 2008). Therefore, the first difference between MZ twins can eliminate most of the biases that are caused by the reference group. Naturally, the MZ twins may use the income of their twin sibling as a reference point, which is addressed in Section 5.1.

2.2 Measurement Error Bias

The measurement error problem poses another concern for this study. Classical errors in the measurement of income produce a downward bias in the OLS estimation of the effect of income on happiness, and the fixed-effects estimator magnifies the measurement error bias. The measurement error of income is generally more serious (Bound & Krueger, 1991) than the small measurement error of education (Ashenfelter & Krueger, 1994; Huang et al., 2009; Li, Liu, & Zhang, 2012).

A straightforward, consistent estimator for Eq. (3) can be obtained by employing instrumental variables that use an independent measure of the income variable as the instrument. We follow Ashenfelter and Krueger's (1994) innovation and ask each of our respondents about their income and the income of their sibling. The survey used is designed to provide complete information about different measures of income levels. If the self-reported income has an error, the co-twin-reported income can be used as a potential instrument because the co-twin-reported income should be correlated with the self-reported income level but not directly correlated with happiness. Assuming Y_j^k as the report of twin

k on the income of twin j implies the presence of two approaches for using the auxiliary income information as an instrumental variable. The four means of estimating the income difference ΔY are as follows.

$$\Delta Y^{'} = Y_1^1 - Y_2^2 \tag{4}$$

$$\Delta Y^{''} = Y_1^2 - Y_2^1 \tag{5}$$

$$\Delta Y^{*} = Y_1^1 - Y_2^1 \tag{6}$$

$$\Delta Y^{**} = Y_1^2 - Y_2^2 . \tag{7}$$

A straightforward and consistent estimator for Eq. (3), under the classical assumption that measurement error terms in $Y_1^1 - Y_2^2$ and $Y_1^2 - Y_2^1$ are uncorrelated, can be obtained using instrumental variables. We use $\Delta Y^{''}$ as an instrument of $\Delta Y^{'}$ in the following estimation equation:

$$\Delta h_i = \beta \Delta Y_i^{'} + \Delta Z_i \gamma + \Delta \varepsilon_i . \tag{8}$$

The instrumental variable fixed-effects (IVFE) method is valid when the error term in the differenced independent variable is uncorrelated with that in the differenced instrument. The above IV estimation of Eq. (8) is consistent even in the presence of common family-specific measurement errors because the family effect is eliminated through differencing. We call this instrumental variable model IVFE-1.

However, IVFE-1 estimates may remain biased if the measurement error terms in $Y_1^1 - Y_2^2$ and $Y_1^2 - Y_2^1$ are correlated, which occurs if an individual-specific component of the measurement error in the reported income exists. Typically, for example, a twin may over-report his/her own income, as well as the income of his/her twin brother or sister. To eliminate the individual-specific component of the measurement error in the estimation, we must use $Y_1^1 - Y_2^1$ as the regressor in Eq. (3) and use $Y_1^2 - Y_2^2$ as the IV (Ashenfelter & Krueger, 1994). We call this estimator IVFE-2.[4]

3. Data

We use data from the Chinese Twins Survey, which was conducted among five cities in China by the Urban Survey Unit of the National Bureau of Statistics (NBS) from June to July 2002. Our survey was funded by the Research Grants Council of Hong Kong. We based our questionnaires on those from USA and other countries to cover a wide range of socioeconomic information. The questionnaire was designed by two authors of this paper in close consultation with Mark Rosenzweig and several Chinese experts from NBS. The local

[4] The measurement error in the self-reported income of twin 1 may be correlated with the measurement error of the income of twin 1 as reported by twin 2. The IVFE-2 estimate will be biased in this case.

Bureau of Statistics identified same-sex adult twins aged 18 to 65 years through various channels, such as colleagues, friends, relatives, newspaper advertisements, neighborhood notices, neighborhood management committees, and household records in the public security bureau. These channels permitted a roughly equal probability for us to contact all the twins who resided within a particular city, which made the obtained twins sample approximately representative. The questionnaires were administered through face-to-face personal interviews with the respondents in their households. The survey was conducted carefully, and several site checks were conducted by Junsen Zhang and several experts from NBS. After discussing the collected data with Mark Rosenzweig and other experts, we inputted these data from July to August 2002 under the close supervision of Junsen Zhang.

This is the first socioeconomic twins dataset in China, and perhaps the first in Asia. The dataset includes rich information on the socioeconomic situation of our respondents in the cities of Chengdu, Chongqing, Harbin, Hefei, and Wuhan. All together, there are 4683 observations, 3012 of which are from twins households. There are completed questionnaires from 3002 individuals, 2996 of which are twin individuals aged 17 to 62 years, and 6 triplets who are not included in our estimations. We carefully distinguished the identical (monozygotic or MZ) twins from the non-identical (fraternal or DZ) twins based on the standard questions that were used in previous twins surveys. We consider a pair of twins to be identical if they *both* responded that they have the same hair color, looks, and gender.[5] Completed questionnaires were collected from 919 pairs of MZ twins (1838 individuals) and 576 pairs of DZ twins (1152 individuals). For 871 of these MZ twins pairs (1742 individuals), complete information on both twins in the pair is available. Each twin was likewise asked some questions about the socioeconomic profile (i.e., income and education) of his/her twin brother or sister.

For comparison purposes, non-twin households in the same five cities were taken from regular households in which the Urban Survey Unit of NBS conducts its regular monthly surveys. The Urban Survey Unit began conducting regular monthly surveys in the 1980s. Their samples were initially random and representative, but such representativeness was reduced over time despite their efforts to maintain favorable sampling characteristics. Given the increasingly high refusal rate among the young people, the samples have gradually become biased toward the oversampling of old people. The survey of non-twin households was conducted at the same time as the twins survey using a similar questionnaire.

[5] MZ twins have the same gender, whereas DZ twins can have either the same or the opposite gender. MZ twins must likewise have the same (not merely similar) natural hair color and looks in their childhood.

The following question was asked in the survey: Do you feel the following emotions? For the item "happy" (*kuaile* in Chinese), the respondents may select among four answers, namely, "often feel happy," "sometimes feel happy," "seldom feel happy," and "never feel happy." These measures have several features. First, given that the question does not specify a time for recall, such question may ask for the overall happiness of the respondents rather than for their momentary happiness (Kahneman et al., 2006), although the answers of the respondents to such question may be affected by their emotions during the short period before answering the survey. Second, the question stresses the frequency rather than the intensity of happiness, thus differing from that used in the American General Social Survey (GSS, see Kahneman et al., 2006).[6] Third, the number of scales in our survey is similar to that of the 3-scale measure in the GSS.[7] The majority of our respondents answered "often feel happy" (1694 cases, or 58.47%) or "sometimes feel happy" (931 cases, or 32.14%). The remaining 9.39% answered either "seldom feel happy" (220 cases, or 7.59%) or "never feel happy" (52 cases, or 1.79%). Very few respondents answered "never feel happy;" thus, we combine the responses for the last two categories and set the value of self-reported happiness as 3 if the respondent answered "often feel happy," 2 if the respondent answered "sometimes feel happy," and 1 if the respondent answered "seldom feel happy" or "never feel happy."[8] A small proportion (9.39%) of responses for the lowest level of a three-scale measure is frequently observed in other surveys. For instance, in the 2004 GSS, a similar proportion of respondents reported that they were "not too happy" (lowest level), although the majority of the respondents answered that they were "quite happy" (middle level) rather than "very happy" (highest level) (Kahneman et al., 2006).

The measurement credibility of self-reported SWB has been a concern in the literature. The extensive studies of Easterlin (1974, 2001), Diener (1984), Veenhoven (1993), and Kahneman and Krueger (2006) conclude that subjective indicators reflect, although imperfectly, the substantive feelings of well-being of the respondents, and that the similar feelings of people toward their sources of happiness provide credence to interpersonal

[6] The question in GSS reads, "Taken all together, how would you say things are these days—would you say that you are very happy, pretty happy, or not too happy?''

[7] It is smaller than the 11-scale Cantril self-anchoring scale of life evaluation used by the Gallup Organization in the Gallup-Healthways Well-Being Index (Kahneman & Deaton, 2010), the 11-scale measure of life satisfaction used in the German Socio-Economic Panel (Frijters, Haisken-Denew, & Shields, 2004), and the 36-scale general health questionnaire score of mental well-being (Gardner & Oswald 2007; Apouey & Clarkm, 2010).

[8] Coding happiness into four values does not change the qualitative results of this study (available upon request).

comparison.[9]

Table 1 shows the distribution of self-reported happiness into five income brackets. Those respondents in higher income brackets are generally more likely to report "often feel happy" and are less likely to report "never feel happy" or other responses. This result provides a first impression that the happiness of the Chinese people is positively related with their income at a given time, which is similar to the findings of Crabtree and Wu (2011) and Easterlin et al. (2012). We go a step further in this study by exploring the causality of income on happiness and examining if such causality supports the abovementioned impression.

Table 2 shows the descriptive statistics of the respondents. To compare the twins sample with the other available samples, we use the basic statistics for a large-scale survey of NBS as a benchmark.[10] Column 1 shows the means of all variables for the twins. Of these twins, 58% were males, and 68% were married. On average, these twins were 36.4 years old with 11.3 years of schooling and with monthly income of 837 *yuan* (equivalent to 102 USD in 2002). The monthly income included all the wage and non-wage earnings of the respondents.[11] The average happiness value of the respondents was 2.49 (between "sometimes feel happy" and "often feel happy"). Health was measured on a self-reported five-point scale, in which a

[9] First, the respondents have little trouble in answering the questions about their SWB. For instance, less than 1% of the respondents in the 1998 American General Social Survey have refused to answer or have answered "do not know" for the question about their happiness, whereas 17% of the respondents have refused to disclose their earnings (Kahneman & Krueger, 2006). Second, the validity of SWB can be assessed by the correlations between its measures and the other characteristics of individuals, and by the various situations under which the respondents are placed, such as objective physiological and medical criteria (Diener & Suh, 1999; Frey & Stutzer, 2002; Layard, 2005), changes in circumstances (e.g., weather and mood, see Schwarz & Clore, 1983), demographic factors (e.g., age, gender, and marital status), education (Oreopoulos, 2007), labor market (Alesina, Glaeser, & Sacerdote, 2005), unemployment and inflation (Di Tella, MacCulloch, & Oswald, 2001), income (see the Introduction section), institutional conditions (Frey & Stutzer, 2000; Veenhoven, 2000; Radcliff, 2001), and environmental factors (Rehdanz & Maddison, 2005; Becchetti et al., 2007). Third, the significant correlations among the repeated measures of life satisfaction suggest that the data may be sufficiently reliable for many purposes (Lucas, Diener, & Suh, 1996). Fourth, the measures of satisfaction can predict future outcomes. For instance, job satisfaction is a strong predictor of the subsequent turnover of workers (Freeman, 1978). Fifth, although circumstances (Schwarz & Clore, 1983) and duration (Lucas, Diener, & Suh, 1996; Kahneman & Krueger, 2006) cause fluctuations in the answers of people from day to day, the idiosyncratic effects of recent, irrelevant events are likely to be averaged in representative population samples. The idiosyncratic effects will not cause any bias in the regression analyses as long as they are uncorrelated with the variable of interest.

[10] NBS has been conducting an annual survey of urban households from 226 cities (counties) in China since 1986, which is the best large-scale survey of its kind. However, NBS only allows us to use its survey data from six provinces, including Beijing, Liaoning, Sichuan, Shaanxi, Zhejiang, and Guangdong.

[11] Total income in this paper covers wages (including bonus and subsidies), investment income, all types of rental income, interest income, pension, unemployment benefits, transfer from parents, housing accumulation fund paid by employer, old age insurance paid by employer, medical insurance paid by employer, unemployment insurance paid by employer, and "other income."

higher value indicated better health conditions (1 = "very poor," 2 = "poor," 3 = "fair," 4 = "good," and 5 = "very good"). The mean health of the respondents was 3.71 (between "fair" and "good"). Column 2 shows the summary statistics for the MZ twins, with both twins having complete information (which were very similar to that of all twins). The individuals in the twins sample were younger and were earning less income than those in the NBS sample,[12] whereas the individuals in the non-twins sample (Column 3) were older than those in the NBS and twins samples.

4. Main Results

4.1 OLS Regressions Using the Whole Twins Sample

The first three columns of Table 3 show the OLS regression results for all twins, including the MZ and DZ twins. The main independent variable of interest is the logarithm of monthly income, and the standard errors (enclosed in parentheses) are robust to heteroscedasticity and clustered at the family level. Among our respondents, 7.6% have reported no income, and the lowest reported non-zero income is 30 *yuan*. Therefore, we use log(income+1) to maximize our observations and examine the potential discontinuity around the reported income of zero.

Column 1 shows a simple regression with income, age, age squared, gender, birth weight, disease symptom history before three years old, and city dummies[13] as independent variables. Disease symptom history before three years old is used as a dummy variable, with 1 indicating the occurrence of symptoms of any of the nine major diseases.[14] We control for birth weight and early disease history for three reasons. First, they are plausibly exogenous. Second, a considerable variation exists in the birth weight among MZ twins, which is significantly related to the differences in their educational outcomes and earnings (Behrman & Rosenzweig, 2004). Third, recent studies indicate that health shocks at early childhood (0 to 3 years) affect intrahousehold human capital investments, such as health, education, and socio-emotional skills (Heckman, Yi & Zhang, 2013), which may affect both income and happiness; moreover, early health history may have direct effects on income and happiness.

The coefficient on logarithmic income is 0.034 and statistically significant, and the

[12] Only one of the cities in our survey is likewise included in the NBS sample. The six provinces in the NBS sample include the three richest provinces in China, namely, Beijing, Zhejiang, and Guangdong. Therefore, the average earnings of the respondents in the NBS sample were larger than those earned by the respondents in our sample.

[13] All twins in our sample live in the same city as their twin siblings. Therefore, we control for city dummies in both OLS and within-MZ-twin fixed-effects estimates.

[14] These diseases include migraine, pollen allergy, frequent skin rash, acoustic trauma, hypertension, neurasthenia, problems caused by drinking, cardiac problems, and dysfunction of neck, back, arms, or legs.

negative and positive coefficients on age and age squared, respectively, are both insignificant. The happiness value reported by females, on average, is 0.12 higher than that reported by males, and this difference is highly significant. Neither birth weight nor early disease history has a significant effect on happiness. To determine if the pre-adulthood health history of our respondents affects their happiness, in unreported specifications we use disease symptom before adulthood (18 years old) rather than early childhood (three years old) and find similar results (available upon request). In other unreported specifications (available upon request), we omit birth weight and early disease history as controls and obtain results that are almost identical with those that are presented in Column 1.

Column 2 shows the potential nonlinearity of the effect of income. Given that the respondents who report a zero income may be very different from the other respondents, we control for a dummy in Column 2 to indicate whether a twin reports a zero income. After we control for this dummy, the coefficient on logarithmic income largely increases from a modest 0.034 to a substantial 0.126, which indicates that an increase of one standard deviation (1.87) in the logarithmic income results in a 0.236 increase in the happiness value, which is approximately 36% of the standard deviation (0.66) of happiness. On average, doubling the income (associated with a 0.69 increase in logarithmic income) increases the happiness value by 0.087 or approximately 13.2% of the standard deviation of happiness. The coefficient on the zero income dummy is 0.695 and significantly positive, which indicates that those respondents reporting a very low income are actually less happy than those reporting a zero income. In unreported specifications, we add the squared term of logarithmic income but we do not detect further nonlinearity. Therefore, we do not detect a decreasing marginal effect of logarithmic income at the high end, although the linear effect of logarithmic income implies a decreasing marginal effect of numeric income in absolute term.[15] The average annual income of our sample is roughly 10,000 *yuan* (12 times larger than their average monthly income of 837 *yuan*) or 1,250 USD in 2002, which is considerably lower than the satiation point of approximately 75,000 USD that is reported by Kahneman and Deaton (2010), who investigate the effect of income on emotional well-being. The low average income in China may explain our failure to detect the satiation of the income effect. Given our limited three-scale measure of happiness and the potential ceiling effect, further studies must be conducted to detect the possibility for observing a decreasing marginal effect of logarithmic income.

[15] In unreported specifications, we replace log(income+1) with numeric income and its squared term. We find an inverted U-shape of the income effect, and the turning point is located at the maximum reported income in our data.

When we add other control variables, such as education, marital status, and self-reported health, in the third column, the estimated coefficient on income decreases by 31% to 0.087 but remains positive and highly significant. The negative and positive coefficients on age and age squared, respectively, become significant. The happiness value reaches its highest at young age, declines at middle age (reaches the lowest at 40 to 50 years), and increases again at old age. This observation is consistent with those of other studies that report that people who live with teenagers obtain the lowest level of life satisfaction, which improves thereafter (Kahneman & Krueger, 2006). Females are happier than the males, which reveal the gender difference in SWB (Nolen-Hoeksema & Rusting, 1999). The coefficient on education is significantly large and positive, but this may not necessarily indicate a causal effect of education on happiness because the OLS estimate can be biased by omitted factors, such as ability and family background.[16] Consistent with most studies (e.g., Kohler, Behrman, & Skytthe, 2005), marital status has a large effect on happiness. Married people are happier than those who are divorced, widowed, or never married. However, we cannot interpret this outcome as a causal effect because marriage is an endogenous choice that may be decided by income and other factors. The coefficient on self-reported health (0.11) is positive and highly significant, with one standard deviation (0.81) increase in health resulting in a 13% increase in the standard deviation of happiness. We likewise conduct ordered probit estimation because the dependent variable (i.e., happiness) is discrete, and we obtain qualitatively similar results (see Table A1 of the Appendix). Therefore, we treat the happiness variable as continuous hereafter.

Column 3 shows that income affects happiness, even conditional on education attainment, marital status, and health. Specifically, it is worth noting that after we control for education, the income variable should capture the effect of the plausibly random shocks of income (i.e., after removing the impacts from the standard determinants of earnings in the

[16] No consensus exists regarding the relationship between education and happiness. Oreopoulos (2007) uses the features of compulsory schooling laws as an instrumental variable for schooling and reveals that years of schooling have a causal effect on happiness. In their analysis of the income level and labor status in Spain, Cuñado and de Gracia (2012) find that education produces direct and indirect effects on happiness. Powdthavee, Lekfuangfu, and Wooden (2013) explore the direct and indirect effects of extra schooling induced by the compulsory schooling laws in Australia on the well-being of individuals, and find a positive net effect of schooling on later SWB, which is larger and statistically more robust among men than among women. They likewise determine that the compulsory schooling effect on the SWB of males is indirect and is mediated through income. Hartog and Oosterbeek (1998) find a non-linear relationship between education and happiness, with the Dutch who have finished non-vocational intermediate level of education achieving the highest happiness value. Stutzer (2004) likewise reports that individuals who have finished middle education obtain the highest life satisfaction level.

Mincer equation) (Mincer, 1974).[17]

The non-pecuniary elements of employment, such as amenities, may be correlated with both income and happiness. The theory of equalizing differences (e.g., Rosen, 1986) predicts that the earnings and amenities of jobs may be the substitutes that are faced by the same worker and may be negatively correlated with each other. Therefore, a job with a higher pay may provide lower amenities for the employees, such as longer working hours. If such is the case, omitting these job features may underestimate the effect of income on happiness. We need to control for these factors to estimate the real effect of income on happiness. Although we do not have complete information about these aspects, we have likewise asked our respondents to self-report their working hours in the survey. We add a dummy in Column 4 to indicate whether a twin is working overtime (more than 40 hours a week). The coefficient on income slightly increases from 0.087 to 0.091. Working overtime is negatively associated with happiness despite the imprecise estimate. This result is consistent with our expectation that working over time is positively correlated with income but is negatively correlated with happiness. Therefore, omitting this variable produces a downward bias on the estimated effect of income on happiness, even though such bias is small.

4.2 OLS Regressions Using the MZ Twins Sample

We repeat the same OLS regressions on the MZ twins sample. We compare the OLS results from the MZ twins sample with those from the entire sample to check the robustness of the estimated coefficients that use different samples. We only use the MZ twins sample for these regressions, hence reducing the sample size to 1,742 observations (or 871 pairs of twins).

The regression results in Columns 5 to 7 of Table 3 suggest that the effect of income is similar between the MZ twins sample and the entire twins sample. Both samples have similar estimated coefficients on most of the other variables, but the coefficient on marriage becomes smaller in the MZ twins sample.

The OLS estimate of the effect of income is positive and significant even after controlling for key covariates. However, we do not know how much of this effect stems from income and how much stems from the effects of unobserved genetic factors and family background. We use within-MZ-twin estimations in the next section to correct the omitted variable bias.

[17] In our data, tenure (i.e., the number of years in full-time work since the age of 16) does not significantly affect income (see Li, Liu, & Zhang, 2012). In addition, controlling for tenure does not change the coefficient on income. Therefore, we do not control for tenure in the reported specifications to obtain more observations.

4.3 Within-MZ-Twin Fixed-Effects Estimation

Prior to running the within-MZ-twin fixed-effects estimation, we check the distribution of happiness levels and income brackets of the 871 pairs of MZ twins in Tables A2 and A3 in the Appendix. Twins in 320 or 461 pairs demonstrate different values of happiness or belong to different income brackets, respectively; these results account for 37% or 53% of all the 871 pairs.[18] This finding indicates a sufficient variation in happiness or income between the MZ twins in the same family, which makes the within-MZ-twin fixed-effects estimation possible.[19]

The results of the within-MZ-twin fixed-effects estimation using Eq. (3) are shown in Columns 8 to 10 of Table 3. Given that MZ twins are of the same age and gender, these variables are dropped in the calculation of the first difference. In our sample, all twins live in the same city as their twin siblings; thus, the city dummies are likewise dropped after calculating the first difference.

The within-MZ-twin fixed-effects estimate of the coefficient on income decreases to 0.075 in Columns 10 from the OLS estimate of 0.098 in Column 7, both with full controls. This within-MZ-twin fixed-effects estimate implies that an increase of one standard deviation (1.87) in logarithmic income results in an increase of roughly 0.141 in the happiness value, which is approximately 21% of the standard deviation (0.66) of happiness.

The within-twin estimation shows that part of the association between income and happiness obtained by the OLS estimation is the result of the effects of unobserved genetic factors or family background. The within-MZ-twin estimate of the effect of income is approximately three-fourths of the OLS estimate. This result suggests that roughly one-fourth of the OLS estimate is attributed to unobserved genetic factors or family background. However, these estimates may be biased by measurement error, which is addressed shortly.

Interestingly, the effect of education in OLS disappears in the fixed-effects estimations, which implies that education *per se* does not affect happiness. In unreported specifications, we do not control for income, and still find no effect of education. This finding indicates that education (measured by years of schooling) has no impact on happiness, and it may be attributed to the high correlation between education and ability, which is verified by Li, Liu, and Zhang (2012). The formal educational system in China is very selective, and those with

[18] In 65% of 871 twin pairs, the difference in logarithmic income is larger than 0.2 (i.e., one twin earns at least 22% more than his/her sibling).

[19] Li, Liu, and Zhang (2012) report that the variation in education is sufficient between the MZ twins in the same family.

more schooling years are likely to be more capable. Individuals with higher abilities are more likely to be happier because they have relative advantages in school, in the workplace, and so on. The high correlation between happiness and education shown in the OLS may reveal the high correlation between happiness and unobserved ability. Thus, on average, education *per se* does not help improve individual happiness in China. Further explorations on the relationship between education (measured by both education levels and years of schooling) and happiness will help provide a more complete answer.

5. Robustness Check

5.1 Jealousy or Love between Twin Siblings?

So far we do not consider the potential effect of the income of twin sibling. On the one hand, each twin within the same family may use the income of his/her twin sibling as a natural reference point because they are very similar in other aspects, which negatively affects his/her happiness. On the other hand, it is likewise possible that increasing the income of the twin sibling may improve one's well-being because he/she may be altruistic toward the sibling. He/she may also expect to receive more transfers from the sibling; this could be especially true in China given the strong family tie and within-family support in the Chinese society.[20] Since the MZ twins within the same family have many sources of similarity and are strongly linked with each other, they provide us a precious chance to closely examine how the income difference between two very close individuals affects their happiness. Moreover, the effect of an income difference may have heterogeneous impacts when one twin is in an advantageous situation over another and when the same twin is in a disadvantageous situation; a special case of this is inequality aversion (Fehr & Schmidt, 1999). Thus, we separate the cases when one is earning more than his/her twin sibling and when one is earning less.

To incorporate the effect of the income difference between the MZ twins, we modify Eqs. (1) and (2) as follows.

$$h_{1i} = X_i\alpha + \beta Y_{1i} + \delta_1 \max(Y_{1i} - Y_{2i}, 0) + \delta_2 \max(Y_{2i} - Y_{1i}, 0) + Z_{1i}\gamma + \mu_i + \varepsilon_{1i} \quad (9)$$

$$h_{2i} = X_i\alpha + \beta Y_{2i} + \delta_1 \max(Y_{2i} - Y_{1i}, 0) + \delta_2 \max(Y_{1i} - Y_{2i}, 0) + Z_{2i}\gamma + \mu_i + \varepsilon_{2i}, \quad (10)$$

where δ_1 (δ_2) measures the effect of the absolute value of the income difference when one twin earns more (less) than his/her twin sibling. If $\delta_1>0$ and $\delta_2<0$, then the income of the twin sibling always has a negative effect; if $\delta_1<0$ and $\delta_2>0$, then the income of the twin sibling always has a positive effect; if $\delta_1<0$ and $\delta_2<0$, then one demonstrates inequality

[20] For instance, Li et al. (2007) report that the Chinese Communist Party membership of a twin has a positive external effect on his/her twin sibling.

aversion (Fehr & Schmidt, 1999): Holding one's income constant, he/she feels happiest when his/her twin sibling earns the same amount as he/she does.

To estimate δ_1 and δ_2, we use Eqs. (9) and (10) and employ the generalized least-squares (GLS) method to overcome the omitted variable bias, which can directly estimate both the bias and the income effect.[21] The correlation between the unobserved family effect and the observables is given as follows.

$$\mu_i = (Z_{1i} + Z_{2i})\xi + X_i\eta + \omega_i, \tag{11}$$

where we assume that the correlations between the family effect μ_i and the characteristics of each twin $Z_{ji}(j=1,2)$ are the same, and that ω_i is uncorrelated with $Z_{ji}(j=1,2)$ and X_i. The vector of the coefficients ξ measures the selection effect related to the family effect and individual characteristics, including all of the covariates in Eqs. (9) and (10) other than the incomes of both twins. After controlling for education and the other characteristics of both twins, if the incomes of both twins have little extra explanatory power for the omitted family effect μ_i, then the effects of own income and the income difference between the MZ twin can be simultaneously identified through the following procedure.

The reduced forms of Eqs. (9), (10), and (11) are obtained by substituting Eq. (11) into Eqs. (9) and (10) and by collecting the terms as follows.

$$h_{1i} = X_i(\alpha+\eta) + \beta Y_{1i} + \delta_1 \max(Y_{1i} - Y_{2i}, 0) + \delta_2 \max(Y_{2i} - Y_{1i}, 0) + Z_{1i}\gamma + (Z_{1i} + Z_{2i})\xi + \varepsilon_{1i}^{'} \tag{12}$$

$$h_{2i} = X_i(\alpha+\eta) + \beta Y_{2i} + \delta_1 \max(Y_{2i} - Y_{1i}, 0) + \delta_2 \max(Y_{1i} - Y_{2i}, 0) + Z_{2i}\gamma + (Z_{1i} + Z_{2i})\xi + \varepsilon_{2i}^{'}, \tag{13}$$

where $\varepsilon_{ji}^{'} = \omega_i + \varepsilon_{ji}(j=1,2)$. Eqs. (12) and (13) are estimated using the GLS method, which is the best estimator that allows cross-equation restrictions on coefficients. The GLS model is estimated by stacking Eqs. (12) and (13) and by fitting them using the seemingly unrelated regressions model.

The GLS estimates are shown in Table 4. According to Column 1 with basic controls, δ_1 and δ_2 are -0.029 and -0.031, and significantly different from zero at the 5% and 10% level, respectively. They become -0.021 and -0.034 in Column 3 with full controls, and remain significant at the 10% level. Thus, the income of the twin sibling has a heterogeneous effect on one's happiness: When one earns more (less) than his/her twin sibling, his/her happiness increases (decreases) with the income of his/her twin sibling. In both cases, holding one's income constant, he/she feels happier when the absolute value of the income difference between them shrinks. Therefore, instead of a pure jealousy or pure love, the MZ twins reveal a preference of inequality aversion in both advantageous and disadvantageous situations, as suggested by Fehr and Schmidt (1999). However, we must be cautious in explaining this

[21] This method is a variant of the approach of Ashenfelter and Krueger (1994) for twins studies.

result. Although both advantageous and disadvantageous differences show a negative effect, it applies only when we hold one's own income constant. In terms of the coefficients of β, δ_1, and δ_2, we note that the coefficient on own income is always larger than that on the income of the twin sibling. For instance, in Column 3 with full controls, the coefficient on own income in the disadvantageous case is 0.120 (i.e, 0.086+0.034), and significantly larger than the coefficient on the income of the twin sibling, -0.034; they are 0.065 (i.e., 0.086-0.021) and 0.021 in the advantageous case, although the difference between these two coefficients become less obvious. In both cases, own income has a positive and significant effect. This result is consistent with the statistics of income transfer between the MZ twins in our sample. On the other hand, the income transfer between the MZ twin pair within the same family is prevalent: For all the MZ twin pairs, 46% have income transfers between them, which supports that the MZ twins help each other in economic terms. However, on average, the net income transfer between the MZ twin pair accounts only for 3% of their income difference, which shows that the richer twin does not attempt to equalize the final economic situation between the twin pair.

5.2 Potential Biases of Within-MZ-Twin-Pair Estimates

Bound and Solon (1999) examine the implications of the endogenous determination of which twin receives more formal education, and they conclude that twins-based estimation is vulnerable to the same sort of bias that affects conventional cross-sectional estimation. The resultant major concern over the within-twins estimate is whether it is less biased than the OLS estimate and is therefore a better estimate (Bound & Solon, 1999; Neumark, 1999). From this work, we can argue that although within-twins differencing removes variations in genes and family background, that is, it removes μ_i from Eq. (3), this difference may still reflect ability and personality bias because ability and personality consist of more than simply genes (see, e.g., Sandewall, Cesarini, & Johannesson, 2014). In other words, within-twins estimation may not completely eliminate the bias of conventional cross-sectional estimation because the within-twins difference in ability and personality may remain in Eq. (3), which may be correlated with $Y_{2i} - Y_{1i}$. Other factors, such as luck in the labor or marriage market, and non-pecuniary features of employment, may likewise be correlated with both income and happiness. If the endogenous share of variation in income comprises as large a proportion of the remaining within-twins variation as it does of the cross-sectional variation, then within-twins estimation is subject to as large an endogeneity bias as cross-sectional estimation.

At length, Ashenfelter and Rouse (1998), Bound and Solon (1999), Neumark (1999), and Isacsson (2007) debate the bias in OLS and within-twins estimations. The bias in the OLS estimator depends on the fraction of variance in income accounted for by variance in unobserved ability, personality, and other factors that may likewise affect income, that is, $\mathrm{Cov}(Y_i, \mu_i + \varepsilon_i) / \mathrm{Var}(Y_i)$. Similarly, the bias of the fixed-effects estimator depends on the fraction of within-twins variance in income accounted for by within-twins variance in unobserved ability, personality, and other factors that likewise affect income, that is, $\mathrm{Cov}(\Delta Y_i, \Delta\mu_i + \Delta\varepsilon_i) / \mathrm{Var}(\Delta Y_i)$. If we are confident that income and happiness error terms are positively correlated both in the cross-sectional and within-twins regressions, and if the endogenous share of variation within a family is smaller than that between families, then the fixed-effects estimator is less biased than the OLS estimator.

To examine whether the within-twin-pair estimate is less biased than the cross-sectional estimate, we follow Ashenfelter and Rouse (1998) and conduct a correlation analysis. In Table 5a, we use the correlations of average family education over each twin pair with the average family characteristics that may be correlated with ability, personality, and family background (e.g., marital status, health, and spousal education) to indicate the expected ability, personality, and family background bias in a cross-sectional OLS regression. We then use the correlations of the within-twin-pair differences in education with the within-twin-pair differences in these characteristics to indicate the expected ability, personality, and family background bias in a within-twin-pair regression. If the correlations in the cross-sectional case are larger than those in the within-twin-pair case, then the ability, personality, and family background bias in the cross-sectional regressions is likely to be larger than the bias in the within-twin-pair regressions. In Table 5b, we perform a similar correlation analysis, but the main interest variable is income.

The correlation tests reported in Tables 5a and 5b suggest that the within-twin-pair estimation of the effect of income on happiness may indeed be less affected by omitted variables than the cross-sectional OLS estimation. The between-family correlations are all larger in magnitude than the within-twin-pair correlations. For instance, the correlation between average family education and average spousal education is as large as 0.62 (Column 1, Row 3 of Table 5a), which suggests that twins in families with high average levels of education marry highly educated spouses. This finding is consistent with the assumption that spousal education reflects the ability, personality, and family background of an individual. The correlation between the within-twin-pair difference in education and that in spousal education is approximately a quarter of the between-family correlation. Similarly, in Table 5b,

the correlation between average family income and average spousal education is 0.21 (Column 1, Row 5), whereas the correlation between the within-twin-pair difference in income and that in spousal education is approximately half of the between-family correlation. This finding suggests that to the extent that spousal education measures ability, personality, and family background, the within-twin-pair difference in income and education is less affected by these biases than average family income and education. The correlations of income and education with some other variables provide similar evidence that within-twin-pair estimation is subject to a smaller omitted variable bias. These characteristics are merely an incomplete set of ability and personality measures, but the evidence is suggestive.

As previously mentioned, the characteristics of one's spouse may reflect either individual ability, personality, or family background, which may all affect both income and happiness and are well controlled for by the within-MZ-twin fixed-effect model. However, luck in the marriage market may matter as well; if one twin happened to marry a higher-educated or higher-income spouse, his/her own income and happiness may likewise differ from those of his/her twin sibling. To control for this condition, in Table 5c, we restrict the sample to married MZ twins and report the results using OLS (Columns 1 and 2) and within-MZ-twin fixed-effects models (Columns 3 and 4). In Column 1 (3), we control for spouse education only; in Column 2 (4), we control for both education and income of one's spouse. The results are similar to those using the entire sample without controlling for spouse education and income, and the within-MZ-twin fixed-effects estimate is smaller than the OLS estimate. These results further suggest that the within-MZ-twin fixed-effects model provides a better estimate than the OLS, and the remaining endogeneity regarding marriage market may not be a major concern.

5.3 Measurement Error

5.3.1 IVFE Estimates

A severe measurement error may cause the within-MZ-twin-pair fixed-effects estimation to exacerbate the measurement error bias. To correct this potential bias, we use an IVFE model. Following Ashenfelter and Krueger (1994), we ask each twin to report his/her twin sibling's income. In this study, the monthly income cross-reported by a sibling is defined as the total annual income cross-reported by the sibling divided by 12.

We write Y_1^1 for the self-reported income of the first twin, Y_1^2 for the sibling-reported income of the first twin, Y_2^2 for the self-reported income of the second twin, and Y_2^1 for the

sibling-reported income of the second twin (i.e., Y_n^m, n, m=1,2 refers to the income of the n-th twin as reported by the m-th twin). The correlations between self and co-twin reports on the income of the same twin, or $\mathrm{Cor}\left(Y_1^1, Y_1^2\right)$ and $\mathrm{Cor}\left(Y_2^1, Y_2^2\right)$, are 0.576 and 0.640, respectively, in our sample, which are smaller than the correlations between self and co-twin reports on the education of the same twin in Ashenfelter and Krueger (1994), Huang et al. (2009), and Li, Liu, and Zhang (2012). This finding implies that the measurement error of income is larger than that of education, causing the measurement error bias in the estimate of income effect to become a larger concern. However, $\mathrm{Cor}\left(Y_1^1, Y_1^2\right)$ and $\mathrm{Cor}\left(Y_2^1, Y_2^2\right)$ are sufficiently high that the co-twin-reported level of income is a good instrumental variable for the self-reported level of income in our sample.

Prior to conducting IVFE-1 and IVFE-2 estimations, we must ensure that a sufficiently large correlation exists between income differences ($\Delta Y^{'}, \Delta Y^{*}$) and their instruments ($\Delta Y^{''}, \Delta Y^{**}$). Our data show that Cor($\Delta Y^{'}, \Delta Y^{''}$) is 0.584, close to $\mathrm{Cor}\left(Y_1^1, Y_1^2\right)$ and $\mathrm{Cor}\left(Y_2^1, Y_2^2\right)$; however, Cor($\Delta Y^{*}, \Delta Y^{**}$) is only 0.315, which is considerably smaller and may reduce the validity of IVFE-2.[22] Thus, we are more confident with the IVFE-1 estimate.

The IVFE-1 estimates reported in the first three columns of Table 6 show that a measurement error has biased the fixed-effects estimates in Columns 8 to 10 of Table 3 downward, as in other studies in the literature. If we select the specification with the controls of education, marital status, health and working overtime (Column 3), the IVFE-1 estimate of the income effect more than triples (from 0.075 with the fixed-effects model to 0.255 with the IVFE-1 model). This result suggests that a fraction of the variability in the reported difference in income is due to a measurement error.

The IVFE-2 estimates reported in Columns 4 to 6 are even larger. Under IVFE-2, the coefficient on logarithmic income is 0.487 in Column 6 (although it is not precise with a large standard error), more than six times of the fixed-effects estimate, or approximately twice of the IVFE-1 estimate. However, as previously discussed, this larger estimate may be due to the weaker first stage of the IVFE-2 estimate, and the low correlation in the first stage reduces the reliability of this estimate.

To summarize, IVFE-1 and IVFE-2 estimates are considerably larger than fixed-effects estimates, which implies a measurement error bias in both OLS and fixed-effects models. According to the IVFE-1 estimate (our favorite specification), an increase of one standard deviation (1.87) in logarithmic income results in a 0.48 increase in the happiness value,

[22] We check the data and observe that this low correlation is due to the fact that the means of ΔY^{*} and ΔY^{**} are significantly different, that is, 0.086 and 0.005, respectively. Such an asymmetry harms the validity of IVFE-2.

which is approximately 72% of the standard deviation (0.66) of happiness.

5.3.2 Other Indicators of Income and Wealth

As mentioned in Section 2.2, even the favorite IVFE-1 estimate may be biased under certain types of non-classical measurement errors. In addition, a discussion of whether money brings happiness may refer to alternative concepts of current income, permanent income, or wealth. Thus, using a measure of income to infer the effect of other measures on happiness may be biased. To further address concerns over the measurement error of income and check the robustness of the relationship between money and happiness, we present the results with three alternative indicators of income and wealth (see Table 7). The first one is wage[23] (including bonus and subsidies) instead of total income. The second one is family income in 2001, which was reported in a nine-scale range in the survey with a larger value indicating a higher total family income: 1 indicates a total family income less than 5,000 *yuan*, whereas 9 indicates a total family income larger than 110,000 *yuan*. The third one is home ownership, which is the best indicator of wealth in our survey; this variable equals 1 if it is owner-occupied, and 0 otherwise. We do not have sibling-reported measures of these variables; hence, we use the within-twin fixed-effects estimation rather than IVFE as our model.

As shown in Table 7, these indicators have large significant and positive effects on happiness. If we select those regressions with full controls as our specifications, holding other factors constant, an increase of one standard deviation (0.55) in logarithmic wage results in a 0.087 increase (or 13% of the standard deviation) in happiness. If family income increases from the bottom scale (1) to the top (9), the happiness value, on average, increases by 0.565 (or 86% of the standard deviation). The value of happiness will increase by approximately 0.151 (or 23% of the standard deviation) if one owns his/her home. The significant effect of home ownership on happiness exactly reveals the strong preference for owner-occupied housing in the Chinese society.

To the extent that the IVFE estimates in Section 5.3.1 might not perfectly correct the measurement error bias, the above results using the alternative measures of income and wealth further support that money has a positive and significant effect on happiness.

5.4 Reverse Causality Concern

[23] The lowest non-zero wage in our data is RMB 50. We exclude those with zero wages, and use log (wage) in regressions.

The foregoing analyses cannot exclude the potential possibility of reverse causality, that is, happier people might earn more (Diener et al., 2002; Graham et al., 2004; De Neve & Osward, 2012; Mohanty & Ullah, 2012; Oswald, Proto, & Sgroi, 2013). For instance, Diener et al. (2002) report that happier college students later earn more in their careers.[24] De Neve and Osward (2012) use data from a large U.S. representative panel and reveal the direct and indirect effects of happiness on income. Oswald, Proto, and Sgroi (2013) confirm the causality from happiness to productivity in a laboratory setting.

To address the reverse causality concern, we use industry average income and industry-age average income computed from our sample as the instrumental variables of own income in Columns 1 and 2 of Table 8, respectively.[25] We have 16 industry categories in our survey[26] and define four age groups (below 25 years, 26 to 35 years, 36 to 45 years, and above 45 years). Although imperfect, these are plausible instrumental variables for two reasons. First, they are aggregate measures that are correlated with individual income but beyond individual influences as long as the industry is sufficiently large and supposing that they do not directly affect own happiness.[27] Second, at least part of the variation in industry wage differentials is due to rents rather than employee characteristics (Katz & Summers, 1989, among others), and part of the pattern of industry affiliations is random. In the context of China, Chen, Lu, and Wan (2009) argue that inter-industry wage differentials increasingly contribute to income inequality in urban China through 1988, 1995, and 2002, mainly due to rapid income growths in monopolistic industries. This type of IV strategy is reported in Luttmer (2005), in which industry-occupation predicted earning is used as an IV of household income to identify its effect on happiness.[28]

Columns 1 and 2 show that the income coefficients are 0.229 and 0.158, respectively, and both are highly significant and close to the IVFE-1 estimate in Section 5.3.1. In unreported

[24] However, their study cannot exclude the possibility that other factors produce both happiness and higher earnings; thus, the causality from happiness to income is not established.

[25] The average is calculated using all of the observed incomes in each cell except own income. We drop cells that include fewer than 10 observations and use the logarithm of the average income as IV.

[26] To maximize the sample, we define "not working" as a further category, thus yielding 17 categories.

[27] Arguably, these industry-level average incomes serve as reference points, which directly affect own happiness. Although they might not be perfect IVs, we argue that a reference group is more likely to be outside one's own industry. An individual is more likely to compare his/her own income with those in his/her city or community working in all industries, and to perceive the average income of people in a similar position within his/her industry as the key factor that decides his/her earning potential.

[28] In a less related study (DiPasquale & Glaeser, 1999), the average home ownership rate within an income quartile, race, and state cell is used as an IV of individual home ownership to identify its effect on citizenship.

regressions, we use industry-occupation-age average income as IV[29] and try median income instead of average income; the results are similar.[30]

The above industry average income could be problematic as an instrumental variable (Pischke, 2012). For instance, even if industry wage differentials entirely reflect rents, another potential problem emerges, that is, sorting individuals into these industries.

To solve this problem, in Column 3, we use the average annual wage growth rate of the industry over the past five years as an IV, thus restricting the sample to those aged beyond 25.[31] Given the highly dynamic nature of the Chinese economy, industrial differences in wage growth rates over five years are more exogenous and less predictable than current industry wage differentials. These growth rates are calculated using data on industry average wage from 1996 to 2001 in the *China Statistical Yearbook 2002*, which uses the same 16 industry categories. The coefficient on income is positively significant and is much larger (0.503) than the other two IV estimates in Columns 1 and 2. We likewise report the weak IV tests of the first stage in the lower panel of Table 8, including Shea's partial R-squared, and a weak IV test suggested by Stock and Yogo (2005). These tests show that the first two IVs are strong, whereas the third one is relatively weak. Hence, the first two coefficient estimates (0.229 and 0.158) are more reliable, whereas the coefficient (0.503) in Column 3 should be cautiously treated. However, the finding further suggests that income may have a positive causal effect on happiness.

6. Conclusions and Discussion

To estimate the effect of income on happiness, we use a new sample of identical Chinese twins and apply a within-twin-pair fixed-effects method to correct for omitted variable bias caused by unobserved genetic factors and family background. With sibling-reported information as an instrumental variable, we likewise employ instrumental variable fixed-effects model to correct the measurement error bias amplified by the fixed-effects model. To address the potential reverse causality concern between happiness and income, we use industry average income and industry wage growth as instrumental variables. These results suggest that the direction of causality runs from income to happiness. Our results are robust after we consider address concerns of potential biases of within-MZ-twin-pair

[29] The advantage of this IV is that it accounts for the large wage differentials across occupations even within the same industry. However, occupation is even more endogenous than industry.

[30] Health and working overtime status are both endogenous; in unreported specifications, we drop these two control variables, and the results are similar.

[31] We use the cutoff age of 25 because the average age at the time of the first full-time job in our sample is 20. The results are similar when an alternative cutoff (tenure>=5) is used.

estimates, and use various measures of income and wealth. In addition, we examine the cross effect of the income of twin siblings and find evidence that twins have a preference of inequality aversion towards their siblings.

Our favorite estimate (IVFE-1 in Section 5.3.1) shows that one standard deviation increase in logarithmic income results in an increase of approximately 72% of the standard deviation of happiness. A one-unit increase in logarithmic income improves happiness by 0.255 points on a three-point scale. This effect is relatively large among studies in the literature, although the disparity among the measures of subjective well-being in the literature restricts a direct comparison across studies.[32] In addition, we observe a nonlinearity of the income effect around zero income, that is, those reporting zero income are happier than those with little income; however, we do not detect a decreasing trend in the effect of logarithmic income at the high level of income. Further studies on the nonlinearity of the income effect are desired.

Our results imply that although Chinese happiness does not seem to increase with economic growth in the past three decades as reported in the literature, for a given time the cross-sectional pattern clearly shows that the rich do feel happier than the poor. Moreover, our analyses suggest that part of this relationship is attributed to a causal effect of income. Our findings have import implications for inequality. An inequality in income not only causes an inequality in consumption and other material or objective outcomes as found in the economics literature, but also results in an inequality in subjective well-being. If happiness could serve as a good proxy for final utility and welfare, this finding would indicate another substantial impact of income inequality. This notion deepens our understanding of inequality in China and other developing countries.

With regard to the time series pattern, we can cautiously draw policy implications from our cross-sectional study. Based on cross-sectional data, our results suggest that income is very likely to have a positive causal effect on happiness; however, the universal increase in income will not necessarily increase the happiness of all people because comparison income (the income of the reference group, see Easterlin, 1974, 1995,2001; Clark & Oswald, 1996;

[32] Frijters, Haisken-Denew, and Shields (2004) report that approximately 35% to 40% of the increase in life satisfaction in East Germany from 1991 to 2001 was attributable to the large increase in real household incomes, and a one-unit increase in logarithmic income results in an increase of roughly 0.5 in an 11-point-scale life satisfaction measure. Gardner and Oswald (2007) estimate that a medium-sized lottery win improves the mental well-being by approximately 1.4 points on a 36-point scale after two years (a medium-sized lottery win is between £1,000 and £120,000 in their data). Apouey and Clark (2010) estimate that a one-unit increase in logarithmic lottery prize improves mental health by 0.025 points on a 12-point scale after two years (the average win reported is roughly £170 in real 2005 pounds).

Ferrer-i-Carbonell, 2005; Fafchamps & Shilpi, 2008; Knight, Song, & Gunatilaka, 2009; Knight & Gunatilaka, 2011) or income aspirations (Stutzer, 2004; Knight & Gunatilaka, 2010, 2012), which negatively affect happiness, may increase with income and undercut the positive effect of income on happiness. However, if the counteraction is incomplete or if we could find tools for holding individuals' comparison income and income aspiration constant, thus isolating the positive effect of income increase *per se* from the negative ones of these confounding factors, increasing income is likely to increase happiness. This case may be especially true when we raise the income of those at the bottom of the income distribution: holding the income of others constant, raising the income of the very poor likewise increases their relative income. Thus, a better income support system is likely to increase the happiness of the poor. This implication is especially important for policies in light of the suggestion of Easterlin et al. (2012), that is, the dissolution and dysfunction of the social safety net may help explain why the life satisfaction of Chinese did not increase with the rapid economic growth from 1990 to 2010, whereas life satisfaction has declined markedly for the lowest income group. Furthermore, if the increase in the happiness of the very poor reduces their radical anti-social behaviors, then a better income support system would further improve social harmony, which is highly desirable for rapidly changing developing and transition societies such as China. All these aspects require further studies.

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Table 1. Distribution of Self-reported Happiness by Individual Monthly Income

	Percentage indicating happiness at individual monthly income (*yuan*) of					Observations
Response	**<200**	**200-400**	**400-800**	**800-1600**	**>1600**	
Often Feel Happy	50.64%	52.31%	56.27%	62.23%	70.63%	1,694
Sometimes Feel Happy	33.12%	35.69%	34.31%	30.71%	23.02%	931
Seldom Feel Happy	13.69%	9.23%	7.58%	5.53%	5.95%	220
Never Feel Happy	2.55%	2.77%	1.85%	1.54%	0.40%	52
Observations	314	325	1,029	977	252	Total: 2,897

Table 2. Descriptive Statistics of the Twins and Non-twins Samples

Variable	All Twins	MZ Twins (both twins have complete information)	Non-twins	NBS Sample
	(1)	(2)	(3)	(4)
Happiness	2.49	2.52	2.44	---
	(0.66)	(0.65)	(0.67)	---
Income(*yuan*)	836.52	837.95	949.29	1062.92
	(1037.50)	(1075.28)	(2562.08)	(840.09)
Age	36.37	37.26	43.82	40.80
	(10.20)	(10.20)	(8.70)	(11.98)
Male	0.58	0.57	0.44	0.55
	(0.49)	(0.50)	(0.50)	(0.50)
Birth Weight	2.43	2.43	3.12	---
	(0.60)	(0.62)	(0.54)	---
Early Disease	0.02	0.02	0.01	---
	(0.12)	(0.12)	(0.10)	---
Education	11.31	11.25	11.44	11.62
	(2.95)	(2.94)	(2.91)	(2.83)
Married	0.68	0.71	0.90	---
	(0.47)	(0.45)	(0.31)	---
Health	3.71	3.72	3.45	---
	(0.81)	(0.81)	(0.73)	---
Working overtime	0.31	0.30	0.28	
	(0.46)	(0.46)	(0.45)	
Observations	2897	1,742	1595	23288

Notes: Mean and standard deviation (in parentheses) are reported here. The first column includes all individuals from the twins sample for which we have complete information on the above variables. The second column only includes those MZ twin pairs for which we have complete information on both twins in a pair. The NBS sample comes from six provinces. Happiness is a 3-scale self-reported measure (1="seldom/never feel happy"; 2="sometimes feel happy"; 3="often feel happy"). Income includes all sources of wage and non-wage income. Early disease is a dummy indicating a disease symptom occurrence before three years old. Education measures years of schooling. Married is defined as 1 if being married, and 0 otherwise. Health is a self-reported five-point scale variable with a higher value indicating better health conditions (1="very poor," 2="poor," 3="fair," 4="good" and 5="very good"). Working overtime is a dummy indicating whether one works more than 40 hours a week.

Table 3. OLS and Fixed-Effects Estimates of the Effect of Income for all Twins and MZ Twins (Dependent variable: Happiness)

Sample	All Twins				MZ Twins					
Model	OLS	OLS	OLS	OLS	OLS	OLS	OLS	FE	FE	FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Log(income+1)	0.034***	0.126***	0.087***	0.091***	0.128***	0.093***	0.098***	0.071*	0.070*	0.075*
	(0.007)	(0.020)	(0.021)	(0.021)	(0.025)	(0.027)	(0.027)	(0.041)	(0.041)	(0.041)
Income=0		0.695***	0.479***	0.495***	0.682***	0.492***	0.510***	0.351	0.360	0.380
		(0.136)	(0.140)	(0.141)	(0.178)	(0.184)	(0.185)	(0.281)	(0.277)	(0.275)
Age/10	-0.114	-0.140	-0.274**	-0.278**	-0.185	-0.292**	-0.298**			
	(0.103)	(0.103)	(0.112)	(0.113)	(0.131)	(0.143)	(0.143)			
$Age^2/100$	0.010	0.013	0.030**	0.031**	0.021	0.035*	0.036*			
	(0.014)	(0.014)	(0.015)	(0.015)	(0.018)	(0.019)	(0.019)			
Male	-0.115***	-0.132***	-0.126***	-0.125***	-0.125***	-0.123***	-0.121***			
	(0.029)	(0.029)	(0.029)	(0.029)	(0.037)	(0.037)	(0.036)			
Birth Weight	0.004	-0.004	-0.010	-0.009	0.006	-0.001	-0.001	-0.011	-0.009	-0.009
	(0.024)	(0.024)	(0.024)	(0.024)	(0.030)	(0.030)	(0.030)	(0.060)	(0.057)	(0.057)
Early Disease	0.033	0.060	0.100	0.099	0.075	0.114	0.111	-0.089	-0.078	-0.076
	(0.090)	(0.090)	(0.087)	(0.087)	(0.109)	(0.105)	(0.105)	(0.189)	(0.197)	(0.197)
Education			0.015***	0.015***		0.015**	0.014**		0.005	0.005
			(0.005)	(0.005)		(0.006)	(0.006)		(0.013)	(0.013)
Married			0.155***	0.156***		0.125***	0.127***		0.130**	0.134**
			(0.037)	(0.037)		(0.047)	(0.047)		(0.057)	(0.058)
Health			0.107***	0.107***		0.102***	0.102***		0.101***	0.101***
			(0.017)	(0.017)		(0.022)	(0.022)		(0.030)	(0.030)
Working overtime				-0.026			-0.037			-0.049
				(0.0279)			(0.035)			(0.048)
Twin pairs					871	871	871	871	871	871
Observations	2,897	2,897	2,897	2,897	1,742	1,742	1,742	871	871	871
R-squared	0.027	0.037	0.062	0.062	0.039	0.061	0.061	0.006	0.024	0.025

Notes: Standard errors in parentheses are robust to heteroscadesticity and for OLS clustering at the family level. * significant at 10%; ** significant at 5%; *** significant at 1%. OLS regressions include city dummies. "Income=0" is a dummy which equals one if the twin' own income is zero, and zero otherwise. For FE specifications, each observation is the first difference between the twin pair.

Table 4. Estimating the Effect of Own Income and Income Difference with Twin Sibling on Happiness (Dependent variable: Happiness)

	GLS	GLS	GLS
	(1)	(2)	(3)
Log(income+1)	0.115***	0.082***	0.086***
	(0.025)	(0.026)	(0.027)
Income=0	0.681***	0.522***	0.540***
	(0.169)	(0.174)	(0.175)
Max(log(income+1)-log(sibling income+1), 0)	-0.029**	-0.022*	-0.021*
	(0.012)	(0.012)	(0.012)
Max(log(sibling income+1)- log(income+1), 0)	-0.031*	-0.033*	-0.034*
	(0.018)	(0.0179)	(0.018)
Age/10	-0.192	-0.295**	-0.299**
	(0.127)	(0.149)	(0.149)
$Age^2/100$	0.022	0.036*	0.036*
	(0.017)	(0.019)	(0.019)
Male	-0.128***	-0.125***	-0.124***
	(0.037)	(0.037)	(0.037)
Birth weight	-0.016	-0.010	-0.011
	(0.058)	(0.058)	(0.058)
Sum of birth weight	0.012	0.006	0.006
	(0.033)	(0.033)	(0.033)
Early disease	-0.081	-0.073	-0.071
	(0.162)	(0.161)	(0.161)
Sum of early disease	0.123	0.150	0.147
	(0.122)	(0.121)	(0.121)
Education		0.005	0.005
		(0.013)	(0.013)
Sum of education		0.006	0.005
		(0.007)	(0.007)
Married		0.133**	0.137**
		(0.059)	(0.059)
Sum of married		-0.007	-0.009
		(0.044)	(0.044)
Health		0.100***	0.101***
		(0.031)	(0.031)
Sum of health		-0.000	-0.001
		(0.021)	(0.021)
Working overtime			-0.053
			(0.049)
Sum of working overtime			0.013
			(0.034)
Twin Pairs	871	871	871
Observations	871	871	871

Notes: Standard errors in parentheses are robust to heteroscadesticity and clustering at the family level. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include city dummies. "Income=0" is a dummy which equals one if the twin' own income is zero, and zero otherwise.

Table 5a. Between-Families and Within-MZ-Twin-Pair Correlations of Education with Other Variables

Between-family correlations		Within-MZ-twin-pair correlations	
	Education		ΔEducation
Married	-0.162***	ΔMarried	-0.002
	(<0.01)		(0.95)
Health	0.129***	ΔHealth	0.088***
	(<0.01)		(0.01)
Spouse education	0.622***	ΔSpouse education	0.189***
	(<0.01)		(<0.01)

Notes: the significance levels are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. The between-family correlations are the correlations between average family education (average of the twins) and average family characteristics, and the within-MZ-twin-pair correlations are the correlations between the within-MZ-twin-pair differences in education and the within-MZ-twin-pair differences in other characteristics.

Table 5b. Between-Families and Within-MZ-Twin-Pair Correlations of Income with Other Variables

Between-family correlations		Within-MZ-twin-pair correlations	
	Log(income+1)		ΔLog(income+1)
Education	0.239***	ΔEducation	0.046
	(<0.01)		(0.18)
Married	0.035	ΔMarried	-0.010
	(0.30)		(0.76)
Health	0.134***	ΔHealth	0.049
	(<0.01)		(0.15)
Log(spouse income+1)	0.251***	ΔLog(spouse income+1)	0.071
	(<0.01)		(0.15)
Spouse education	0.208***	ΔSpouse education	0.098**
	(<0.01)		(0.02)

Notes: the significance levels are in parentheses. * significant at 5%; ** significant at 5%; *** significant at 1%. The between-family correlations are the correlations between average family income (average of the twins) and average family characteristics, and the within-MZ-twin-pair correlations are the correlations between the within-MZ-twin-pair differences in log(income+1) and the within-MZ-twin-pair differences in other characteristics.

Table 5c. OLS and Fixed-Effects Estimates of the Effect of Income for Married MZ Twins Controlling for Spouse's Education and Income (Dependent variable: Happiness)

	OLS		FE	
	(1)	(2)	(3)	(4)
Log(income+1)	0.101***	0.098***	0.088*	0.087*
	(0.035)	(0.036)	(0.053)	(0.053)
Income=0	0.549**	0.541**	0.499	0.495
	(0.240)	(0.239)	(0.353)	(0.352)
Age/10	-0.078	-0.064		
	(0.258)	(0.259)		
$Age^2/100$	0.011	0.008		
	(0.031)	(0.031)		
Male	-0.117**	-0.099**		
	(0.047)	(0.048)		
Birth Weight	0.021	0.020	0.086	0.082
	(0.037)	(0.037)	(0.077)	(0.077)
Early Disease	0.159	0.149	-0.019	-0.029
	(0.120)	(0.121)	(0.231)	(0.230)
Education	0.007	0.006	0.005	0.006
	(0.008)	(0.008)	(0.016)	(0.016)
Health	0.110***	0.108***	0.075*	0.071*
	(0.029)	(0.028)	(0.038)	(0.038)
Working overtime	-0.028	-0.027	-0.006	-0.008
	(0.048)	(0.048)	(0.066)	(0.066)
Spouse education	0.011	0.007	-0.002	-0.004
	(0.009)	(0.009)	(0.012)	(0.012)
Log(spouse income+1)		0.020**		0.016
		(0.010)		(0.014)
Twin Pairs	523	523	523	523
Observations	1,046	1,046	523	523
R-squared	0.059	0.063	0.019	0.022

Notes: Standard errors in parentheses are robust to heteroscadesticity and for OLS clustering at the family level. * significant at 10%; ** significant at 5%; *** significant at 1%. OLS regressions include city dummies. "Income=0" is a dummy which equals one if the twin' own income is zero, and zero otherwise.

Table 6. Instrumental Variable Fixed-Effects Estimates of the Effect of Income on Happiness (Dependent variable: Happiness)

	IVFE-1 ($\Delta Y^{"}$ as IV)			IVFE-2 (ΔY^{**} as IV)		
	(1)	(2)	(3)	(4)	(5)	(6)
Log (income+1) ($\Delta Y^{'}$)	0.249***	0.243***	0.255***			
	(0.084)	(0.082)	(0.083)			
Log (income+1) (ΔY^{*})				0.472	0.456	0.487
				(0.307)	(0.293)	(0.301)
Income=0	1.472**	1.441**	1.509**	3.077	3.012	3.185
	(0.625)	(0.601)	(0.602)	(2.535)	(2.424)	(2.472)
Birth Weight	-0.036	-0.034	-0.037	-0.028	-0.030	-0.032
	(0.064)	(0.060)	(0.060)	(0.073)	(0.070)	(0.071)
Early Disease	-0.122	-0.107	-0.102	-0.093	-0.072	-0.065
	(0.202)	(0.211)	(0.212)	(0.241)	(0.251)	(0.253)
Education		0.001	0.001		0.004	0.003
		(0.014)	(0.014)		(0.015)	(0.015)
Married		0.121**	0.127**		0.112*	0.118*
		(0.059)	(0.059)		(0.063)	(0.064)
Health		0.110***	0.111***		0.122***	0.123***
		(0.031)	(0.031)		(0.035)	(0.035)
Working overtime			-0.080			-0.078
			(0.052)			(0.055)
Twin pairs	854	854	854	854	854	854
Observations	854	854	854	854	854	854

Notes: $\Delta Y^{'}$ is the difference between the self-reported incomes of twin 1 and twin 2. $\Delta Y^{"}$ is the difference between the income of twin 1 as reported by twin 2 and the income of twin 2 as reported by twin 1. ΔY^{*} (ΔY^{**}) is the difference between twin 1's (twin 2's) reports of his/her own income and of the twin sibling's income (see details in Section 2.2). Standard errors in parentheses are robust to heteroscadesticity. * significant at 10%; ** significant at 5%; *** significant at 1%. "Income=0" is a dummy which equals one if the twin' own income is zero, and zero otherwise. Each observation is the first difference between the twin pair.

Table 7. Effects of Other Indicators of Income and Wealth on Happiness for MZ Twins (Dependent variable: Happiness)

	FE	FE	FE	FE	FE	FE	FE	FE	FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log(Wage)	0.167***	0.157***	0.159***						
	(0.061)	(0.060)	(0.060)						
Family income				0.075***	0.070***	0.071***			
				(0.021)	(0.021)	(0.021)			
Home ownership							0.146**	0.151**	0.151**
							(0.061)	(0.060)	(0.060)
Birth Weight	0.056	0.051	0.051	0.009	0.007	0.007	0.004	0.005	0.005
	(0.087)	(0.085)	(0.084)	(0.060)	(0.058)	(0.057)	(0.058)	(0.055)	(0.055)
Early Disease	0.152	0.178	0.178	-0.113	-0.095	-0.094	-0.116	-0.103	-0.102
	(0.114)	(0.134)	(0.133)	(0.188)	(0.196)	(0.196)	(0.186)	(0.193)	(0.193)
Education		0.007	0.007		0.002	0.002		0.007	0.007
		(0.015)	(0.015)		(0.013)	(0.013)		(0.013)	(0.013)
Married		-0.001	0.001		0.091	0.094*		0.123**	0.125**
		(0.064)	(0.065)		(0.056)	(0.057)		(0.056)	(0.056)
Health		0.064*	0.063*		0.103***	0.103***		0.107***	0.107***
		(0.035)	(0.035)		(0.030)	(0.030)		(0.030)	(0.030)
Working overtime			-0.022			-0.034			-0.024
			(0.054)			(0.047)			(0.047)
Twin pairs	468	468	468	867	867	867	867	867	867
Observations	468	468	468	867	867	867	867	867	867
R-squared	0.021	0.027	0.028	0.015	0.030	0.030	0.007	0.026	0.026

Notes: Standard errors in parentheses are robust to heteroscadesticity. * significant at 10%; ** significant at 5%; *** significant at 1%. Wage includes bonus and subsidies. Family income is scaled from 1 to 9, with a larger value indicating a higher total family income: 1 indicates a total family income less than 5,000 *yuan*, whereas 9 indicates a total family income larger than 110,000 *yuan*. Home ownership equals 1 if owner occupied, 0 if otherwise. Each observation is the first difference between the twin pair.

Table 8. IV Estimates of the Effect of Income on Happiness for all Twins (Dependent variable: Happiness)

	IV: industry average income	IV: industry-age average income	IV: growth rate of industry average wage over past five years (restricted to age>=25)
	(1)	(2)	(3)
Log(income+1)	0.229***	0.158***	0.503**
	(0.056)	(0.057)	(0.224)
Income=0	1.318***	0.869**	3.082**
	(0.363)	(0.368)	(1.541)
Age/10	-0.336***	-0.321***	-0.441**
	(0.117)	(0.117)	(0.221)
$Age^2/100$	0.037**	0.036**	0.048*
	(0.015)	(0.015)	(0.028)
Male	-0.151***	-0.140***	-0.172***
	(0.030)	(0.030)	(0.054)
Birth Weight	-0.014	-0.009	-0.019
	(0.024)	(0.024)	(0.035)
Early Disease	0.155*	0.142*	0.285***
	(0.086)	(0.086)	(0.102)
Education	0.004	0.010	-0.017
	(0.007)	(0.007)	(0.019)
Married	0.153***	0.159***	0.127***
	(0.038)	(0.038)	(0.049)
Health	0.095***	0.101***	0.068**
	(0.018)	(0.018)	(0.028)
Working overtime	-0.057*	-0.037	-0.077*
	(0.031)	(0.032)	(0.044)
Observations	2,779	2,779	1699
First-stage weak IV tests			
F-statistics	280.84	273.81	27.42
Critical value (10% maximal IV size)	16.38	16.38	16.38
Shea's Partial R-squared	0.14	0.14	0.02

Notes: Standard errors in parentheses are robust to heteroscadesticity and clustering at the family level. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include city dummies. "Income=0" is a dummy which equals one if the twin' own income is zero, and zero otherwise. Industry average income and industry-age average income are computed from our sample. The growth rate of industry average wage over the past 5 years is calculated using the data of industry average wage from 1996 to 2001 in China Statistical Yearbook 2002. The first-stage weak IV tests follow Stock and Yogo (2005), and Shea's partial R-squared.

Appendix

Table A1. Ordered Probit Estimates of the Effect of Income for all Twins (Dependent variable: Happiness)

	(1)	(2)	(3)	(4)	(5)
Log(income+1)	0.241***	0.197***	0.189***	0.164***	0.171***
	(0.036)	(0.038)	(0.038)	(0.038)	(0.039)
Income=0	1.364***	1.102***	1.065***	0.938***	0.964***
	(0.245)	(0.256)	(0.256)	(0.257)	(0.259)
Age/10	-0.280	-0.254	-0.597***	-0.496**	-0.502**
	(0.188)	(0.189)	(0.207)	(0.206)	(0.206)
$Age^2/100$	0.027	0.027	0.064**	0.057**	0.057*
	(0.025)	(0.025)	(0.027)	(0.027)	(0.027)
Male	-0.273***	-0.258***	-0.234***	-0.257***	-0.256***
	(0.053)	(0.053)	(0.053)	(0.054)	(0.054)
Birth Weight	0.006	0.008	0.009	-0.002	-0.002
	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)
Early Disease	0.137	0.151	0.139	0.227	0.225
	(0.172)	(0.174)	(0.173)	(0.171)	(0.171)
Education		0.030***	0.032***	0.033***	0.033***
		(0.010)	(0.010)	(0.010)	(0.010)
Married			0.280***	0.269***	0.270***
			(0.066)	(0.065)	(0.065)
Health				0.195***	0.195***
				(0.032)	(0.032)
Working overtime					-0.044
					(0.053)
Observations	2,897	2,897	2,897	2,897	2,897

Notes: Standard errors in parentheses are robust to heteroscadesticity and clustered at the family level. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include city dummies. "Income=0" is a dummy which equals one if the twin' own income is zero, and zero otherwise.

Table A2. Distribution of Happiness Levels of the MZ Twins Sample

(871 Pairs of MZ Twins)

Twin 1	Twin 2		
	Often Feel Happy	Sometimes Feel Happy	Seldom Feel Happy or Never Feel Happy
Often Feel Happy	**392**	99	29
Sometimes Feel Happy	120	**137**	20
Seldom Feel Happy or Never Feel Happy	25	27	**22**
Total	537	263	71

Table A3. Distribution of Income Brackets of the MZ Twins Sample

(871 Pairs of MZ Twins)

Twin 1	Twin 2				
	<200 *yuan*	200-400 *yuan*	400-800 *yuan*	800-1600 *yuan*	>1600 *yuan*
<200 *yuan*	**33**	14	27	16	1
200-400 *yuan*	13	**31**	35	23	1
400-800 *yuan*	31	31	**160**	76	6
800-1600 *yuan*	16	12	66	**166**	41
>1600 *yuan*	1	1	13	37	**20**
Total	94	89	301	318	69