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Income Inequality and Happiness: Which Inequalities Matter in China?

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Abstract

The effect of inequality on happiness should intrigue social scientists. Of the many dimensions of income inequality, we explore four, analysing a rich data set for China. Does actual or perceived inequality have a greater effect on happiness? We find that perceptions of inequality are the more important. How broad is the reference group with which people compare themselves? They report that it is narrow; and indeed narrowly defined inequality has the greater effect on happiness. Do perceptions of the degree of fairness of inequality matter? They do, as they ameliorate the adverse effect of inequality on happiness, especially for the poorest. Is it self-centred or community-based inequality which affects happiness? Both measures have significant effects, but in opposite directions. The research and policy implications are discussed.

Keywords China; Happiness; Inequality; Reference group; Relative income.

JEL codes D03; D63; I131, Z13.

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1. Introduction

The effect of inequality on happiness is an issue that should intrigue social scientists. It is one that sits uncomfortably with much conventional economics. Yet it goes back a long way: both Adam Smith and Karl Marx argued that happiness depends not only on one's own income but also, negatively, on the income of others relative to one's own. We live in society, and it is likely that we evaluate our lives in relation to society. Results from playing the Ultimatum Game show that people in many contexts are willing to forgo absolute income in order to avoid lower relative income. In many countries inequality and redistribution are central issues in public discourse and economic policy-making, often implying that a reduction of inequality is considered to be good for the well-being of society.

Income inequality is widely researched but there is inadequate discussion of the concepts and measures that are appropriate for normative and policy purposes. We need to think beyond measures of the national Gini coefficient. Our approach is to estimate happiness functions in order to discover which forms of inequality are important for subjective well-being. We define inequality as household differences in income per capita. Thus, it encompasses both the inequality of an income distribution among households and the income of each household relative to other households.

This study explores the relationships between income inequality and happiness in ways that remain under-researched. For instance, in a comprehensive albeit now dated survey of the literature on the effect of inequality on happiness, Clark et al. (2008) had little to say about any of the distinctions that will be addressed. The opportunity to do so arises because of the data available in the China Household Income Project (CHIP) surveys. They enable us to analyse interesting aspects of the relationship between income inequality and happiness, a relationship made complex by conceptual and measurement issues and the various channels of influence.

Section 2 provides the setting and explains relevant aspects of the data. We then pose four questions. *First*, is happiness sensitive, or more sensitive, to actual or perceived income inequalities? Most happiness studies analyse only actual inequality, normally because actual inequality is the only measured variable available. However, because happiness itself is a subjective variable, it is plausible that inequality as subjectively

perceived has the greater influence on happiness. This issue is addressed in Section 3, first by summarising the relevant literature, second by setting out the hypothesis to be examined and the hypothesis tests to be applied, and third by conducting the tests.

Second, does broadly or narrowly defined inequality have an impact, or a greater impact, on happiness? Some happiness studies analyse quite broad comparator groups, normally because these are the only data available. Much depends on the information about others that people possess: poorly informed people are likely to have narrow orbits of comparison. It is important to identify people's reference groups, and to analyse the relevant comparator incomes. Section 4 does this under the same three sub-headings.

Third, we pose the question: does the effect on happiness differ according to whether inequality is perceived to be fair or unfair? It is plausible, and also supported by evidence, that people are willing to accept inequality if they perceive it to be fair but unwilling if it seems to be unfair. Section 5 reviews the literature and tests the hypothesis with proxies for fairness and unfairness available in the data.

Fourth, does self-centred or community-based inequality have an impact, or a greater impact, on happiness? Income inequality can affect happiness through two different channels. One concerns the distribution of income in relation to the individual's income. The other concerns the distribution of income irrespective of the individual's place in that distribution. Both channels can affect happiness, but the literature often analyses only one or other of them. In Section 6 we analyse both, contrasting the two notions and their corresponding variables under the same three sub-headings.

The literature on the effects of inequality on happiness has grown rapidly in recent years. A more up-to-date literature survey (Clark and D'Ambrosio, 2015) contained direct discussions of three of our four questions: choice of reference group, the moderating effect of fairness, and the distinction between comparative and normative inequality. Nevertheless, our case study and data set make it possible to contribute to that literature. We will suggest that perceptions of inequality are more important for happiness than actual inequality, that inequality when more narrowly defined has a greater effect on happiness, that perceptions of fairness ameliorate the adverse effect of inequality on happiness, and that both self-centred and community-based inequality have significant

effects on happiness but in opposite directions. Section 7 concludes, reflects, and examines the implications of the results for research and for policy.

2. The data

The main source of data is the CHIP 2013 survey, supplemented by data from the CHIP 2002 survey where appropriate. The CHIP 2002 rural survey contained a special module on happiness, devised by one of the authors, which produced a flow of papers.[1] The CHIP 2013 rural and urban survey questionnaires contain many of the same questions relevant to our analysis. The survey contains much conventional socioeconomic information on individuals, households, and communities, as well as individuals' attitudes. The rural and urban questionnaires differ because of the economic and administrative differences and different ways of life in rural and urban China. Accordingly, we analyse rural and urban China separately.

Each sample was drawn from a representative sub-sample of the National Bureau of Statistics' (NBS) nationally representative sample for its annual household survey.[2] Both the rural and urban CHIP questionnaires contain a question that can be converted into a measure of happiness**.** It can be translated as: how happy are you nowadays? The choice of answers offered was: very happy, happy, so-so, not happy, not at all happy, or hard to say. Answers to this question were cardinalised to form the dependent variable in much of the analysis, whose value ranged from 4 (very happy) to 0 (not at all happy). The few who reported 'hard to say' were excluded.

CHIP 2013 surveyed 10,489 rural households in 14 provinces. Within each province on average 14.3 counties were sampled, and within each county on average 5.9 villages. Only those households in villages where at least nine households had been sampled were included in the analysis. This left 787 villages belonging to 178 counties. Rural respondents were also classified according to their answers to the question: how does your household's living standard compare with the average for your village: much below

[1] For instance, Knight et al., 200**9**, Knight and Gunatilaka, 2011, and Knight and Gunatilaka, 2013.
[2] Information was obtained directly from the logbooks of each house compiled by the NBS, and further information was gathered for each household in the CHIP sub-sample by the usual NBS interviewers. Thus, the further information designed with hypotheses in mind, including the questions on happiness and relative income in the locality, was obtained separately.

average, below average, average, above average, or much above average for your village? This question generated a measure of 'comparator income' or 'relative income', i.e. own income relative to that of other households in the village.

Villagers were also asked to compare the income of their village with that of other villages in the county: much below average, below, average, above average, much above the average of villages in the county. This question makes possible the analysis of the response of happiness to a broader reference group.

Rural interviewees were asked about the people with whom they made comparisons: neighbours, relatives, people in the village, people in the township, people in the county, rural people, urban people, or all of China? The answers indicate the nature and breadth of reference groups.

The urban sample contained 12,704 households from the same 14 provinces. We used only those households in cities where at least nine households had been surveyed and had non-missing values for the explanatory variables in each specification. This amounted to about 6,900 households in 422 urban areas (towns, cities, and municipal districts), averaging 37 households per urban area. The urban questionnaire contained the same or similar key questions as the rural questionnaire. The question intended to establish the main reference group distinguished people who were relatives or neighbours, people in the same community or 'street', in the same district, in urban areas, in rural areas, or in China as a whole. The measure of relative income provided the same categories as in the rural questionnaire, but in relation to the urban locality.

Our measure of relative income in the locality and our use of it may is unusual in studies of happiness. Our measures of income, both absolute and relative, are of household income per capita or perceived household living standard respectively, whereas our measure of happiness is normally that of the household head (or the most senior household member present at the interview). This inconsistency is often (necessarily) found in happiness studies. A positive coefficient on household income per capita is likely to be smaller than it would be if the respondent's own income were available.

3. Perceived or actual inequality?

3.1 Literature

Layard *et al* (2009) is one of the few happiness studies to distinguish and analyse both actual and perceived relative income. Its objective was to test for negative effects on happiness of community income relative to own income, using data from the US General Social Survey (GSS). The authors found such an effect for actual relative income. The GSS also measured perceived relative income, which had a highly significant negative effect. The authors commented: 'this adds enormously to the plausibility of the analysis because it directly measures cognition' (p. 5).

Using the European Values Survey, Schalembier (2019) analysed the effect of a society's actual and perceived income inequality on the happiness of respondents, irrespective of their position in that income distribution. Actual income distribution in the country was measured by the Gini coefficient. Perceived income distribution was measured by a subjective Gini coefficient constructed from respondents' perceptions of what type of society they lived in. Both measures of income inequality were found to reduce happiness. Their result of greatest interest to us is that the link between the two subjective concepts is stronger than the link between actual income distribution and happiness.

Many studies have found that perceived and actual inequality are systematically different (for instance, Cruces et al. (2013), Hauser and Norton, 2017, Knell and Stix, 2017, Gimpelson and Treisman, 2018). Moreover, it is often claimed that perceived, rather than actual, inequality drives behaviour, attitudes, and preferences for redistribution (for instance, Hauser and Norton, 2017, Gimpelson and Treisman, 2017, Kuhn, 2015). This implies that perceived inequality is more likely to affect happiness than actual inequality. In several studies it is argued that, owing to limited information about wider inequality, respondents' perceptions of inequality are influenced by their reference groups, which are normally sets of people like themselves. Thus, poor people are likely to overestimate their actual income rank and rich people to underestimate their rank (for instance, Engelhardt and Wagner, 2014, Knell and Stix, 2017, Iacono and Ranaldi, 2019). The implication is that, if actual inequality is defined to cover a wider population than a person's reference group, reported perceived inequality is less than actual inequality.

The literature suggests that subjectively perceived relative income is relevant to happiness, and indeed it might be more relevant than the objective measures of relative income that are normally analysed.

3.2 Hypothesis and hypothesis tests

There is a persuasive argument for claiming that, since happiness is subjectively perceived, subjectively perceived inequality should be the relevant concept and measure. However, most happiness research uses the measure that is normally available, and that is actual inequality. Yet information about actual inequality might be limited, and respondents might be poorly informed. Can the research which relies on actual inequality produce misleading results? Our hypothesis is that perceived inequality has the greater effect on happiness.

The 2013 rural survey provides a measure of perceived inequality at the village level. The group of dummy variables denoting the respondent's subjective perception of relative income inequality in the village were based on their answer to the question: how does your household's living standard compare with the average for your village: much below average, below average, average, above average, or much above the average?

The best approach to exploring the distinction between perceived and actual inequality is to compare the relationship between happiness score and perceived inequality and that between happiness score and actual inequality. Because our perceived inequality measure involves five dummy variables whereas the actual inequality measure is based on own income relative to average income in the village**,** actual inequality must be converted into a distribution that is comparable with that of perceived inequality, in order to assess which relationship is the stronger.

To do this we ordered households in the village according to the ascending order of per capita income, and then assigned them to five groups These were determined by the proportions of respondents in the entire rural sample who perceived their relative income position in the village as being much below average, below average, average, above average, or much above average. For example, 0.9% of all rural respondents reported that their household was in the much above average income group, 17.2% in the above average group, 56.0% in the average group, 20.9% in the below average group, and 5.1% in the much below average group. Accordingly, with rounding, the poorest 5.1% of

households in the village sample were assigned to the very much below actual average income group, the richest 0.9% of households in the village sample were assigned to the much above average village income group, and so on.

The same methodology is applied to the urban sample, with town, city or municipal district rather than village as the relevant spatial characteristic. (Henceforth we refer to the urban areas simply as cities.) The weights based on the distribution of responses to the question about subjective relative income in the urban sample were 5.4% (much below average), 25.4% (below average), 53.0% (average), 15.2% (above average), and 1.2% (much above average). The average number of respondents per village in the rural sample was 10, and per city in the urban sample 37. The samples used for the rural and urban analyses were limited to households belonging to communities from which at least nine households had been surveyed.

The hypothesis test is to compare the two regression equations, one containing the set of perceived relative income dummy variables and the other the set of actual relative income dummy variables, in terms of the substance and significance of their respective coefficients.

3.3 Analysis

The estimated regressions in this section are based on the following form of equation:

$$H_i = \alpha + X_i\beta + PI_{ijk}\gamma + AI_{ijk}\delta + u_i \qquad (1)$$

where H is the happiness score, X is a vector of control variables, β is a vector of their coefficients, the test variables are PI (perceived inequality) and AI (actual inequality), u is the error term, i are observations, j are relative income categories, and k are types of locality. The test variables are introduced separately and in combination. The equation is estimated for the rural sample (Table 1) and the urban sample (Table 2). Estimated equations in all subsequent tables have the same form as equation (1), with happiness score as the dependent variable and the same control variables, but can have different test variables.

Table 1 compares the effect of perceived relative income and actual relative income on happiness in rural China in 2013. It distinguishes the control variables and the test variables. There are five columns. Column 1 shows the means or proportions and column

2 the 'parsimonious' equation which omits the relative income variables. It contains the control variables - individual (household head) and economic variables that are conventionally included in happiness functions. There is an inverted U-shaped relationship between age and happiness, men are less happy than women, marriage raises happiness by comparison with single status whereas divorce lowers it, ethnic minorities are less happy than the Han majority, years of education add to happiness, reporting good health has a powerful positive effect, and both ln income per capita and ln financial assets per capita raise happiness.[3] These conditioning variables confirm the results from the CHIP 2002 rural survey (for instance, Knight *et al*, 2008) and from the 2013 rural survey (Knight *et al*, 2020).

Column 3 introduces perceived relative income. The omitted category in the dummy variable analysis is income at the village average. For a reason shortly to be explained, we reduce the perceived relative income categories from five to three: below, at, or above the village average. The coefficient is 0.76*** for those above and falls to -0.57*** for those below the average. The adjusted R-squared rises from 0.08 to 0.17 between columns 2 and 3. People appear to be extremely sensitive to their perceived income position within the village.[4]

There is a danger that, by necessarily allocating more households to the extreme categories than their rural proportions warrant, we reduce their coefficients and thus narrow the range of actual relative income coefficients. We therefore group together the two categories that are below average and the two that are above., so creating the three categories used in columns 3 and 4. Households are allocated to these categories according to their proportions in the rural survey. For instance, if there are ten surveyed households in a village, then, with rounding, 3, 5, and 2 households are allocated to the three categories respectively. Column 4, replacing perceived relative income with actual relative income, produces a weaker relationship, ranging from 0.09*** to -0.05**. Adjusted R-squared is down to 0.08. When actual and perceived relative income are combined in column 6, the perceived dummy coefficients retain their pattern, size, and significance whereas the actual dummy coefficients become weaker in all three respects.

[3] By contrast, the coefficient on working hours is not significantly different from zero.
[4] It is notable that, whereas the respondent's happiness is reduced by higher village income, it is raised by higher village happiness (Knight and Gunatilaka, 2017).

Table 2 presents the same analysis for urban China. The results for the control variables are very similar to those obtained from urban CHIP 2002 (Knight and Gunatilaka, 2010). Happiness has a U-shaped relationship with age, marriage is better, and divorce worse, than being single, years of education improve happiness, as does better health. Absolute ln income raises happiness, and working hours reduce it. Happiness is highly sensitive to perceived relative income, ranging from 0.23*** (above village average) to -0.42*** (below). Adjusted R-squared nearly doubles (from 0.10 to 0.18) with the addition of these relative income terms (column 3). When the perceived dummies are replaced by the actual dummies, the differences in coefficients narrow sharply, ranging from 0.09*** to -0.13*** (column 4). When both perceived and actual relative income are included in the equation (column 5), the coefficients of the perceived dummies remain unchanged in size, pattern, and significance whereas the those of the actual dummies lose in both size and significance.

We conclude that happiness appears to be much more sensitive to perceived relative income than to actual relative income. However, there are two caveats. First, when we analyse the effect of one subjective variable, perceived position in the local income distribution, on another subjective variable, reported happiness, we face possible omitted variable bias: both might depend on the personality of the respondent. For instance, a person who is intrinsically happy might on that account report higher relative income, or a more energetic person might on that account report being happier and also have higher relative income - so biasing upwards the estimated effect of relative income position on happiness. However, it is implausible that endogeneity of this sort can fully explain the big difference between the perceived and actual results. It is difficult to instrument relative income or to find valid instruments. Nevertheless, Section 4 examines the causal effect of relative income on happiness and finds supportive evidence.

Second, perceived relative income is based on all households in the locality whereas actual relative income is based on the sampled households alone. The measure of actual inequality in the village is likely to be less accurate because it is based on few observations. It is gratifying that we find the same results for urban-dwellers: the caveat has less force because the average sample size is greater in urban localities.

4. Wide or narrow inequality?

4.1 Literature

Economic research on subjective well-being has increasingly incorporated relative income variables (well surveyed by Clark *et al.*, 2008 and Clark and D'Ambrosio, 2015). A crucial variable in such analyses is the choice of the reference group with which income is compared. The sociological notion of a reference group can be defined as a group that frames the social norms, attitudes, values, and behaviour of the individual. The income of the reference group relative to one's own income is hypothesised to affect one's happiness. If reference group income is lower, a person might feel a sense of relative achievement, and so happiness rises. If reference group income is higher, one person might feel a sense of relative deprivation, and accordingly happiness falls. However, another person might see it as a signal of opportunities and a target for as yet unfulfilled aspirations, and happiness rises.[5]

For a group to serve as a reference group, people must be or feel sufficiently well informed about the relevant characteristics (in this case income) of the reference group. Each researcher must define the reference group being used. Information about reference groups is exceedingly rare. Exceptions include Clark and Senik (2010) and Knight *et al*. (2009) (and indeed the current paper). Most studies rely on judgements about the selected reference group and infer the group rather than identify it directly. A common approach is simply to measure the effect of group income on happiness and to assume that a significant effect indicates that the group income hypothesis cannot be rejected while a non-significant effect indicates that it can be rejected. Much research uses broad group concepts according to what data are available.

Two main approaches to the definition of the reference group have been adopted. One is to examine the income of people with similar characteristics – more or less specific - irrespective of location. The other is to consider people in the same locality – whether large or small – as indicating the relevant comparator income. It is rare for the two approaches – both personal characteristics and geographical location – to be combined.

[5] Consistent with this argument, Knight and Gunatilaka (2019) provided evidence for rural China (from CHIP 2002) supporting the hypothesis that anticipation of a future increase in income raises current happiness.

Whichever, approach is adopted, it is because the researcher assumes that this is the group to which people refer when gauging their happiness.

We provide a brief illustrative account of notable results and of the comparator groups chosen. Many studies have found that happiness varies inversely with comparator income. For instance, in an early study, Clark and Oswald (1996) found that job satisfaction of British workers was inversely related to the wage rates of workers who had the same wage-generating characteristics. Ferrer-i-Carbonell (2005), analysing a German data set, found that the income of the respondent's reference group, defined by a combination of age, education, and region, was roughly as important to happiness as the respondent's own income, but had the opposite sign. McBride (2001) estimated a negative relative income effect for the United States, based on the income of parents and of people in the same age group. Within-race group income comparisons reduced happiness in South Africa (Kingdon and Knight, 2007), as did within-caste income comparisons in India (Carlsson *et al*., 2009). Graham and Pettinato (2002), using panel data for Peru and Russia, found that the change in happiness over time depended on relative rather than absolute income growth. Studies which have failed to identify a comparator income effect on happiness are open to the criticism that an inappropriate comparator group may have been examined.

Some studies have explored geographical neighbours as the relevant reference group. However, the concept of 'neighbour' has varied greatly. Using a very broad definition of neighbourhood (areas containing at least 100,000 inhabitants), Luttmer (2005) found that 'neighbours are negatives' in the United States. Reference groups might be broad in societies with strong, wide information flows whereas they might be narrow in poor rural societies. Using the rural sample of CHIP 2002 Knight *et al,* (2009) and Knight and Gunatilaka (2010) obtained a negative relationship within Chinese villages. That same sensitivity is present in the 2013 rural survey (Knight et al., 2020).

There are a few exceptions to the rule that a negative relation is reported in studies of the effect of comparator income on happiness. For instance, Kingdon and Knight (2007) found that subjective well-being rose with the income of close residential neighbours in South Africa and, after tests, interpreted this as reflecting fellow-feeling. Defining the income of the reference group as the predicted income of those with the same

characteristics, Senik (2004) found that group income raised subjective well-being in transitional Russia, a result that was explained as a demonstration effect.[6]

4.2 Hypothesis and hypothesis tests

Our hypothesis is that reference groups if narrowly defined have a greater effect on happiness than if broadly defined. The objective, therefore, is to discover which reference groups, defined by breadth, have the largest coefficients in the happiness function.

All five perceived income categories can now be used in the rural analysis that compares village and county effects. We attempted to use mean household income per capita in the relevant rural locality as a measure of actual relative income, but no significant coefficients were obtained. The reason is that this variable can have other effects on happiness which counter the hypothesised relative income effect. For instance, mean income might reflect local amenities and facilities, which are likely to be important in rural China because villages have to find much of their own funding. The corresponding urban survey provides comparative information on actual relative income in the city and in the province. Since perceived relative income is available only for one reference group (the city) in the urban sample, it cannot be used to compare different reference groups.

4.3Analysis

Respondents were asked about the group with which they mainly compared themselves. Table 3 presents the distribution of replies. Our particular interest is in the proportion of rural respondents whose main reference group was within their village. This corresponded to the first two reference categories. Accordingly, 84% of rural people compared mainly within the village. A further 4% claimed to compare mainly with people in the county. In the urban sample, choosing the first three categories (83%) implied that respondents compared mainly within their city. Far fewer (12%) referred to urban areas in general or to China as a whole. In summary, Table 3 indicates that we should expect the most relevant income comparisons to be made within the village (by rural-dwellers) or within the city (by urban-dwellers). This reflects the limited information which people

[6] Consistent with this interpretation, Goldsmith (2010) found for the same Russian data that when income was used as the comparative measure, the relationship was positive, whereas when consumption – more visible to others - was the comparator, the relationship was negative.

have about life beyond their own locality and a tendency to compare themselves mainly with people whom they know or with whom they interact.

The estimated equations of section 4 are based on equation (1) above, although the test variables are defined in different ways. In Table 4, relating to the rural sample, columns 1 and 2 correspond to the equivalent columns in Table 1 except that all five perceived relative income categories are now included. Happiness is highly sensitive to perceived income position within the village (column 3): the coefficients – all significantly different from zero (set at village average income) - fall monotonically as relative position declines, from 0.84 for much above village average to -0.85 for much below. The range of conditional happiness above average village income is thus similar in size to that below. Our results contrast with Ferrer-i-Carbonell's (2005) finding that the effect of relative income on happiness was asymmetric in Germany: the happiness of those with income below the average decreased whereas that of those with income above did not increase. These contrasting findings have normative implications.

Column 4 adds instead the variable denoting the income position of the village in relation to other villages in the county.[7] Again, happiness is highly sensitive to perceived income position of the village. The coefficients fall monotonically and are all significantly different from zero, but the within-county range is smaller (1.05) than the within-village range (1.69). Moreover, when both variables enter the equation (column 5), the within-county range, although still significant, is reduced (to 0.33) whereas the within-village range is not affected (1.69). Within-village effects have a more powerful effect on happiness.

Table 5, relating to urban China, is confined to actual relative income because perceived relative income is not available at the province level. It compares the effect on happiness according to whether the city or province is assumed to be the reference group. In column 2 we introduce actual relative income, defined as mean income per capita in the city, and in column 3 it is defined as mean income per capita in the province Both coefficients are negative but that on mean city income is significantly so (-0.216***) whereas that on mean province income is smaller and not significant (-0.133). When both variables are

[7] The questionnaire does not permit a comparison of a household's income in relation to that of other households in the county.

included in the estimation (column 4), the city coefficient is barely changed (-0.210***) and the province coefficient is now negligible (-0.030).

In summary, we found that respondents in both rural and urban China reported that their reference groups were narrow, largely being within their village or their city respectively. Moreover, it was at these levels of aggregation that the effects of inequality on happiness appeared to be greater. Narrowly-defined inequality is important in China and probably in other countries as well, especially where information flows are limited.

These results must be qualified by the possibility that the relative income variables are endogenous in the happiness equation. This is because both perceived relative income and happiness, being subjective variables, might be dependent on personality. The normal method of achieving identification in a cross-section analysis is to use external instruments which (in this case) can predict relative income but cannot plausibly influence happiness. Unfortunately, it is not possible within our data set to find variables that would be valid external instruments for the suspect variables. [8] A second difficulty in testing for a causal effect of relative income on happiness is the problem of instrumenting several relative income variables.

Our solution to the first difficulty is to generate heteroskedasticity-based instruments, as proposed by Lewbel (2011) and explained by Baum and Lewbel (2019). These internal instruments are increasingly used when external instruments are not available. Where H is happiness and I is cardinal relative income, the endogenous explanatory variable, we have:

$$H = X'\beta + I\gamma + e_1 \qquad (2)$$

$$I = X'\alpha + e_2 \qquad (3)$$

We estimate α by means of OLS linear regression of I on X and obtain estimated residuals $e_2 = I - X'\alpha$. Where the vector Z is some or all of the elements of X (not including the constant term), we then estimate β and γ by regression of H on X and (Z $-\dot{Z}$) $\hat{e}_2$ (where $\dot{Z}$ is mean Z). The variable I is endogenous because it contains an error component (U) that appears in the errors of both equations ($e_1 = cU + V_1$ and $e_2 = U + V_2$). Two conditions are required for identification. First, that the common error, U, is homoskedastic, i.e. U^2 is not

[8] Our best variable for this purpose was a cardinal version of father's education but this proved to be too weak an instrument.

correlated with Z, a condition for which there is no conclusive test.[9] Second, the error e_2 must be heteroskedastic, i.e. e_2^2 is correlated with *Z*. Breusch and Pagan (1979) provides a test that can reject homoskedasticity. We solve the second problem by converting the relative income dummies into a cardinal variable, running from 1(much below) to 5 (much above) average village income. We can then instrument this variable (cardinal relative income).

Table 6 reports both OLS and IV equations estimating happiness in which five-valued cardinal relative village/city income is included along with the other explanatory variables of Tables 1 and 2. The heterogeneity test (the null hypothesis being homoskedasticity) establishes heteroskedasticity in both the rural and urban samples. The underidentification test indicates whether the excluded instruments are correlated with the endogenous regressors. This test again rejects the null hypothesis that the instruments are uncorrelated with the endogenous variable. The test of weak identification produces an F-value above the value of 10 (used as a rule of thumb for strong instruments) in the rural case but fails below it in the urban case. The Hansen J overidentification test has the null hypothesis that the instruments are uncorrelated with the error term. There is a rejection in the rural case, casting some doubt on the validity of that instrument, but an acceptance in the urban case. Thus, each equation passes three of our four tests.

Consider the rural estimates, starting with the IV equation. The coefficient (0.628***) is positive, as predicted, and significant, and greater than the corresponding OLS coefficient. Thus, instrumenting raises the coefficient[10]: the causal relationship running from relative income to happiness may be even stronger than the powerful association between them that is reported in Table 4. Turning to the urban case, the IV coefficient for cardinal perceived city relative income (0.394***) is positive and greater than the corresponding OLS coefficient. In summary, we draw two conclusions from Table 6. First, the instruments appear to be valid. Second, the coefficient on cardinal relative income when

[9] Pagan and Hall (1982) provides a partial test of this condition but a rejection of the null might be due to heteroskedasticity of V_1.

[10] This is possible if an omitted variable is negatively correlated with happiness or if there is attenuation bias associated with measurement error in the explanatory variable.

instrumented is in each case positive and no less than the corresponding OLS coefficient. The powerful relationship between relative income and happiness does not melt away. [11]

5. Fair or unfair inequality?

5.1 Literature

Economists tend to examine income inequality often with the presumption that it is too high. There is little discussion in the economics literature of the distinction between 'fair' and 'unfair' inequality. This lack is probably related to the difficulties of conceptualising and measuring fair and unfair inequality. However, reflecting the distinction that ordinary people often have in mind, there is a groundswell towards making that distinction in research on inequality. For instance, Deaton (2019) in setting out his thoughts at the start of the five-year research programme entitled 'Inequality in the Twenty-first Century' that he was to lead, observed: 'It is not inequality itself that is hurting people, but the mechanisms of enrichment' and, elsewhere, 'Inequality is not the same thing as unfairness, and to my mind it is unfairness which has incited so much turmoil in the world today'.

People in different societies might have different views on which sources of inequality are fair, and which unfair, and these differences might be rooted in history, culture, and institutions. For instance, Alesina *et al*. (2004) contrasted attitudes in Europe and the United States. They found that happiness is lower in both countries when inequality is higher, but that the effect is greater in Europe. Their interpretation, not directly tested, was that Americans have the perception (not necessarily the reality) that they live in a mobile society, whereas Europeans perceive that they live in an immobile one. This interpretation is consistent with the view that people in Europe tend to dislike inequality of outcomes whereas people in the United States tend to accept inequality of outcomes provided that they perceive sufficient equality of opportunities.

There is evidence from neuroeconomics that people distinguish fair and unfair inequality. Cappelli *et al*. (2014) combined an experimental game and neural scanning to show that

[11] We attempted also to instrument cardinal relative income in the three-value case, corresponding to Tables 1 and 2. In each IV equation the coefficient exceeded that in the corresponding OLS equation, and in each perceived relative income equation the coefficient exceeded that in the corresponding actual relative income equation. However, the instruments were suspect in three of the four IV equations.

their subjects responded differently to income changes related and unrelated to work effort.

Researchers face the task of distinguishing between inequality that is fair and that which is unfair. One possible distinction is between inequalities that are due to personal responsibility and to forces beyond personal control. Another is the notion that inequalities are unfair if they are man-made and amenable to correction. However, empirical analysis might best be served by measures of perceptions of fairness reported by respondents.

Two studies have found that the negative effect of inequality on happiness depends on their measures of perceived fairness and trust in society. Oishi *et al.* (2013) used reported measures of fairness and of trust provided in the United States GSS. The authors found a negative time series relationship between inequality and happiness, and showed that lower values of fairness and trust in years of high inequality were responsible for this relationship. Bjornskov *et al.* (2013) analysed the World Values Survey covering 80 countries over the years 1990-2008, employing three measures of perceived fairness in society. Although the thrust of the paper was elsewhere, they found that higher inequality reduced happiness, that higher perceived fairness raised happiness, and that when inequality was interacted with fairness, higher perceived fairness weakened the effect of inequality on happiness.

Turning to China: when in 1978 China embarked on economic reform it had too much equality. The egalitarian arrangements in the communes and the factories stifled incentives and produced inefficiency. The new Chinese leadership recognised that greater income inequality was necessary to provide the incentives essential to an economy that was in the process of making the transition from a centrally planned to a market-driven system. Income inequality increased rapidly over the reform period as people acquired incentives for using talent, for effort, saving, investment in physical and in human capital, and risk-taking. However, some of the new inequalities cannot be justified by the criterion of economic efficiency. They might be better explained in terms of institutional segmentation of labour, rent-seeking, corruption, and abuse of power. A sociological survey conducted in 2004 examined Chinese people's attitudes to the degree of inequality and what inequality they regarded as fair (Whyte, 2010). It was found that Chinese people were not averse to inequality based on merit, effort, or risk-taking.

Indeed, such inequality appeared to offer people incentives or other opportunities for improving their economic positions. By contrast, inequality based on unfairness in treatment or in access to opportunities was generally disliked. Knight (2017) argued that researchers, particularly on China, should extend inequality research and research instruments towards an economics of fairness and unfairness, and that happiness research could provide a helpful link.

There are two approaches to the concept and measurement of fairness. One is to follow 'the idea of justice' that Sen (2009) develops, which equates injustice with unfairness. To identify unfairness, Sen adopted Adam Smith's (1759) appeal to an 'impartial spectator' to avoid the influence of vested interests and entrenched attitudes. This approach requires the marshalling of evidence from which a value judgement can be formed. The alternative approach is to rely on people's own perceptions of fairness or unfairness by obtaining data on their attitudes and their effects on subjective well-being from national household surveys. That is the approach adopted in this section since one of the CHIP surveys provides a ready measure of perceived fairness that can be used to examine its influence on people's happiness.

5.2 Hypothesis and hypothesis tests

Is the negative effect of income inequality on happiness reduced or eliminated if people perceive inequality in society to be fair? Testing requires measures of perceived fairness. Our approach is to estimate a standard happiness function with relative income and our measure of fairness included among the independent variables, and then with the addition of interaction terms representing relative income x fairness. The hypothesis is that the interaction terms weaken or eliminate the negative effect of inequality on happiness.

The 2013 urban survey contains two potential proxies for fairness based on whether respondents find their relatives and friends trustworthy. However, since the degree of trust might not be a good proxy for perceived fairness, another approach is available. That is to use the 2002 CHIP data set, which generates a basic equation that is very similar to the 2013 basic equation and contains more attitudinal variables that might provide better proxies for fairness. The 2002 urban questionnaire asks respondents to report whether they are in the top, second, third, or bottom quarter of the city income distribution. It also

has questions: do you think the current income distribution nationwide is fair; do you think the current distribution in your city is fair? The permitted replies are: very fair, fair, not fair, not at all fair, no reply. Discarding the last one, we have four replies which can be valued from 3 (very fair) to 0 (not at all fair) categorised in the happiness function. The equivalent questions are not available in the 2002 rural questionnaire and our attempt, using attitudinal questions, to construct a rural proxy for the fairness of the income distribution proved to be unsuccessful. The analysis is confined to urban China, using CHIP 2002.

5.3 Analysis

In order to examine interaction between inequality and fairness, equation (1) now uses different test variables: $PI_{ijk}\gamma + F_{ik}\delta + (PI_{ijk} \,.\, F_{ik})\varepsilon$, where F is the fairness score. We build a matrix of interaction term coefficients (ε) to show the extent to which greater fairness reduces the harmful effect of inequality on happiness. We add to the usual parsimonious equation perceived position in the city income distribution and reported fairness. Fairness is placed in three categories, the lowest being fairness 1 and the highest fairness 3, as explained in the notes to Table 7. Then, in addition to these terms, we include interaction terms, being the multiplication of the relative income categories and fairness categories.

Table 7 reports three sets of interaction terms, relating to the combined fairness score, fairness in China as a whole, and fairness in the respondent's city. It shows matrices of interaction terms, with the four income quarters shown across the rows and the three fairness categories down the columns. The top income quarter and the lowest fairness level are the omitted categories in the regression analysis, and thus the cell which combines them has a value of zero. Other cells indicate the departure of the conditional happiness score from the zero cell, and its statistical significance.

We begin with the combined fairness score. There is little variation in coefficients according to the fairness level when interaction terms are included in the estimated equation but when interaction terms are omitted from the equation the effect of fairness on happiness is large and positive: it is 0.182*** more in fairness category 2, and 0.435*** more in category 3, than in category 1 (Panel 4). The perception of fairness on its own is associated with greater happiness.

If people perceive that the income distribution is fair or very fair, their happiness is raised in each income quarter relative to quarter 1 (for which the coefficients are all set to zero by definition). Looking across the row for fairness 1 in Panel 1, the interaction terms are all zero, because this fairness category is the omitted dummy variable. However, when derived from the coefficients for income quarter in the full equation, happiness is lower by 1.471*** in the lowest income quarter than in the highest (Panel 4). Looking across the row for fairness 3 in Panel 1, the coefficient increases monotonically, being 0.642* in the lowest income quarter. The disparity across income quarters is significantly smaller if respondents are in the lowest fairness category than in the highest. It appears that the poorest urban people, feeling relative deprivation most keenly, derive most happiness from regarding their relative income as fair or very fair.

The pattern of interaction coefficients is very similar in the analysis of fairness for China as a whole (Panel 2) and for the respondent's city (Panel 3) to that for the combined fairness measure. However, the ameliorating effect of fairness is somewhat greater for national fairness than for city fairness. For instance, for the national measure the coefficient in the cell representing income quarter 3, fairness 3 is 0.605* and in the cell income quarter 4, fairness 3, it is 0.949**, whereas for the city measure the latter cell has a coefficient of 0.677*. People appear to take a broad view in their perceptions of fairness.

We have presented evidence that in urban China perceptions of fairness ameliorate the effect of perceived relative income position on happiness, and that this effect is strongest for people in the poorest income quarter. However, except in the extreme cases our evidence is weak and even those in the highest fairness category were still quite sensitive to their relative income within the community. Moreover, there is again a potential problem of endogeneity: people who are inherently less happy may be more likely to perceive injustice or to compare themselves negatively with others (Graham, 2014: 257).

6. Self- or community-centred inequality

6.1 Literature

The forms of inequality mentioned above involve the 'self-centred' approach to happiness, by examining how a person's happiness is affected by the income of their comparator group relative to their own income. This is the usual approach to the analysis of the effects of inequality on happiness. There is another approach, less frequently found in the happiness literature, which analyses the effect of income inequality within the relevant community on the happiness of respondents irrespective of their own income or relative income. This is the 'community-centred' (or community-based) approach.

Clark and D'Ambrosio (2015) distinguished self-centred and community-centred concepts of inequality, the former being the inequality of income relative to that of the respondent and the latter the inequality of income independent of the respondent. The authors referred to these concepts as comparative and normative respectively. Their chapter contains a table listing 28 studies of the effects on happiness of the normative concept, i.e. inequality in the community. The great majority (22) of these employed the Gini coefficient as their measure of inequality, and more than half (16) chose the country as their unit for measuring inequality. Half (13) of the studies found a negative effect on happiness, 7 found a positive effect, and 7 found no effect.[12]

It is possible that some people make a value judgement in favour of less inequality, and that for this reason higher inequality reduces their happiness. Another possibility is that higher income inequality reduces a sense of social cohesion and of common identity, or that it generates adverse socioeconomic effects such as social instability. The outcome of these effects as a whole can be that average happiness in the society falls. It is not important for our purposes to distinguish these motives for reducing inequality; each is plausible. Nevertheless, there is scientific support for the hypothesis that people value equality in itself. Dawes *et al*. (2007) devised an experimental game which showed preference for greater equality even when it is isolated from the promotion of

[12] However, the authors warned that most studies were unable reliably to distinguish normative from comparative effects - whether or not the comparative variable was included in the estimated equation – as the variables were often correlated.

cooperation and reciprocity; Tricomi *et al*. (2010) reached the same conclusion by means of neural imaging.

It is nevertheless possible that some people are happier in a more unequal society. The reason is likely to be that they perceive an advantage to themselves. Particularly in a rapidly changing economy and society, and one in which there is high mobility of people, higher income inequality can signal that people have opportunities for improving themselves. This is the reasoning by which Senik (2004) explained her finding that comparator group income in transitional Russia raised happiness. It is the same argument that Hirschman (1973), in his analogy of traffic held up in a tunnel, evinced to explain how motorists observing the other lane moving at last, would take this as a signal that their lane would soon move as well. Higher inequality of income could raise hopes of future benefit. Knight *et al*. (2009), in their analysis of happiness in rural China by means of CHIP 2002, found that the Gini coefficient of income inequality at county level raised happiness, and they interpreted this result in the same way. If the reason why happiness is raised by income inequality is that people see a future benefit to themselves, even measures of community-based inequality contain an element of self-centred inequality.

6.2 Hypothesis and hypothesis tests

The hypothesis of inequality-aversion is testable by means of the CHIP 2013 survey. We use not only the 'self-centred' relative income measure analysed in previous sections but also a 'community-centred' measure of inequality. Under the latter approach, equality can be regarded as a 'pure public good' (Thurow, 1971) and inequality as a 'pure public bad'. We investigate the effects on happiness of three measures of income inequality in the community: Gini coefficient, Theil L, and Theil T. They provide measures of the happiness to be gained from this public good or lost from this public bad.

The community-centred approach is usually examined at national level, for instance by including a measure of income inequality as an explanatory variable in the happiness equation in cross-country analysis or analysis over time. However, the CHIP 2013 cross-section survey permits an analysis of the community-centred approach within rural China at the village, county, and province levels. For urban China the same tests can be conducted at the city and province levels. It is possible that the comparative and the

normative reference groups are different. For instance, the comparative reference group might be narrow, reflecting local social interaction, whereas the normative reference group might be broad, reflecting the type of society that people would prefer to live in.

6.3. Analysis

The test variables used in the rural and urban equations of Tables 8 and 9, are as for equation (1) above, being $PI_{jk}\gamma + AI_k\delta$, where the self-centred variables are perceived relative income and the community-centred variables are summary measures of actual income inequality.

We initially estimated the Gini coefficient of income inequality as our measure of community-centred inequality. The Gini coefficient was in each case positive in the happiness equation but never significantly so. We therefore decided to experiment with measures of income inequality which give less weight to the centre of the distribution and more weight to its tails. Our experiment was with the Theil index of inequality, in two forms: Theil L (which places more weight at the bottom of the distribution) and Theil T (which places more weight at the top).

Table 8 reports results for the rural sample. When Theil L [also known as general entropy index GE (0) or the mean log deviation] measured at the village level is added to the baseline equation, its coefficient is positive and significant (column 1). The same is true of the village Theil T [or general entropy index (GE (1)] (column 2). It is relevant that, when the county values of Theil L and Theil T are included instead (columns. 3 and 4), the coefficients are larger and remain significant. The coefficients of Theil L and Theil T measured at province level (columns 5 and 6) have still larger coefficients but they lose some significance. In the case of Theil T, the coefficients at village, county and province level are 0.270***, 0.537*** and 0.740 respectively. Columns 6 and 7 combine the self-centred village relative income dummy variables with the community-based Theil variables. The perceived relative income coefficients are as powerful and significant as ever, but the Theil coefficients are now not at all significant.

We conclude from Table 9 that the Theil measures of community income inequality have positive and significant coefficients. The similarity of the Theil L and Theil T results indicates sensitivity to both tails of the distribution. The fact that the coefficients are positive also in broader areas suggests that people view inequality within the community

as a signal of future self-advancement rather than as a local public bad. The fact that the coefficients are larger at the county than at the village level suggests that people look beyond the village to assess their prospects for future progress. The finding that the relative village income variables dwarf the measures of village inequality suggests that income inequality as a basis for comparison of oneself with others is more important for happiness than income inequality as a basis for assessing prospects for self-improvement.

Table 10 reports the results of equivalent experiments for urban China. Columns 1 and 2 add measures of inequality at the city level, Theil L and Theil T respectively, to the baseline equation. Both have negative coefficients, but neither is significantly different from zero. When city relative income dummy variables are added to the specifications in columns 6 and 7, the Theil coefficients are barely changed and remain insignificant. However, the city relative income dummy variables – our measure of self-centred inequality – have powerful and significant effects on happiness, as in previous tables. The introduction of province-level measures (columns 3 and 4) produces large positive coefficients that are not significant (0.813) in the case of Theil L but significant (0.692**) in the case of Theil T.

In summary of Table 10, there is a weak indication that community-based inequality at the city level might generate feelings of relative deprivation, whereas the positive coefficients at the province-level suggest that inequality, when perceived over a broader area, serves as a signal of personal advancement. The Theil index of income inequality, if its effects do not arise by chance, probably reflects self-interested signals.

How important is community-based inequality measured against self-centred inequality? It is difficult to attach meaning to changes in the value of the Theil index other than to know that a rise in the index indicates a rise in inequality. However, Table 8 reveals that an increase in happiness on account of a move from the category at average village income to above (but not much above) average village income would be equivalent to an increase in the Theil index of village income inequality by several standard deviations. Table 9 shows that the corresponding rise in relative income in cities would require a fall of multiple standard deviations in the Theil index for cities in order to keep happiness

constant.[13] Happiness is much more sensitive to plausible variation in self-centred inequality than to plausible variation in community-based inequality.

7. Conclusions and Reflections

This paper has combined two topics of growing interest. One is inequality of income, which has risen in recent years in both the West and China. The other is happiness, or subjective well-being, which has increasingly claimed the attention of economists. Both are important for well-being in society, and that is no less true of their intersection. Our method was to estimate happiness functions using a rich national survey data set for China in 2013.

Because, unusually, there is information on perceived as well as actual inequality, on inequality at different levels of aggregation, and on the perceived fairness and unfairness of the income distribution, the data have made possible the analysis of four under-explored research questions. Each of the questions has policy implications. It is the common data set and the policy relevance of the research that integrate the paper under the umbrella: which inequalities matter in China?

Our data set has the limitations of other cross-section studies of happiness, in that valid instruments are difficult to find, particularly if the potentially endogenous variable is income inequality. Nevertheless, by cardinalising the relative income dummy variables and generating heteroskedasticity-based instruments, we provided some evidence supportive of a causal effect of relative income on happiness. Where we established no more than interesting statistical associations, the interpretations and conclusions are qualified accordingly.

It is well established in the happiness literature, in China and in general, that comparator, or reference, income reduces happiness. Who, then, comprise the reference group? The answer is likely to differ according to the information set available and the extent of social interaction. Our respondents reported that their comparator groups are narrow, being within the village in rural China and within the city in urban China. Moreover, estimation

[13] To illustrate the rural case: 0.2044 / (0.2700 x 0.14) = 5.4; and the urban case: 0.2046/ (-0.0967 x 0.11) = -19.3.

of alternative happiness functions indicated that the strongest negative effect on happiness was indeed with people within the village or within the city.

Our measure of relative income in this case was the respondent's perceived income position in the village or in the city. We constructed an equivalent measure based on reported actual income. A comparison of the two suggested that the perceived measure had a more powerful effect on happiness. This is understandable because both happiness and relative income perceptions are matters of the mind.

Economists normally measure income inequality with only superficial regard to its ethical character. Yet there is evidence that people distinguish between fair and unfair inequality. It is difficult to separate fairly and unfairly acquired income, but it is possible to measure respondents' reports of the degree of fairness in the income distribution that they encounter or observe. In the urban case we were able to examine whether the negative effect of having lower relative income on happiness varied according to the degree of fairness. A high degree of perceived fairness appears to ameliorate the negative effect of relatively low income on happiness, particularly in the case of the poorest.

We examined which of self-centred or community-based income inequality has a greater effect on happiness. The former was found to be more powerful in both rural and urban areas. Moreover, in rural China, the former was consistent with feelings of relative deprivation and the latter with signals of personal advancement, whereas in urban China the latter depended on the size of reference area.

Consider the implications of our results for research. Perceived income inequality might differ from actual income inequality and might have a greater effect on subjective well-being. That raises the question why the two might differ and whether perceived income inequality is biased. It is important to identify reference groups as well as to measure income inequality according to reference groups. The effect of income inequality on subjective well-being is likely to depend on the degree of fairness with which inequality is perceived; our results are suggestive but better data sets are needed. Income inequality relative to one's own income and independent of one's own income involve different hypotheses and can have very different effects on subjective well-being. The questions posed in this paper could be answered more reliably with time series data.

If happiness depends on relative income, there is an incentive for households with low relative income in their locality to move to a locality in which they would have higher relative income, i.e. to a poorer place. However, this does not appear to be the pattern in China. The main form of movement is rural-urban migration., motivated by the incentive to raise absolute income. However, Knight and Gunatilaka (2010) have argued that such migration may reduce happiness, partly because the migrants, unable fully to anticipate their life in the city, find that their relative income falls as their reference groups change. In the context of migration, change in reference group is a promising research topic.

Consider the policy implications of our results. First, policymakers should recognise that the effects of inequality on subjective well-being may depend on reference groups that are narrower than those which are normally implicitly assumed. Second, policy concern about inequality should be greater the more do people, and particularly the poor, feel that inequality is due to unfairness. Information on people's perceptions of unfairness in society and its relationship to inequality is important for policymaking. Third, using the community-based approach, we found that greater income inequality raises the happiness of the average respondent. This rise is likely to be based on expectations of self-advancement in the future. Although the anticipation of higher future income has a positive and causal effect on current happiness (Knight and Gunatilaka, 2019), it might be thought that this happiness is akin to the pleasure of holding a lottery ticket. Using the self-centred approach, the happiness of those with above-average income is likely to be raised by higher inequality and that of those with below-average income to be lowered. The evidence requires that normative judgements be made.

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Table 1: Comparison of the effect of perceived relative income and actual relative income on happiness, rural China 2013

	(1) mean	(2)	(3)	(4)	(5)
Control variables					
Age (years)	50.59	-0.0157***	-0.0157***	-0.0175***	-0.0162***
	(12.55)	(0.0047)	(0.0045)	(0.0047)	(0.0045)
Age squared	2716.32	0.0002***	0.0002***	0.0002***	0.0002***
	(1282.69)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Male (sex)	0.67	-0.0767***	-0.0666***	-0.0772***	-0.0668***
	(0.47)	(0.0207)	(0.0197)	(0.0207)	(0.0197)
Married	0.90	0.3407***	0.2216***	0.3490***	0.2252***
	(0.30)	(0.0566)	(0.0539)	(0.0566)	(0.0539)
Divorced	0.01	-0.3271***	-0.2744***	-0.3317***	-0.2770***
	(0.11)	(0.0979)	(0.0929)	(0.0978)	(0.0929)
Widowed	0.05	0.1121	0.0886	0.1192*	0.0916
	(0.22)	(0.0718)	(0.0681)	(0.0717)	(0.0681)
Ethnic minority dummy	0.08	-0.0684*	-0.0706**	-0.0722**	-0.0717**
	(0.27)	(0.0353)	(0.0335)	(0.0352)	(0.0335)
Education (years)	7.15	0.0247***	0.0181***	0.0242***	0.0179***
	(2.80)	(0.0037)	(0.0035)	(0.0037)	(0.0035)
In good health	0.69	0.3043***	0.2402***	0.2989***	0.2391***
	(0.46)	(0.0215)	(0.0205)	(0.0215)	(0.0205)
Log of per capita household income 2002 (Yuan)	9.14	0.0992***	0.0619***	0.0685***	0.0528***
	(0.88)	(0.0113)	(0.0108)	(0.0130)	(0.0123)
Net wealth ('000 Yuan)	9.19	0.0195***	0.0138***	0.0206***	0.0142***
	(2.68)	(0.0037)	(0.0035)	(0.0037)	(0.0035)
Working hours ('00 per year)	17.37	0.0004	0.0003	0.0004	0.0003
	(35.44)	(0.0003)	(0.0003)	(0.0003)	(0.0003)

	(1) mean	(2)	(3)	(4)	(5)
Test variables					
Perceptions of relative income variables					
Household income above village average	0.01		0.7626***		0.7548***
	(0.09)		(0.0932)		(0.0933)
Household income below village average	0.25		-0.5702***		-0.5666***
	(0.44)		(0.0209)		(0.0211)
Actual relative income variables					
Above actual average income in village	0.28			0.0908***	0.0451**
	(0.45)			(0.0238)	(0.0227)
Below actual average income in village	0.31			-0.0487**	0.0011
	(0.46)			(0.0234)	(0.0223)
Constant		1.0527***	1.7991***	1.3545***	1.8758***
		(0.1415)	(0.1367)	(0.1563)	(0.1496)
Adjusted R-squared		0.0798	0.1723	0.0826	0.1725
Number of observations		7393	7393	7393	7393

Source: In this table and in all subsequent tables (except Table 7) the data source is CHIP 2013. Notes: In this table, and in all subsequent tables that report estimated equations, the dependent variable is the happiness score, ranging from 0 (not at all happy) to 4 (very happy). The mean happiness score in this table is 2.58, standard deviation 0.83, The columns report coefficients; standard deviations in parentheses below the means; standard errors in parenthesis below the coefficients. The omitted categories in the dummy variable analyses are: marital status of the household head is single; perceived household income is at the level of average village income; actual household income is at the village average. In this and all subsequent tables, and also in the text, ***, **, and * denote statistical significance at the one per cent, five per cent and ten per cent levels respectively.

Table 2: Comparison of the effect of perceived relative income and actual relative income on happiness, urban China 2013

	(1) mean	(2)	(3)	(4)	(5)
Control variables					
Age (years)	40.98	-0.0184***	-0.0161**	-0.0177***	-0.0159**
	(10.97)	(0.0068)	(0.0065)	(0.0068)	(0.0065)
Age squared	1799.44	0.0002***	0.0002***	0.0002***	0.0002***
	(928.55)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Male (sex)	0.55	-0.0289	-0.0227	-0.0291	-0.0230
	(0.50)	(0.0202)	(0.0193)	(0.0201)	(0.0193)
Married	0.83	0.2585***	0.2189***	0.2666***	0.2233***
	(0.37)	(0.0390)	(0.0374)	(0.0389)	(0.0374)
Divorced	0.03	-0.1883***	-0.1589**	-0.1875***	-0.1590**
	(0.17)	(0.0695)	(0.0666)	(0.0693)	(0.0666)
Widowed	0.01	-0.0869	-0.0357	-0.0726	-0.0305
	(0.11)	(0.1008)	(0.0966)	(0.1005)	(0.0965)
Ethnic minority dummy	0.05	-0.0346	-0.0636	-0.0352	-0.0633
	(0.21)	(0.0465)	(0.0446)	(0.0464)	(0.0445)
Education (years)	11.28	0.0149***	0.0127***	0.0163***	0.0133***
	(3.43)	(0.0034)	(0.0033)	(0.0034)	(0.0033)
In good health	0.80	0.3482***	0.2828***	0.3421***	0.2814***
	(0.40)	(0.0259)	(0.0249)	(0.0258)	(0.0249)
Log of per capita household income 2002 (Yuan)	10.00	0.1831***	0.1188***	0.1099***	0.0883***
	(0.67)	(0.0172)	(0.0167)	(0.0205)	(0.0197)
Net wealth ('000 Yuan)	10.37	0.0236***	0.0077	0.0251***	0.0087
	(1.85)	(0.0058)	(0.0056)	(0.0058)	(0.0056)
Working hours ('00 per year)	23.33	-0.0035**	-0.0034**	-0.0034**	-0.0033**
	(7.08)	(0.0014)	(0.0014)	(0.0014)	(0.0014)

	(1) mean	(2)	(3)	(4)	(5)
Test variables					
Perceptions of relative income variables					
Income above city/town average	0.16		0.2277***		0.2227***
	(0.37)		(0.0270)		(0.0271)
Income below city/town average	0.31		-0.4168***		-0.4078***
	(0.46)		(0.0220)		(0.0222)
Actual relative income variables					
Income above actual average income in city/town	0.17			0.0882***	0.0335
	(0.38)			(0.0292)	(0.0282)
Income below actual average income in city/town	0.30			-0.1379***	-0.0636***
	(0.46)			(0.0250)	(0.0242)
Constant		0.3851**	1.3591***	1.0971***	1.6507***
		(0.1925)	(0.1891)	(0.2205)	(0.2132)
Adjusted R-squared		0.0972	0.1721	0.1033	0.1731
Number of observations		5999	5999	5999	5999

Notes: The mean happiness score is 2.69, standard deviation 0.80. The columns report coefficients; standard deviations in parentheses below the means; standard errors in parenthesis below the coefficients. The omitted categories in the dummy variable analyses are: marital status of the household head is single; perceived household income is at the level of average city income; actual household income is at the city average.

Table 3: Proportions reporting which reference group is the main one, rural and urban China 2013

	Rural	Urban
Relatives and friends	15.8	35.1
Others in community or village (rural)/street (urban)	67.9	34.7
People in the district (urban)/county (rural)	3.9	13.5
People in urban areas	2.6	9.6
People in rural areas	9.5	4.8
People in the country	0.4	2.2
Total (%)	100.0	100.0
Total (Number)	6949	5155

Notes: The total number is of positive responses. A total of 5.99% of all rural respondents found it hard to say which was their main reference group. The equivalent proportion in urban areas was 1.85%.

Table 4: Comparison of the effects of different reference groups on happiness, rural China 2013

	(1) mean	(2)	(3)	(4)
Perceptions of relative income variables at village level				
Household income much above village average	0.01	0.8432***		0.7056***
	(0.09)	(0.0922)		(0.0993)
Household income above village average	0.17	0.2712***		0.2362***
	(0.38)	(0.0241)		(0.0269)
Household income much below village average	0.21	-0.4425***		-0.4198***
	(0.41)	(0.0227)		(0.0253)
Much below average income in village	0.05	-0.8500***		-0.8476***
	(0.22)	(0.0419)		(0.0467)
Perceptions of relative income variables at county level				
Village income much above average income in county	0.01		0.6260***	0.3445***
	(0.09)		(0.1007)	(0.1037)
Village income above average income in county	0.16		0.2055***	0.0736***
	(0.36)		(0.0259)	(0.0276)
Village income below average income in county	0.22		-0.2449***	-0.0479**
	(0.41)		(0.0230)	(0.0244)
Village income much below average income in county	0.05		-0.4227***	0.0136
	(0.22)		(0.0440)	(0.0471)
Constant		1.9372***	1.4513***	1.9564***
		(0.1351)	(0.1400)	(0.1352)
Adjusted R-squared		0.1948	0.1211	0.1970
Number of observations		7393	7393	7393

Notes: The columns report coefficients; standard deviations in parentheses below the means; standard errors in parentheses below the coefficients. The same control variables are included in the specification, but their coefficients are not shown because they are not notably different from those reported in Table 1.

Table 5: Comparison of the effects of different reference groups on happiness, urban China 2013

	(1) Mean	(2)	(3)	(4)
Log of per capita household income 2002 (Yuan)	9.94 (0.66)	0.2743*** (0.0328)	0.1951*** (0.0266)	0.2743*** (0.0329)
Log of average income in city/town	10.06 (0.45)	-0.2158*** (0.0465)		-0.2102*** (0.0487)
Log of average income in province	10.14 (0.20)		-0.1529 (0.1614)	-0.0300 (0.1105)
Constant		1.5703*** (0.4084)	1.8011 (1.7098)	1.8171* (1.0297)
Adjusted R-squared		0.1046	0.0983	0.1045
Number of observations		5999	5999	5999

Notes: The columns report coefficients; standard deviations in parentheses below the means; standard errors in parenthesis below the coefficients. City- and provincial-level clustered standard errors are reported where appropriate. The same control variables are included in the specification, but their coefficients are not shown because they are not notably different from those reported in Table 2.

Table 6. The effects on happiness of cardinalised perceived relative income based on five values, rural and urban China 2013, OLS and IV

	Rural		Urban	
	OLS	IV	OLS	IV
Coefficient on cardinal village/city relative income	0.380***	0.628***	0.299***	0.394***
	(0.018)	(0.088)	(0.023)	(0.119)
Heteroskedasticity test, p-value		0.000		0.000
Underidentification test, p-value		0.000		0.013
Weak identification test, F-value		13.06		6.410
Overidentification test, p-value		0.063		0.420

Notes: We cardinalise village relative income to obtain an instrumental variable. It is: much below average village income = 1, below = 2, at = 3, above = 4, and much above = 5. The instrumental variables are heteroskedasticity-based. No external instruments are added to the internal instruments; all explanatory variables (except the constant term) are included in the instrumenting. The estimates are made using the *ivreg2h* programme. We use the Breusch-Pagan test of heteroskedasticity, the Kleibergen-Paap underidentification test, the Cragg-Donald-Wald test of weak instruments, and the Hansen J overidentification test. Cluster-robust standard errors are estimated. The figures in parentheses beneath the coefficients are standard errors.

Table 7: The effect on happiness of interaction between perceived city income quarter and reported fairness category: combined fairness, national fairness, and city fairness, urban China 2002

	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Panel 1: combined fairness				
Fairness 1	0.0000	0.0000	0.0000	0.0000
Fairness 2	0.0000	0.3828	0.4487	0.3401
		(0.2820)	(0.2617)	(0.2889)
Fairness 3	0.0000	0.2394	0.3904	0.6424*
		(0.3591)	(0.3584)	(0.3845)
Panel 2: national fairness				
Fairness 1	0.0000	0.0000	0.0000	0.0000
Fairness 2	0.0000	0.1194	0.2002	0.1183
		(0.2946)	(0.2931)	(0.2999)
Fairness 3	0.0000	0.4442	0.6052*	0.9487**
		(0.3574)	(0.3565)	(0.3816)
Panel 3: city fairness				
Fairness 1	0.0000	0.0000	0.0000	0.0000
Fairness 2	0.0000	0.3908	0.4503	0.2947
		(0.2868)	(0.2852)	(0.2917)
Fairness 3	0.0000	0.2277	0.4040	0.6769*
		(0.3389)	(0.3380)	(0.3629)
	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Panel 4: combined fairness with and without interaction terms				
Income quarter coefficients:				
Equation without interaction terms	0.0000	-0.3182***	-0.6107***	-1.1744***
		(0.1160)	(0.1160)	(0.1211)
Equation with interaction terms	0.0000	-0.5896**	-0.9371***	-1.4712***
		(0.2390)	(0.2381)	(0.2413)
		Fairness 1	Fairness 2	Fairness 3
Fairness coefficients:				
Equation without interaction terms		0.0000	0.1819***	0.4349***
			(0.0219)	(0.0352)
Equation with interaction terms		0.0000	-0.2364	0.0980
			(0.2802)	(0.3550)

Source: CHIP 2002. Notes: The perceived city income categories are top quarter (Q1), 2nd quarter, 3rd quarter, and bottom quarter (Q4). In the combined fairness equation, scores of 0-1 are fairness 1, of 2-3 are fairness 2,

and of 4-6 are fairness 3. In the national fairness and city fairness equations, scores of 0 (not at all fair) are fairness 1, of 1(unfair) are fairness 2, and of 2-3 (fair or very fair) are fairness 3. There are only a few cases of very fair. The same control variables as in Table 2 are included in the specification but not reported. The figures in parentheses below the coefficients are standard errors.

Table 8: Comparison of the effects of different measures of income inequality on happiness, rural China 2013

	Means	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Economic variables									
Log of per capita household income 2002 (Yuan)	9.12	0.1196***	0.1115***	0.1100***	0.1019***	0.1028***	0.0996***	0.0509***	0.0512***
	(0.89)	(0.0154)	(0.0144)	(0.0157)	(0.0181)	(0.0178)	(0.0179)	(0.0142)	(0.0131)
Log of net wealth ('000 Yuan)	9.15	0.0211***	0.0199***	0.0236***	0.0200***	0.0228***	0.0207***	0.0117***	0.0116**
	(2.72)	(0.0051)	(0.0051)	(0.0053)	(0.0050)	(0.0040)	(0.0039)	(0.0045)	(0.0045)
Working hours ('00 per year)	17.50	0.0005	0.0005	0.0005	0.0005	0.0004	0.0004	0.0003	0.0003
	(35.93)	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0005)	(0.0005)	(0.0003)	(0.0003)
Inequality variables									
Village GE (0) measure	0.16	0.1564***						0.0289	
	(0.29)	(0.0411)						(0.0366)	
Village GE (1) measure	0.14		0.2700***						0.0883
	(0.14)		(0.0962)						(0.0861)
County GE (0) measure	0.21			0.3580***					
	(0.16)			(0.1192)					
County GE (1) measure	0.18				0.5268***				
	(0.09)				(0.1732)				
Province GE (0) measure	0.25					0.8393**			
	(0.07)					(0.2859)			
Province GE (1) measure	0.24						0.7395		
	(0.05)						(0.5070)		
Perceived relative village income variables									

	Means	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Household income much above village average	0.01							0.8404***	0.8381***
	(0.09)							(0.0813)	(0.0812)
Household income above village average	0.17							0.2702***	0.2696***
	(0.38)							(0.0268)	(0.0269)
Household income much below village average	0.21							-0.4413***	-0.4413***
	(0.41)							(0.0282)	(0.0281)
Much below average income in village	0.05							-0.8476***	-0.8472***
	(0.22)							(0.0844)	(0.0842)
Constant		0.8667***	0.9301***	0.8578***	0.9397***	0.7683***	0.8654***	1.9001***	1.8937***
		(0.1781)	(0.1723)	(0.1838)	(0.1925)	(0.1394)	(0.1495)	(0.1763)	(0.1696)
Adjusted R squared		0.0820	0.0816	0.0838	0.0828	0.0841	0.0813	0.1948	0.1949
Number of observations		7393	7393	7393	7393	7393	7393	7393	7393

Notes: The columns report coefficients; standard deviations in parentheses below the means; standard errors in parentheses below the coefficients. Standard errors are clustered at village, county and province level as appropriate. The same control variables are included in the specification, but their coefficients are not shown because they are not notably different from those reported in Table 1.

Table 9: Comparison of the effects of different measures of income inequality on happiness, urban China 2013

	Means	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Economic variables								
Log of per capita household income 2002 (Yuan)	9.98	0.2092***	0.2078***	0.2083***	0.2177***	0.2176***	0.1179***	0.1184***
	(0.67)	(0.0263)	(0.0265)	(0.0264)	(0.0319)	(0.0299)	(0.0255)	(0.0254)
Working hours ('00 per year)	23.31	-0.0037**	-0.0037**	-0.0037**	-0.0041**	-0.0041**	-0.0035**	-0.0035**
	(7.04)	(0.0019)	(0.0019)	(0.0019)	(0.0016)	(0.0016)	(0.0018)	(0.0018)
Inequality variables								
City GE (0) measure	0.12		-0.0967				-0.0881	
	(0.10)		(0.1451)				(0.1399)	
City GE (1) measure	0.12			-0.0795				-0.0701
	(0.11)			(0.1274)				(0.1254)
Province GE (0) measure	0.19				0.8133			
	(0.05)				(0.6803)			
Province GE (1) measure	0.20					0.6916**		
	(0.07)					(0.2991)		
Perception of relative city income variables								
Household income much above city/town average	0.01						0.4567***	0.4542***
	(0.11)						(0.0784)	(0.0784)
Household income above city/town average	0.15						0.2046***	0.2044***
	(0.36)						(0.0420)	(0.0419)
Household income below city/town average	0.25						-0.3771***	-0.3771***
	(0.43)						(0.0392)	(0.0392)
Much below average income in city/town average	0.05						-0.6586***	-0.6596***

	Means	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	(0.22)						(0.0746)	(0.0743)
Constant		0.3904	0.4166	0.4097	0.1449	0.1721	1.4543***	1.4472***
		(0.2907)	(0.2945)	(0.2930)	(0.3686)	(0.3250)	(0.2966)	(0.2944)
Adjusted R squared		0.0963	0.0963	0.0963	0.0987	0.1001	0.1789	0.1789
Number of observations		6330	6330	6330	6330	6330	6330	6330

Notes: The columns report coefficients; standard deviations in parentheses below the means; standard errors in parentheses below the coefficients. Standard errors are clustered at city and province level as appropriate. The same control variables were included in the specification but are not reported because the coefficients are not notably different from those of Table 2.