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Memory and Anticipation: New Empirical Support for an Old Theory of the Utility Function

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Abstract. The paper contrasts early theories of the utility function (starting with Bentham and elaborated by Jevons) with the modern theory (laid down by Fisher and Samuelson). The former include in the utility function not only the sensation of current events but also the memory of past events and the anticipation of future events. The alternative hypotheses are tested by introducing both past and expected future income into the estimated subjective well-being function, using an appropriate data set for China. The tests favour the early theories. Implications are drawn.

Key Words. Anticipation; China; Discounted utility; Memory; Subjective well-being; Utility function

JEL Classification. B13, B21, D60

1. Introduction

Drawing on Irving Fisher (1930), Paul Samuelson (1937) in five pages modelled a theory of the utility function so elegant and illuminating for economic analysis that it is widely accepted, and indeed has become a standard tool in the professional economist's toolkit. At its heart is the assumption that current utility is a function of current consumption and neither of past nor of future consumption. By contrast, William Stanley Jevons (1879) and his son Herbert Stanley Jevons (1905) argued that current utility is dependent not only on the present but also on memory of the past and anticipation of the future.

In this paper we provide evidence – taken from household surveys which include information on subjective well-being – that is inconsistent with the conventional view of the utility function and consistent with the older and broader view that the utility function contains both memory of the past and anticipation of the future.

Section 2 briefly summarises the conventional approach, its limitations and implications. Section 3 outlines the alternative approach and provides some support from both the economic and the non-economic literature. By means of an appropriate data set for China, described in Section 4, tests of the alternative hypotheses are provided in Section 5. Section 6 summarises, draws out implications, and concludes.

1. The conventional theory

The 'discounted utility' theory proposed by Samuelson (1937) has, despite his own reservations, been generally accepted both as a normative standard and as an accurate description of behaviour. Underlying it is the assumption that all considerations relevant to intertemporal choice can be reduced to a single parameter, the discount rate. Moreover, the intertemporal utility function has the form:

$$U(c_t,\ldots..c_z) = U(c_t)\,[1/(1+\rho)]^t + U(c_{t+1})\,[1/(1+\rho)]^{t+1}\ldots + U(c_{t+z})\,[1/(1+\rho)]^{t+z} \qquad (1)$$

when valued at time 0, where U is utility, c is consumption, t is time (0,1,…t…z), and ρ is the rate of time discount. Accordingly, utility at time t, when valued at time t, is simply $U(c_t)$, and is independent of consumption at any other time.

According to the permanent income hypothesis of consumption, c_t is in turn determined by $c_t = c_t(y_t, y_{t+1},\ldots y_z)$, that is:

$$c_t = \alpha\,(y_t + y_{t+1}\,[1/(1+\rho)] + y_{t+2}\,[1/(1+\rho)]^2 \ldots + y_{z-t}\,[1/(1+\rho)]^{z-t} \qquad (2)$$

where y is income and the series $y_{t+1}, y_{t+2},, \ldots y_z$ is expected income. Thus, current utility U_t depends on anticipated future utility only through its effect on current consumption c_t.

The discounted utility model has been subject to both empirical and theoretical criticism, thoroughly surveyed in Frederick et al. (2002). Among the anomalies that empirical research has uncovered is evidence that: the discount rate declines rather than remains constant; gains in outcomes are discounted more than losses; small amounts are discounted more than large amounts; delays in outcomes are discounted more than their expedition; and improving sequences of outcomes are preferred to worsening sequences.

In the light of such anomalies, several alternative models have been suggested, including: hyperbolic discounting; self-awareness that tastes will change, giving rise to commitment devices; and modifications of the instantaneous utility function. These modifications include models that incorporate habit formation, urgent wants, reference points, and anticipated utility. Our data set enables us to examine the reference point and anticipated utility models.

3. Incorporating memory and anticipation

The idea that memory and anticipation enter current utility goes back to the founder of utilitarianism (Bentham, 1789). Since then it has occasionally cropped up in the writings of economists old and new, but it has little or no impact on the thinking of most economists today. The view that memory and anticipation of the future enter

current utility was expressed by W. S. Jevons (1989) and H. S. Jevons (1905). Indeed, it was held by other prominent economists of their time (for instance, Marshall, 1920: 120) but Jevons (father and son) had most to say about it.

In their view, the effect of anticipation on current utility (their 'anticipal utility') depends (positively) on the emotional intensity of the event (the level of utility that will be derived directly in the future), (negatively) on the length of time before it occurs, and (positively) on the likelihood of its occurring. Similarly the effect of memory on current utility depends (positively) on the emotional intensity of the past event felt at that time and (negatively) on the length of time since it occurred (H. S. Jevons, 1905: 32, 63, 69, 82). Thus, in contrast to the conventional view of modern economists, not only does the sensation of current events enter into the current utility function, but also the memory of past events and the anticipation of future events. The former enters directly and the latter enter indirectly. Thus:

$$U_t = U_t\,(c_{t-x},\ldots\, c_{t-1},\, c_t,\, c_{t+1},\, \ldots\, c_{t+z}) \qquad (3)$$

where U is utility, c is consumption, t is current period, and periods range from t-x to t+z. Insofar as there is discounting of the past, the discount rate depends on the distance in time of the event being remembered. Insofar as there is discounting of the anticipated future, the discount rate depends on both the distance in time of the event being anticipated and the probability of its occurrence. Thus, consumption at another time raises utility at the present time but its effect is weakened as the time becomes more distant from the present: $\delta U_\tau / \delta c_\tau > 0$ where $|\,\tau\,| > 0$ and $\delta^2 U_\tau / \delta c_\tau^2 < 0$ where $|\,\tau\,| > 0$ and where τ indicates the number of periods distant from t. By contrast, in equation (2), U_t depends only on c_t, and, according to the permanent income hypothesis, $c_t = c_t\,(y_t, y_{t+1}, y_{t+2},,.. , y_{t+z})$.

It is helpful to think of cases in which memory and anticipation are likely to be important. One might look forward with pleasure to a future event, such as a holiday, the purchase of a new car, a job promotion, or the birth of a baby. However, the news that the event will not occur will immediately end the pleasure and might instead cause pain. The anticipation of a future unpleasant event, such as a disliked task, a job loss or

a surgical operation, causes current pain. Memory of a past event, whether as trivial as an outstanding meal, as memorable as a holiday, or as serious as the death of a family member, affects current utility. Memories or anticipations of different types of consumption are liable to have different effects on current utility depending on how vividly and enjoyably they can be remembered or imagined. Memory of the past can include past aggregate consumption (which we shall proxy by income) and anticipation of the future can include expected future aggregate consumption (again, proxied by income).

Loewenstein (1987) gave analytical rigour to the anticipated utility model. He used the term *savouring* if the anticipated utility from a future event is positive and *dread* if it is negative. He assumed anticipated utility to be proportional to the utility of consumption discounted at a rate of σ. σ is not the time discount rate (ρ) but a measure of the degree to which immediate utility is derived from anticipated consumption. The savouring of future consumption biases downwards conventional estimates of the rate of time discount ($\sigma < \rho$). Desired consumption is delayed when the net present value of the consumption, taking account of both savouring and consumption itself, increases as a function of time delay. The condition for delay is thus that the marginal benefit of savouring exceeds the marginal cost that is due to the increased discounting of consumption; the optimal delay time is when the marginal benefit equals the marginal cost. Similarly, there can be an incentive to advance an undesirable event rather than suffer more dread.

Reference point theory can be traced back at least as far as Runciman (1966)[2], who argued that people's welfare is much influenced by their reference group or reference time. Thus, people feel relative deprivation if their income falls short of their reference income, which might be determined either by the income of the people with whom they compare themselves or by their own income at some other time. Welfare can be determined by changes in income relative to the reference time and not merely by current income level. Thus, it is possible that two identical people with the same current

[2] And indeed back to Adam Smith and Karl Marx.

income report different current subjective well-being if at some past reference time their incomes were different: the person whose income has risen is happier than the person whose income has fallen. If aspirations for income are determined by the income of the reference group, subjective well-being is determined by actual income in relation to the income of the reference group. Two identical people with the same income may report different subjective well-being if they live in communities with different income levels: the person who lives in a poor community is happier than the person who lives in a rich community.

Drawing on psychological research, Rabin (1998) argues that people are not good at predicting how their aspirations will change, or at recalling how their aspirations have changed. Current predictions of future aspirations and current memory of past aspirations tend to be locked into the present. Thus, it is possible that a person comparing their current income with their past income will judge past income by their aspirations for income today. The implication is that if both income and aspirations have risen, their current happiness is raised despite the past rise in their aspirations.

Similarly, it is possible that a person expecting income to rise in future will judge it by their aspirations for income today: their current happiness is accordingly raised by that expectation. However, if it turns out that not only own income but also community income, and thus their aspirations, will rise in the future, their happiness will not rise over time. Easterlin (1974) used the same reasoning to explain what has come to be known as the Easterlin Paradox – the constancy of happiness scores despite the rise in income per capita over time. Subjective well-being is a positive function of own income and a negative function of aspirations for income: aspirations for income depend on income in society, and aspirations rise as income in society rises.

Elster and Loewenstein (1992) extended the analysis of anticipation made in Loewenstein (1987) to include memory as well as anticipation. They distinguished two effects: a *consumption* effect and a *contrast* effect. Higher utility in the past or expected in the future has a positive consumption effect on current utility. However, it has a

negative contrast effect on current utility. For instance, memory of higher income in the past can raise current utility through the former and lower it through the latter. This fall in utility results from the perception of relative deprivation, the frame of reference being oneself in the past. The same past or future can have a different effect on current utility via the contrast effect depending on one's current situation. For instance, a given anticipated future income can raise or lower current utility depending on whether the anticipated change in income is expected to be a rise or a fall.

Whether the consumption effect or the contrast effect dominates depends on their relative strengths in the current utility function. Elster and Loewenstein (1992) made the behavioural assumptions that, in the case of memory, the (negative) contrast effect dominates; whereas in the case of anticipation, the (positive) consumption effect does so. Thus, a rise in past income has a net positive (contrast) effect on current utility, and a rise in anticipated future income a net positive (consumption) effect. Whether there are consumption and contrast effects at all, and whether these assumptions about dominance hold, are testable hypotheses. We test them in Section 5.

4. The survey, variables and background

Our data come from a national household survey of the China Household Income Project (CHIP) comprising a team of Chinese and foreign scholars. The survey relates mainly to the year 2002. It was conducted by the National Bureau of Statistics (NBS) and was based on a representative sub-sample of the annual official household survey. The questionnaires were designed by the team with research hypotheses in mind, and thus contained many more questions than did the official survey. There were separate sub-samples and questionnaires for rural and urban residents, and for rural-urban migrants. All three sub-samples contained a question on subjective well-being but we shall concentrate here on the rural survey, for which we designed a special questionnaire module in order to investigate subjective well-being in more detail. We are thus able to combine the information on subjective well-being with a wealth of socioeconomic data on rural communities, households and individual members.

The rural survey covers 22 of China's 31 provinces and is intended to be nationally representative. Within each province on average 5.5 counties were sampled, and within each county on average 7.9 villages; selection was on the basis of income per capita ranking with a random starting point. Within each village normally 10 households were randomly sampled. The rural sample thus contains 9,500 households.

In each household one member – normally the household head – was asked a set of attitudinal questions, including some about subjective well-being. A novelty of this data set is that, although a cross section, it asked questions about income in the past and expected income in the future. Although surveys containing information on reported happiness are becoming more common, it is rare for them to include information on recalled past and expected future income, as this survey does, although panel surveys generally have data on actual past and actual future income.

Three of the survey questions are crucial to our analysis. First, in answer to the question: 'how happy are you nowadays?', respondents were offered five choices: very happy, happy, so-so, not happy, and not at all happy. When treated as a dependent variable, these answers can be converted into a cardinal score (with very happy given a score of 4 and not at all happy given a score of zero) to which linear regression analysis can then be applied. Probit and ordered probit experiments analysing the answers as a latent variable were also conducted, but our estimations produced no notable differences in the three sets of results.[3] We therefore report only the estimates for the happiness score, which can be interpreted more readily.

Respondents were asked to think back five years and to think forward five years. The second key question was: 'how do your current living standards compare with five years ago?'.[4] The permitted answers were that they were: better, the same, or worse. Thirdly, 'how do you expect your income to change over the next five years?', to which

[3] This was also found to be the case in a methodological paper by Ferrer-i-Carbonnel and Frijters (2004).
[4] The term living standards was used in order to avoid possible confusion between real and nominal income.

four answers were possible: that there would be a big increase, a small increase, no change, or a decrease.

The questions on perceived past and expected future income have been included in other analyses of the CHIP 2002 national household survey, but without emphasis or with different emphasis. Two studies have looked backwards. Knight et al. (2009) found for the rural sample that current happiness was sensitive to the perceived change in income over the previous five years. Appleton and Song (2008) found for the urban sample that there were fairly high reported levels of satisfaction with past income growth, and also that satisfaction with income growth had a positive multivariate correlation with overall life satisfaction. They concluded that the previous average rapid growth of incomes was important to current life satisfaction, and so might have provided some protection against social instability.

Studies have been made of the role of expected future income on current happiness: Knight et al. (2009) for rural residents, Knight and Gunatilaka (2010a, 2010b) for rural-urban migrants and urban residents respectively, and Knight and Gunatilaka (2011) and Frijters et al. (2012) for all three sub-samples. Each of the studies found that expected future income had a statistically significant and substantively large positive effect on current happiness. The paper by Frijters et al. (2012) which, unlike the others, concentrated solely on this variable, found that the effect of expectations on happiness was important even after correction for endogeneity. Their objective was to confirm that a reversal of income expectations would cause an immediate fall in happiness levels which, they surmised, could have implications for social instability.

The role of perceived past and expected future income in affecting current subjective well-being has thus been well described. It is an advantage of the CHIP 2002 household survey that this has been made possible. What has not been explored, however, is the theoretical explanation for and implications of the phenomenon. That is the objective of this paper.

5. Empirical tests

Our method is to introduce past and future income change into happiness functions. We proceed in stages, corresponding to our six tables. We start by estimating standard OLS happiness functions with our key explanatory variables included, and show variations in the specification of these variables. As a test of an alternative explanation, income per capita is replaced with consumption per capita. The remainder of the empirical analysis reports various ways of dealing with the possible endogeneity of the key variables.

Table 1 confirms many of the results obtained for the CHIP 2002 survey and for many surveys around the world (columns 1 and 2). The 'conditioning variables' indicate that: the (conditional) effect of years of age on the respondent's happiness score is U-shaped; men are less happy than women; divorce and widowhood reduce happiness; and good health is important for happiness. Conditional years of education have no significant effect. Current mood (introduced to eliminate irrelevant effects) has a positive coefficient. Because their pattern of results is robust to the alternative specifications to come, the conditioning variables, although included in all specifications, are not reported in the subsequent tables.

Turning to the 'economic variables': log of household income per capita raises happiness but the effect is surprisingly small. For instance, in the four equations a doubling of income per capita raises the happiness score within the range from 0.05 to 0.11 units. As expected, household financial assets raise happiness but, unexpectedly, household debts appear not to lower it. The more hours are worked, the lower is happiness. The coefficients of the economic variables are robust to our experimentation, and so these, as well, are included in the specifications but not reported in the subsequent tables unless they deserve comment.

The results so far suggest that happiness can be well-explained. Many of the coefficients are statistically significant, economically substantial, and have plausible explanations. The equations have to be taken seriously. We turn now to the variables

that are relevant to our hypothesis tests. Columns 3 and 4 introduce relative income. As two-thirds of the rural sample said that they compared themselves with others in the village, we introduced people's perception of their income rank in the village.[5] It is statistically significant and large: the conditional happiness score of someone with household income 'much above the village average' exceeds that of someone 'much below the village average' by more than one point on the five-point happiness scale.[6] Relative income appears to have a greater effect than absolute income: perceptions of relative deprivation are important for happiness. It is clear, therefore, that reference income is determined partly by the income of the people with whom the respondent makes comparisons.

The variables representing memory and anticipation are shown in columns 3 and 4 of Table 1. Two-thirds of respondents expected a small increase in income over the next five years; three-fifth reported to have experienced an improvement in living standards over the last five years. The effect of both dummy variables (with 'no change' as the reference category) is monotonic, statistically significant, and substantial. The difference in happiness between the expectation of a large increase in income and a decrease is about 0.3 points, and the difference between current living standards being better and worse than five years ago is also about 0.3 points, whether province dummies are included or not. The additional explanatory variables of columns 3 and 4 add about a third to the explanatory power of the equations. Their addition also somewhat reduces the size (but not significance) of the coefficient on the current income variable. It seems that current happiness depends on perceived income change in the past and in the future.[7] Moreover, the signs of the coefficients imply that the respondent's current happiness is partly determined by perceived income at some past and some future time in relation to current aspirations for income. In the terminology of

[5] As only ten households were randomly sampled in each village, it was not possible to use actual village income rank.
[6] It is possible to distinguish absolute and relative income effects because of the wide variation in mean household income per capita across villages.
[7] We also introduced interaction terms in order to investigate what characteristics (such as educational level or village income rank) were associated with larger or smaller values of the coefficients on past and future income change. However, we were unable to find patterns that would illuminate the causes of the hypothesised relationships.

Elster and Loewenstein (1992), and in line with their expectations, the contrast effect dominates in the case of memory and the consumption effect dominates in the case of anticipation.

Approaching the results of Table 1 within the framework of textbook economic theory, it can be argued that the equation is mis-specified. Given that utility is a function of current consumption and not past or expected future consumption, and that current consumption is a function of expected 'permanent income', then expected future income determines 'permanent income' and is thus a determinant of current consumption. The introduction into the happiness equation of current consumption instead of current income should, on this reasoning, eliminate the effect of expected future income on current happiness.

This hypothesis can be tested. In Table 2 log of real per capita household consumption replaces log of real per capita household income; the specification is otherwise identical to that in Table 1. Almost nothing changes. The coefficients on the consumption variable are again highly significant and are very close to the corresponding income coefficients. The test is whether the coefficients of the expected income variable lose their size and significance. On the contrary, the range in coefficients between expecting a large increase in income and a decrease rises, albeit very slightly, in both cases. There is no support for the argument that the positive coefficient on expected future income simply reflects the positive effect of expected future income on 'permanent income' and hence on current consumption relative to current income. Nor is the influence of past income any lower in Table 2 than in Table1.

Our results for the two key variables are open to the criticism that the coefficients represent associations but not causal relationships. The association can arise if the true causal factors are unobserved characteristics with which the key variables are correlated. First, the causal factors can be personal characteristics. For instance, an optimistic or a dynamic personality might raise both expectations of future income growth and current happiness. In that case the coefficient on expected income in the

happiness equation would be biased upwards. Second, the causal factors can instead or in addition be community characteristics. For instance, living in a cooperative or energetic community might raise individual expectations of income growth and also current happiness. Third, there might be reverse causation: people who are naturally happy might take a rosy view of both their future and their past change in income. Identification strategies are required to test for such endogeneity of the key variables and to correct for any resultant bias in the OLS equations.

We first attempt to eliminate the effect of unobserved individual or household characteristics using as instruments the mean village values of the key variables. There are normally ten (randomly selected) observations per village: we use the mean values of the expected future income change and of the perceived past income change of the other nine respondents. This instrument eliminates the influence of unobserved personal characteristics unless these characteristics are shared among members of the village.

For purposes of instrumenting, the two key variables are cardinalised by giving the expected income variable values from 2 to -1 and the perceived past income variable values from 1 to -1. The coefficients on the dummy variables in Table 1 indicate that this simplification is acceptable for our purposes of checking whether the positive relationships between happiness and past, and also future, income change are robust. Rising from lowest to highest, the differences in coefficients are 0.118, 0.074 and 0.124 for future income change and 0.109 and 0.209 for past income change.

Column 1 of Table 3 reports the OLS happiness results when the key variables are cardinalised. The coefficient on expected future income change is 0.095 and that on perceived past income change is 0.186; both are highly significant. When perceived past income change is excluded from the OLS equation, the coefficient on expected future income change rises slightly (by 0.025) and when expected future income change is excluded the coefficient on perceived past income change also rises slightly (by 0.017) (estimations not reported). The (small) rise in each case reflects the positive correlation (albeit weak) between these two variables ($r = 0.204$) However, the positive

correlation between the predicted values of the instrumented versions of these two variables is strong ($r = 0.698$) and significant at the 1% level. For this reason it was not possible to include both instrumented variables in the same equation.

The exclusion restriction used in each equation is the village mean of the same variable. Thus, for instance, the expected future income change of the household is instrumented by the mean of the expected future income change of the nine other respondent households in the village. Table 3 presents the IV results in columns 2-5. Columns 2 and 3 use instrumented expected future income change and columns 4 and 5 use instrumented perceived past income change. Column 2 differs from column 3 in that the former column includes (uninstrumented) past income change and the latter does not; similarly, column 4 includes (uninstrumented) expected future income change and column 5 does not. Test statistics are reported in the table. The exclusion restriction variables are significant in the first stage equations, and the rule-of-thumb criterion for strong instruments ($F>10$) is met in three of the four cases. The Anderson-Rubin-Wald test indicates that instrumenting is necessary. We lack a Sargan test of instrument validity.

There are fewer significant coefficients in the four columns that contain instrumented variables than in the OLS column, reflecting the larger standard errors. Nevertheless, the key variables retain positive coefficients in the IV estimations The coefficients on instrumented expected future income change are significantly positive and larger than in the OLS case, and those on instrumented perceived past income change are also significantly positive but now implausibly large. The roles of memory and anticipation in the happiness function survive our attempt in Table 3 to eliminate the effect of unobserved personal characteristics.

Unobserved community characteristics might explain our key variable results. We saw in Table 1 that standardisation for province made no notable difference to the key coefficients. Table 4 reports the results of our attempt to eliminate the influence of unobserved characteristics at the, socially important, village level. The first column

excludes village dummy variables whereas the second column includes them. Comparing columns 1 and 2 (OLS), we see that the introduction of village dummies reduces the coefficients on both key variables, but they remain significantly positive. The expected income coefficient falls by 50% and the past income coefficient falls by 5% when the village dummies are included. This suggests that unknown aspects of the village in which a respondent lives are positively correlated with the expected income variable, and that their causal influence might explain as much as a half of the association between expected future income and happiness. However, this unobserved heterogeneity can explain only a tiny fraction of the effect of past income on happiness.

It would be desirable to eliminate unobserved heterogeneity not only among villages but also among individuals or households of the village. However, it is not possible to combine the methods used in Tables 3 and 4, that is, to estimate an equation that includes both village dummy variables and the instrumented income change variables using their village mean values as instrumental variables. Nevertheless, it is relevant to know whether villages possessing unobserved characteristics that make people happier do indeed have higher mean values of expected income and past income. We run a village-level OLS regression in which each key variable is explained by the estimated coefficients of the village dummy variables in the happiness equations (Table 5). The variable representing the vector of estimated village dummy coefficients is positive and significant, whether the mean expected income change or the mean past income change is the dependent variable. The value of adjusted R-squared is very low in both equations. In line with Table 4, the coefficient on the village dummies is higher in the expected income than in the past income equation. Unobserved village characteristics are likely to contribute a larger part of the explanation for the role of anticipation than for the role of memory in the happiness equation. Tables 4 and 5 imply that unobserved village characteristics influence both happiness and expected future or perceived past income change: further instrumenting is required.

Table 6 presents the results of an exercise to instrument first expected income (columns 2 and 3) and then past income (columns 4 and 5) in a way which deals with both

omitted heterogeneity and reverse causality problems. Comparing this table with the OLS estimates in Table 1, the coefficients on the conditioning variables (not reported), the economic variables and the relative income variables are very similar. We concentrate on the two key variables.

Consider the results when only expected income change is instrumented and perceived past income change is not instrumented but is included in column 2 and excluded in column 3. The choice of instrumental variables is guided by the criteria that they are well correlated with the potentially endogenous variable and, for theoretical or contextual reasons, do not plausibly enter the happiness equation directly. After experimentation to find instrumental variables that were strong, plausible and likely to be valid, the following three variables met the criteria: the household has at least one child aged less than five years (providing an incentive effect[8]), the head's father was a landlord before land reform (possibly a social capital or attitudinal effect), and the village is currently a 'production base' or as a 'specialised village' (improving expectations).

The relevant test statistics are reported in the table. Each exclusion restriction is significant in the first-stage equation, although the F-statistic falls short of the rule of thumb guide for strong instruments that F>10. The equation passes the test of overidentification of all instruments ($p > 0.05$), indicating that the hypothesis of valid instruments cannot be rejected. It also passes the test of joint significance of the endogenous regressors in the main equation ($p>0.05$), implying that instrumenting is not needed after all. In column 2 the coefficient on instrumented expected future income change is positive and larger than its OLS counterpart but the large standard error means that it is not significantly greater than zero, while the coefficient on uninstrumented perceived past income change is positive and significant. In column3 – not containing perceived past income change - the coefficient on instrumented expected future income change is positive and significant.

[8] Knight et al., 2010.

Turning to the results when only perceived past income change is instrumented, the three exclusion restrictions are: the household has at least one child aged 0-9 years (positively associated with past income growth), its ratio of non-dependants to total members (likely to be positive) and its share of the labour force in non-agricultural activities (again, plausibly positive). All three are significant in the first-stage equation, and the F-statistic just meets the F>10 criterion for avoiding weak instruments in column 5 and just fails in column 4. The equation scrapes through the test of instrument validity; it fails the test of whether instrumenting is unnecessary, so indicating that there is indeed an endogeneity problem. We see that the estimated coefficient of instrumented perceived past income change is positive and significant both in column 4 and in column 5, albeit uncomfortably large.

All four of the instrumented coefficients are substantially positive and three of them are significantly so. However, it is a general problem of instrumenting in a cross section that almost any exclusion restriction is open to the challenge that it might influence the dependent variable, and the problem is exacerbated when the dependent variable – such as happiness - is open to many influences. All we can safely claim from the exercise in Table 6 is that we have been unable to refute the hypothesis that memory and anticipation enter the happiness function.

As a further test of the argument that expected future income would be found to have no effect on happiness if income were replaced by consumption in the happiness equation, Table 6 was re-estimated with consumption instead of income (not reported). The difference in the coefficients on expected future income and expected future consumption was negligible..

6. Conclusion

Thomas Schelling[9] has viewed the mind not only as an information processor and decision maker but also as a 'consuming organ', that is, a generator of pleasure and

[9] Nobel prizewinner and self-confessed 'errant economist'.

pain independently of the current objective reality (Schelling 1984). Our hypothesis fits into his framework: 'We consume past events that we bring up from memory; future events that we can believe will happen' (Schelling 1984: 344).

We produced evidence consistent with this hypothesis. The method was to introduce expected future income change and perceived past income change into an estimated happiness function. Both were found to have a positive association with the current happiness score, consistent with the hypothesis. Our several attempts to identify the causal relationships failed to disprove the hypothesis: the effects of both past and expected income change remained positive and generally significantly so. Our evidence is also consistent with reference point theory, that is, happiness depends on actual income relative to reference income, where that is determined by both reference group and reference time.

Nevertheless, the cross section nature of our data set makes it difficult to prove that the hypothesised relationships are causal. This means that the main contribution of this paper is to show that the influences of memory and of anticipation are a promising topic for further research.

The notion that current utility depends not only on current variables but also on memory and on anticipation of those variables has numerous implications for economic behaviour involving the timing and sequencing of chosen outcomes, and indeed for any analysis of intertemporal relationships. This is discussed by Lowenstein (1987), Elster and Loewenstein (1992), and also Frederick et al. (2002) in relation to the discount rate. It can affect individual optimization of a variable over time, such as consumption (a 'good') or labour supply (a 'bad'). For instance, intertemporal allocation can be influenced by the strength of memory and of anticipation - both of which are *non-primary* experiences in the language of Elster and Loewenstein (1992) - relative to the current *primary* experience.

Consider how the introduction of memory might alter the standard case in which only primary experience enters the utility function. If the contrast effect dominates (as we found) there is an incentive to ensure that a positive experience consistently increases over time and a negative experience consistently decreases. If anticipation is introduced instead of memory, a dominant consumption effect (as we found) might encourage the delaying of a positive experience, to savour the prospect for longer. Similarly, it might encourage the advancing of a negative experience, to shorten the period of dread.

The results can have implications for saving behaviour. Outcomes that can be readily imagined and are pleasurable to contemplate are more likely to be delayed. For instance, saving for particular purposes may well bring greater anticipated utility than saving in general. The possibility of savouring leading to delay in consumption can give rise to 'reverse time inconsistency'. If consumption is delayed until the optimal time, when that time arrives there is a similar incentive to delay consumption again, and so on. However, the self-awareness that comes with repetition might reduce the utility of savouring, and further delay might involve sunk costs (Loewenstein, 1987: 677-8). The fact that we found subjective well-being to be sensitive to expected future income in our sample may help to explain why the household saving rate is as high as 25% in China (Knight and Ding 2012: 274).

It might be argued that a measure of happiness (or life satisfaction, or subjective well-being) is not the 'utility' that, according to conventional economics, does govern individual economic behaviour and should govern social evaluation, that is, can be used for positive and normative purposes. For instance, Becker and Raya (2008) distinguish happiness and utility, arguing that happiness is an important determinant of utility but not the only one. If utility is defined as whatever set of factors governs individual behaviour, then happiness – as it is measured in surveys - contributes to utility but so also do such desiderata as health and longevity. According to this argument, happiness is an inadequate criterion for individual decision making. A possible counterargument is that these other factors do affect happiness. Indeed, they might be regarded simply as instruments in the indirect or unconscious pursuit of happiness. Kahneman (1994 and

elsewhere) distinguishes between 'decision utility' and 'experienced utility', that is, between the weight assigned to the outcome in the decision and the hedonic experience of the outcome. There can be systematic differences between the two because aspirations can neither be tethered nor the extent and timing of their change well forecast. However, although the happiness score may be a poor guide to decision utility, it may nevertheless be the best available guide to experienced utility.

Is China unusual in the importance of memory and anticipation for subjective well-being? There is at least one other study of the effect on subjective well-being: the analysis of a panel household survey for Russia also showed a significant and substantial positive effect of expected future income on current subjective well-being (Goldsmith, 2009). The methodology applied to China and Russia is potentially more widely fruitful. The answer that it can provide to the question of whether this old theory of the utility function is generally applicable must await the availability and analysis of more data sets that include past income, actual or perceived, and expected future income.

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Table 1
Factors Associated with Happiness Score, OLS Estimates

	Mean/ proportion	(1)		(2)		(3)		(4)	
		coeff	se	coeff	se	coeff	se	coeff	se
Conditioning variables									
Age	45.29	-0.0093	0.0064	-0.0086	0.0060	-0.0133**	0.0062	-0.0128**	0.0057
Age squared	2161.73	0.0002**	0.0001	0.0001**	0.0001	0.0002***	0.0001	0.0002***	0.0001
Male	0.75	-0.0699***	0.0240	-0.0542**	0.0232	-0.0728***	0.0228	-0.0517**	0.0221
Married	0.95	0.1029	0.0934	0.1204	0.0819	0.097	0.0907	0.111	0.0789
Divorced	0.00	-0.3500*	0.2112	-0.3654*	0.2156	-0.3908*	0.2004	-0.4144**	0.2006
Widowed	0.02	-0.2713**	0.1146	-0.2057**	0.1039	-0.2127*	0.1096	-0.1547	0.0983
Education (years)	7.14	0.0053	0.0043	0.0026	0.0040	0.0023	0.0039	-0.0016	0.0037
Respondent's mood	0.65	0.5485***	0.0249	0.5259***	0.0243	0.4130***	0.0244	0.3831***	0.0236
Respondent's health	0.75	0.3983***	0.0258	0.3778***	0.0243	0.3275***	0.0244	0.3035***	0.0231
Economic variables									
Log of real per capita household income	7.64	0.1623***	0.0190	0.1286***	0.0190	0.0986***	0.0176	0.0567***	0.0175
Log of financial assets	1.04	0.0540***	0.0083	0.0362***	0.0079	0.0449***	0.0077	0.0250***	0.0075
Log of household debt	0.22	-0.0091	0.0131	-0.0094	0.0128	0.0034	0.0124	0.0016	0.0120
Working hours ('00 per year)	17.14	-0.0029**	0.0012	-0.0023**	0.0011	-0.0026**	0.0011	-0.0022**	0.0011
Relative income variables									
Household income much above village average	0.02					0.2434***	0.0565	0.2355***	0.0536
Household income above village average	0.19					0.0958***	0.0251	0.1307***	0.0238
Household income below village average	0.19					-0.2937***	0.0264	-0.2732***	0.0256
Household income much below village average	0.02					-0.8099***	0.0718	-0.7781***	0.0684
Expected income variables									
Expect big income increase next 5 years	0.10					0.1978***	0.0391	0.2014***	0.0364
Expect small income increase next 5 years	0.68					0.0743***	0.0265	0.0950***	0.0252
Expect decrease in income over next 5 years	0.04					-0.1183**	0.0490	-0.0961*	0.0501

Perception of past income variables									
Current living standards better than 5 years ago	0.61					0.2094***	0.0254	0.2230***	0.0236
Current living standards worse than 5 years ago	0.05					-0.1091**	0.0497	-0.1166**	0.0499
Province dummies included				Yes				Yes	
Constant		0.8019***	0.1965	1.4972***	0.2113	1.4014***	0.1916	2.1611***	0.2108
R-squared		0.2173		0.2587		0.2925		0.3346	
Number of observations		8799		8799		8799		8799	

Notes:
1. Dependent variable: happiness (mean 2.68, standard deviation 0.8624, coefficient of variation 0.3213).
2. The omitted categories in the dummy variable analyses are: female sex; married; in normal or worse than normal mood; not healthy; household at average village income; expect no change in income; current living standard the same as five years ago.
3 ***, **, and * denote statistical significance at the one per cent, five per cent and ten per cent levels respectively.
4. The models have been clustered at village level for robust standard errors.

Table 2
Factors Associated with Happiness Score with Log of Per Capita Consumption Replacing Log of Per Capita Income OLS Estimates

	(1)		(2)		(3)		(4)	
	coeff	se	coeff	se	coeff	se	coeff	se
Economic variables								
Log of real per capita household consumption	0.1512***	0.0188	0.1216***	0.0182	0.1006***	0.0177	0.0671***	0.0171
Log of financial assets	0.0718***	0.0080	0.0498***	0.0077	0.0552***	0.0075	0.0305***	0.0072
Log of household debt	-0.0225*	0.0132	-0.0202	0.0130	-0.0058	0.0125	-0.0047	0.0122
Working hours ('00 per year)	-0.0026**	0.0012	-0.0021*	0.0011	-0.0025**	0.0011	-0.0022**	0.0011
Relative income variables								
Household income much above village average					0.2402***	0.0573	0.2316***	0.0537
Household income above village average					0.0969***	0.0252	0.1306***	0.0238
Household income below village average					-0.2948***	0.0264	-0.2722***	0.0256
Household income much below village average					-0.8210***	0.0716	-0.7821***	0.0684
Expected income change variables								
Expect big income increase next 5 years					0.2057***	0.0390	0.2057***	0.0363
Expect small income increase next 5 years					0.0773***	0.0265	0.0968***	0.0252
Expect decrease in income over next 5 years					-0.1202**	0.0487	-0.0979*	0.0501
Perceived past income change variables								
Current living standards better than 5 years ago					0.2075***	0.0253	0.2216***	0.0235
Current living standards worse than 5 years ago					-0.1188**	0.0495	-0.1221**	0.0497
Province dummies included			Yes				Yes	
Constant	0.9099***	0.1874	1.5720***	0.1996	1.4160***	0.1832	2.1082***	0.2011
R-squared	0.2145		0.2575		0.2919		0.3348	
Number of observations	8804		8804		8804		8804	

Notes:
1. Dependent variable: happiness (mean 2.68, standard deviation 0.8624, coefficient of variation 0.3213). The conditioning variables of Table 1 are included in the estimation but not reported in the table.

2. The omitted categories in the dummy variable analyses are: female sex; married; household at average village income; expect no change in income; current living standard the same as five years ago.
3 ***, **, and * denote statistical significance at the one per cent, five per cent and ten per cent levels respectively.
4. The models have been clustered at village level for robust standard errors.

Table 3
Factors Associated with Happiness Score: OLS Estimates and IV Estimates with Expected Future or Perceived Past Income Changes Instrumented

	OLS	Expected future income change instrumented		Past income change, instrumented	
	(1)	(2)	(3)	(4)	(5)
Economic variables					
Log of real per capita household income	0.0993***	0.1113***	0.1122***	0.0058	0.0188
	(0.0128)	(0.0167)	(0.0164)	(0.0481)	(0.0380)
Log of financial assets	0.0450***	0.0567***	0.0568***	0.0452***	0.0477***
	(0.0055)	(0.0079)	(0.0078)	(0.0114)	(0.0105)
Log of household debt	0.0041	-0.0049	-0.0054	0.0479*	0.0411*
	(0.0104)	(0.0135)	(0.0134)	(0.0286)	(0.0238)
Working hours ('00 per year)	-0.0027***	-0.0026**	-0.0026**	-0.0033*	-0.0032*
	(0.0009)	(0.0011)	(0.0011)	(0.0018)	(0.0017)
Relative income variables					
Household income much above village average	0.2522***	0.0540	0.0568	-0.1517	-0.1494
	(0.0595)	(0.0982)	(0.1025)	(0.2125)	(0.1921)
Household income above village average	0.0995***	-0.0003	0.0026	-0.2676*	-0.2483*
	(0.0210)	(0.0413)	(0.0464)	(0.1626)	(0.1378)
Household income below village average	-0.2928***	-0.1952***	-0.1988***	0.1434	0.1160
	(0.0211)	(0.0409)	(0.0470)	(0.1913)	(0.1594)
Household income much below village average	-0.8012***	-0.6037***	-0.6120***	0.2179	0.1473
	(0.0522)	(0.0911)	(0.1046)	(0.4483)	(0.3704)
Expected future and perceived past income change variables					
Expected future income change	0.0953***	1.0143***	1.0213***	-0.2334	
	(0.0125)	(0.2907)	(0.2760)	(0.1427)	
Perceived past income change	0.1860***	0.0232		2.6735**	2.3631***
	(0.0145)	(0.0546)		(1.0619)	(0.7961)
Constant	1.4013***	0.9715***	0.9712***	1.2260***	1.1532***
	(0.1474)	(0.2312)	(0.2315)	(0.3166)	(0.2994)
R-squared	0.2919				
Number of observations	8799	8799	8799	8799	8799
Significance of exclusion restriction for expected future income in first stage equation					
Mean of change in expected future income of others in the village		***	***		
Mean of perceptions of past changes in income of others in the village				**	***
F-test of excluded instrument					
F statistic		26.24	28.60	7.11	10.20
Anderson-Rubin Wald test of joint significance of endogenous regressors in main equation, F test (P-val)		0.0000	0.0000	0.0000	0.0000

Notes:
1. Dependent variable: happiness (mean 2.68, standard deviation 0.8624, coefficient of variation 0.3213). The conditioning variables of Table 1 are included in the estimations but are not reported in the table.
2. Expected future income change variables have been converted into a unit scale as follows: 2 if a big increase is expected; 1 if a small increase is expected; 0 if respondent does not expect any change; and, -1 if the respondent thinks income will decrease in the future. Variables for perceived changes in past income have been converted to unit scale as follows: 1 if respondent thinks he or she is earning more now than before; 0 if there has been no change; and, -1 if income has decreased.
3. The omitted categories in the dummy variable analyses are: female sex; married; household at average village income.
4 ***, **, and * denote statistical significance at the one per cent, five per cent and ten per cent levels respectively.
5. Instrumented variables regression results generated using Baum, Schaffer and Stillman's (2007), ivreg2.ado programme for extended instrumental variables/2SLS, GMM and AC/HAC, LIML, and k-class regression. See, Baum, C. F., M. E. Schaffer, and S. Stillman. (2007), Enhanced routines for instrumental variables/generalized method of moments estimation and testing. *Stata Journal* 7: 465-506.

Table 4
Factors Associated with Happiness with and without Village Dummies: *OLS Estimates*

	(1)		(2)	
	coeff	se	coeff	se
Economic variables				
Log of real per capita household income	0.0993***	0.0176	0.0339**	0.0163
Log of financial assets	0.0450***	0.0077	0.0213***	0.0075
Log of household debt	0.0041	0.0124	0.0123	0.0111
Working hours ('00 per year)	-0.0027**	0.0011	-0.0010	0.0010
Relative income variables				
Household income much above village average	0.2522***	0.0561	0.2508***	0.0639
Household income above village average	0.0995***	0.0251	0.1760***	0.0213
Household income below village average	-0.2928***	0.0265	-0.3010***	0.0246
Household income much below village average	-0.8012***	0.0711	-0.7608***	0.0662
Expected future and perceived past income Change variables				
Expected future income change	0.0953***	0.0155	0.0479***	0.0149
Perceived past income change	0.1860***	0.0210	0.1761***	0.0192
Village dummies included	no		yes	
Constant	1.4013***	0.1892	2.2332***	0.1824
R-squared	0.2919		0.5453	
Number of observations	8799		8799	

Notes:
1. Dependent variable: happiness (mean 2.68, standard deviation 0.8624, coefficient of variation 0.3213). The conditioning variables of Table 1 are included in the estimations but are not reported in the table.
2. In models (1) and (2), expected future income change variables have been converted into a unit scale as follows: 2 if a big increase is expected; 1 if a small increase is expected; 0 if respondent does not expect any change; and, -1 if the respondent thinks income will decrease in the future. Variables for perceived changes in past income have been converted to unit scale as follows: 1 if respondent thinks he or she is earning more now than before; 0 if there has been no change; and, -1 if income has decreased.
3. The omitted categories in the dummy variable analyses are: female sex; married; household at average village income.
4 ***, **, and * denote statistical significance at the one per cent, five per cent and ten per cent levels respectively.
5. The models have been clustered at village level for robust standard errors.

Table 5
Impact of Coefficients of Village Dummies taken from the Happiness Equation on Expected Future and Perceived Past Income Changes: OLS Estimates

	Expected future income change		Perceived past income change	
	(1)		(2)	
	coeff	se	coeff	se
Coefficients of village dummies	0.1426***	0.0250	0.0943***	0.0277
Constant	0.8748***	0.0141	0.5892***	0.0136
Adjusted R-squared	0.0322		0.0153	
Number of observations	960		960	

Notes:
1. The happiness function from which the coefficients of village dummies were obtained is identical to Model (1) in Table 3, but with the addition of village dummies.
2. In models (1) and (2), expected future income change variables have been converted into a unit scale as follows: 2 if a big increase is expected; 1 if a small increase is expected; 0 if respondent does not expect any change; and, -1 if the respondent thinks income will decrease in the future. Variables for perceived changes in past income have been converted to unit scale as follows: 1 if respondent thinks he or she is earning more now than before; 0 if there has been no change; and, -1 if income has decreased.
3. ***, **, and * denote statistical significance at the one per cent, five per cent and ten per cent levels respectively.
4. The models have been clustered at village level for robust standard errors.

Table 6
Factors Associated with Happiness Score, with Expected Future and Perceived Past Income Changes Instrumented

	OLS	Expected future income change instrumented		Past income change, instrumented	
	(1)	(2)	(3)	(4)	(5)
Economic variables					
Log of real per capita household income	0.0993***	0.1022***	0.1083***	0.0723***	0.0746***
	(0.0128)	(0.0136)	(0.0135)	(0.0185)	(0.0173)
Log of financial assets	0.0450***	0.0479***	0.0490***	0.0455***	0.0453***
	(0.0055)	(0.0066)	(0.0065)	(0.0061)	(0.0060)
Log of household debt	0.0041	0.0019	-0.0012	0.0165	0.0155
	(0.0104)	(0.0109)	(0.0110)	(0.0128)	(0.0122)
Working hours ('00 per year)	-0.0027***	-0.0027***	-0.0026***	-0.0028***	-0.0028***
	(0.0009)	(0.0009)	(0.0009)	(0.0010)	(0.0010)
Relative income variables					
Household income much above village average	0.2522***	0.2040**	0.2058**	0.1508*	0.1642**
	(0.0595)	(0.0851)	(0.0875)	(0.0817)	(0.0833)
Household income above village average	0.0995***	0.0752**	0.0847**	0.0004	0.0115
	(0.0210)	(0.0369)	(0.0404)	(0.0502)	(0.0497)
Household income below village average	-0.2928***	-0.2691***	-0.2824***	-0.1730***	-0.1860***
	(0.0211)	(0.0364)	(0.0410)	(0.0583)	(0.0571)
Household income much below village average	-0.8012***	-0.7531***	-0.7872***	-0.5238***	-0.5534***
	(0.0522)	(0.0798)	(0.0905)	(0.1369)	(0.1329)
Expected future and perceived past income change variables					
Expected future income change	0.0953***	0.3188	0.4261*	0.0059	
	(0.0125)	(0.2772)	(0.2469)	(0.0424)	
Perceived past income change	0.1860***	0.1464***		0.8613***	0.7991***
	(0.0145)	(0.0512)		(0.3023)	(0.2674)
Constant	1.4013***	1.2967***	1.2638***	1.3638***	1.3749***
	(0.1474)	(0.1981)	(0.1957)	(0.1658)	(0.1653)
R-squared	0.2919				
Number of observations	8799	8799	8799	8768	8768
Significance of exclusion restriction for expected future income in first stage equation					
Household has at least one child less than 9 years		**	**		
Father was a landlord before land reform		**	***		
Village appointed as production base or specialized village in 2002		***	***		
F-test of excluded instrument					
F statistic		6.16	7.97		
Significance of exclusion restriction for perceived past income in first stage equation					
Household has at least one child less than 9				*	**

years				
Non-dependent ratio of household			***	***
Share of labour force in non-agriculture			***	***
F-test of excluded instrument				
F statistic			8.35	10.07
Anderson-Rubin Wald test of joint significance of endogenous regressors in main equation, F test (P-val)	0.6993	0.3671	0.0007	0.0006
Sargan test for over-identification of all instruments (P-val)	0.9675	0.9902	0.0569	0.0552

Notes:
1. Dependent variable: happiness (mean 2.68, standard deviation 0.8624, coefficient of variation 0.3213). The conditioning variables of Table 1 are included in the estimations but are not reported in the table.
2. Expected future income change variables have been converted into a unit scale as follows: 2 if a big increase is expected; 1 if a small increase is expected; 0 if respondent does not expect any change; and, -1 if the respondent thinks income will decrease in the future. Variables for perceived changes in past income have been converted to unit scale as follows: 1 if respondent thinks he or she is earning more now than before; 0 if there has been no change; and, -1 if income has decreased.
3. The omitted categories in the dummy variable analyses are: female sex; married; household at average village income.
4 ***, **, and * denote statistical significance at the one per cent, five per cent and ten per cent levels respectively.
5. Model (1) has been clustered at village level for robust standard errors.
6. Instrumented variables regression results generated using Baum, Schaffer and Stillman's (2007), ivreg2.ado programme for extended instrumental variables/2SLS, GMM and AC/HAC, LIML, and k-class regression. See, Baum, C. F., M. E. Schaffer, and S. Stillman. (2007), Enhanced routines for instrumental variables/generalized method of moments estimation and testing. *Stata Journal* 7: 465-506.