Evidence on feedback loops between household finances, expectations and emotions^{*}

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ABSTRACT

We use household panel data to provide evidence that a deterioration in household finances causes a reduction in their emotional well-being and makes them more pessimistic going forward. The negative impact on emotions in turn leads to an increased probability of a further decline in financial situation. It also affects the nature of expectation errors: more depressed individuals are more likely to make forecasts that are too pessimistic. We control for individual traits using fixed effects.

Keywords: Household finance, psychological well-being, experiences, expectation errors.

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1 Introduction

What are the main determinants of changes in household finances? How do those changes impact individuals' emotional well-being? And their expectations for their future finances? Are expectations errors related to emotions? These are important questions on which we provide evidence using almost two decades of U.K. household panel data.¹

In our data, and in each year individuals are asked to report on significant changes (if any) to their financial situation. We study these changes to find that there is significant variation over the life-cycle in the proportion of households who benefit from a significant improvement to their finances, from 0.40 for the young to only 0.10 for those over sixty-five years of age. This is a reflection of the fact that earlier in life earnings profiles are increasing. However, a different picture emerges when we look at deteriorations in households' finances. The proportion of individuals who are significantly worse off (one in four individuals) is relatively stable both over the life-cycle and across income levels.

If the events that lead to an improvement or to a deterioration in household finances are persistent, then a change in period t could have a additional effects on household finances at t + 1. We analyze our data to find that there is indeed some persistence. Around one third of the those individuals who in a given year report being better off (worse off) due to an increase in earnings (expenditures), report again being better off (worse off) for the same reason the following year. The persistence in these events, and the impact that they may have on expectations and on emotions is something that we take into account in our analysis.

In order to be able to provide evidence on the causal impact of changes in household finances on emotional well-being we use an instrumental variables approach. The two main reasons for significant changes in household finances are changes in earnings and in expenditures. We instrument changes in earnings using the unemployment rate in the region where the household lives and for the age group that corresponds to the age of the head of the household. Our data has information on the amount that the household has spent on food. We use the lagged value of the amount spent on food relative to household income interacted with the current level of food price inflation to instrument changes in expenditures. Food is a necessary good on which households may not be able to reduce expenditure even when faced with higher prices.

¹See Campbell (2006) for a survey of the literature on household finance.

Our data contains several measures of emotional well-being, including whether individuals have been feeling more unhappy or depressed than usual, whether they have been recently loosing more sleep due to worry, and whether they have been finding it more difficult to face problems. These variables can capture individuals' inability to plan for the future, as in the model of Gabaix and Laibson (2017), making them more exposed to events that negatively impact their financial situation. Individuals who are depressed may also increase their spending in an attempt to make them feel better, leaving them in a worse financial situation, or they may be less productive and focused at work affecting their ability to earn. Even though the survey asks individuals to report on changes in emotions relative to their usual level, throughout the analysis we control for individual fixed effects. Therefore, our results are not driven by individuals who, for example, in every year report that they are in a worse financial situation and that they are feeling more depressed than usual. Our results come from time-variation in changes in financial and emotional well-being for a given individual. Furthermore we control for age and time effects so that they are not driven by age or time related unobservable individual characteristics that may affect both changes in financial situation and emotional well-being.

From the panel instrumental variables approach, we find evidence that changes in financial situation have an impact on emotional well-being. A deterioration in household finances due to higher expenditures leads to individuals becoming more depressed and to loosing more sleep due to worry. The estimated effects are economically meaningful: increased probabilities of around 0.06. On the other hand, an improvement in financial situation due to an increase in earnings decreases the likelihood that individuals become depressed.

We also investigate whether emotional state has an impact on future changes in financial situation. Figure 1 provides a graphical description of the linkages that we study. We find evidence that year t emotions have an economically significant impact on changes in year t + 1 financial situation. For example, individuals who have more (less) difficulty facing problems this year are more likely to be financial worse (better) off next year. These results are robust to controlling for past changes in financial situation, and for the expectations of future changes.

[Figure 1 here]

We study the causal impact of changes in household finances on their expectations of future changes in their finances (the bottom left hand arrow in Figure 1). More precisely, we use instrumental variables regressions to show that an improvement (deterioration) in finances in year t makes it more likely that households expect that in year t + 1 there will be a further improvement (deterioration). This in itself does not mean that households are more over-optimistic (over-pessimistic) as a result of the improvement (deterioration) in their finances, since as we mentioned there is persistence in the reasons that led to the changes. Therefore we explore the panel nature of our data, the expected changes in year t and the realized changes in year t + 1, to calculate expectation errors.

We find that a deterioration in household finances due to higher expenditures leads to reduced forecast accuracy. And furthermore we find that the higher expenditures event leads to individuals making more inaccurate forecasts in both directions, i.e. expect to be better off than the realization and expect to be worse off than the realization. There is however an interesting asymmetry with improvements in financial situation due to higher earnings which leads to improved forecast accuracy, in both directions. This may be due to reduced (increased) uncertainty going forward after an earnings (expenditures) increase so that households are better (less) able to assess what such an event means for the future changes in their financial situation.

In order to investigate the role of emotions, we regress the expectations errors on the emotions variables, controlling for individual fixed effects. We find a role for emotions: individuals who at time t have more difficulties facing problems and who are more depressed are less likely to make inaccurate forecasts that are over-optimistic. Similarly, individuals who are less depressed are less likely to at time t have expectations that are more over-pessimistic. Therefore there is time-series variation in individual emotions that is related to the inaccuracy in individual forecasts in a meaningful way.

Our paper is related to a growing literature on the links between household finances and psychological well-being. Taylor, Jenkins and Sacker (2011) document a link between financial capability and psychological well-being while Bridges and Disney (2010) focus specifically on the relation between financial indebtedness and depression. Praag, Frijters and Ferrer-i-Carbonell (2003) relate different aspects of life, including household finances, to subjective well-being. Brown and Taylor (2014) analyze the relationship between financial decisionmaking and personality traits, while Xu, Briley, Roberts and Brown (2016) investigate the relative importance of genetic and environmental factors for this relationship.

Our paper is also related to the growing literature on the role of personal experiences in

shaping expectation formation and household decisions (Kaustia and Knupfer (2008), Malmendier and Nagel (2011, 2016), Kuchler and Zafar (2016), Malmendier and Shen (2016), and Kuhnen, Nagel and Das (2017)). Most of this literature focus on expectations of aggregate variables, such as expected stock returns or inflation, while our paper studies expectations of changes in household financial situation. Our results also contribute to the literature on optimism and financial decisions (e.g. Puri and Robinson (2007)). One advantage of our data is that we have a panel and therefore we can control for individual fixed effects.

Finally, our paper is related to the behavioral economics and finance literature. We find that the main reason for a deterioration in household finances is higher expenditures. These higher expenditures may arise both because households are unable or unwilling to cut-back on consumption. Such unwillingness may be due to present bias arising from hyperbolic discounting as in the model of Laibson (1997).

The paper is organized as follows. Section 2 describes the data. Sections 3 and 4 study the links between emotions and household finances. In section 5 we consider how expectations are linked to changes in financial situation and emotional condition. The final section concludes.

2 The data

2.1 Data sources

Our main data source is the British Household Panel Survey (BHPS), which is a representative panel of U.K. households. The sample starts in 1991 and there is annual data available until (and including) 2008. After 2008 the BHPS became part of a new survey entitled Understanding Society, but at this time several of the questions that are crucial for our study were dropped from the survey, so that we focus on the data contained in waves 1 through 18. The nature of the data, both in terms of the data collection process and the information available, is similar to that in the U.S. Panel Study of Income Dynamics (PSID). The panel nature of the data allows us to control for individual fixed effects in the regressions. Therefore our regression results capture changes over time for the same individual.

Each year individuals are asked a wide range of questions about their circumstances including income, financial situation, demographic variables, expenditures, psychological well-being, expectations, among others. The first wave contains information for around 5,500 households. In subsequent years more households were added to the survey bringing the total

number to around 9,000. We use the answers of the household head. Not all households appear in each of the eighteen waves, so that we use an unbalanced panel. Furthermore the data lacks detailed yearly information on household wealth, however, it is fairly rich in terms of income, both labor and asset income (interest, dividends, etc.) and other demographic information. In our analysis we also use retail price indices and regional unemployment data from the U.K. Office of National Statistics.

2.2 Financial situation

Our data has information on significant changes in household finances. In each year individuals are asked whether they are *significantly* better off, about the same, or *significantly* worse off financially than they were one year ago. The answers naturally represent changes in financial situation as they are perceived by the individuals themselves. Their advantage is that they capture the state of the world as evaluated by the agents when they are making their consumption/saving decisions. But in addition in section 2.5 we provide evidence that the individual answers are highly correlated with objective measures of changes in financial situation (e.g. changes in earnings). In Panel A of Table I we report the number and the proportion of responses for each category, for all years in the sample. Thus the unit of observation is household/year (we use the responses of the household head). Roughly half of the responses are for about the same, and the remainder are equally split between better off and worse off.

[Table I here]

2.2.1 Reason for change in financial situation

Our data allows us to quantify the importance of the different channels that drive changes in household finances. From 1993 onwards, those participants who responded that they were significantly better off or significantly worse off than in the previous year were also asked to provide the main reason for the change.

We use the households' budget constraint as a framework. The equation describing the evolution of *nominal* cash-on-hand for household *i* in year t + 1 ($X_{i,t+1}$) can be written as:

$$X_{i,t+1} = (X_{it} - p_{it}c_{it})(1 + R_{i,t+1}) + B_{i,t+1} - M_{i,t+1} + Y_{i,t+1},$$
(1)

where p_{it} is the date t price of the consumption basket of individual i, $R_{i,t+1}$ is the return on his/her portfolio of assets, $B_{i,t+1}$ denotes government transfers and other benefits, $M_{i,t+1}$ captures other expenditures that the individual must meet, such as out-of-pocket medical expenditures, car repairs, among others, and $Y_{i,t+1}$ denotes labor income.

In the previous equation all variables except consumption are written in nominal terms. One can also write the real counterpart of that equation as:

$$x_{i,t+1} = (x_{it} - \frac{p_{it}}{p_t}c_{it})(1 + r_{i,t+1}) + b_{i,t+1} - m_{i,t+1} + y_{i,t+1},$$
(2)

where lower case letters denote the real counterpart of the nominal variables, and p_t denotes the date t price level.

The above equation is useful because it allows us to think of the different channels through which households can be financially better or worse off. In addition to lower investment returns $(r_{i,t+1})$, an important channel that has been the focus of the literature on background risk is *real* earnings $(y_{i,t+1})$. But households can also be worse off (lower cash-on-hand) because of lower net government transfers (net of taxes, $b_{i,t+1}$), higher real expenditures (m_{it}) , or because of a higher price for the goods that form their consumption basket (p_{it}) . When this consumption basket is similar to the one used to compute the price level then p_t equals p_{it} and the two cancel out. When that is not the case, the evolution of the individual's financial situation will depend on the evolution of the prices of the goods that make a larger part of their expenditures. It will also depend on the extent the individual is willing to substitute among the different goods that make up the composite good when their price changes.

Finally individuals may have lower financial wealth tomorrow because they choose a very high level of consumption (c_{it}) today. The fact they are financially worse off the following year does not mean that they are necessarily worse off in utility terms. However, the level of consumption today may also have been suboptimally high because of poor financial planning (e.g. Lusardi and Mitchell (2007) or van Rooij, Lusardi and Alessie (2012)), leaving them with too little savings going forward. Alternatively, individuals may lack self-control (as in Laibson, Repetto and Tobacman (1998) or Laibson (1997)), which leads them to spend more than they can afford and to make use of expensive credit card debt or payday loans (Melzer (2011), Morse (2011), Bhutta, Skiba and Tobacman (2015)).²

²One potentially important aspect of individuals' financial situation that is not directly reflected in the

In Panel A of Table II we tabulate the answers to the reason for being (significantly) better off question. Unsurprisingly, the main reason is higher earnings (54%). The second highest category is lower expenditures, with a response rate of 15%.

[Table II here]

In the first two columns of Panel B we tabulate the answers for those individuals who report being significantly worse off than a year ago. The main reason is higher expenditures (52%), a reason that is given twice more often than lower earnings (24%).³

2.2.2 Age and income splits

In order to gain some initial insights into life-cycle effects, in columns two to five of Panel A of Table III we report responses by age. There is a marked age decline in the proportion of individuals who are financially better off, from 0.38 for the 20 to 35 age group to 0.10 for those above 65. This decline is mirrored by an increase in the proportion of those who are about the same, while the fraction of those who are worse off remains stable over the life-cycle.

[Table III here]

In panel B we report the reasons given for better off, as a fraction of the total of better off. Early in life the main reason why individuals are better off is higher earnings. During this part of the life-cycle earnings profiles are upward sloping and this is naturally reflected in the answers given. As individuals age, and labor income profiles flatten, the proportion of those who report being better off declines and so does the relevance of earnings increases as the reason for being better off. For the above 65 age group the main reason is higher benefits. In panel C we tabulate the worse off answers. Higher expenditures is the main reason for all age groups, and particularly so for those aged over 65. For those below retirement age,

equations above are changes in the value of housing. However, changes in housing value does not appear as one of the categories in the survey. There is a residual category of other reasons, but it is not quantitatively very important. One possible explanation is that individuals do not think of fluctuations in the value of their house as making them financially better or worse off since they must live in the house, so that they are implicitly hedged against fluctuations in its value (Sinai and Souleles (2005)).

³The number of observations for the reasons why individuals are better off and worse off in Table II add to 51,838 whereas in Table I they add to 55,585. The main reason is that, as previously mentioned, the question on "why the change in financial situation" is only available from 1993 onwards.

lower earnings is also an important reason why individuals are financially worse off, with a fraction of around 0.30.

In the last three columns of Table III we report the responses by income group. In each year t - 1 we divide individuals in our data into three groups based on their household income. The low (high) income group refers to individuals in the bottom (top) one-third of the distribution of household income for that year. We then tabulate their answers one year after (in year t). Higher (lower) income individuals are more (less) likely to become significantly better off, an event which occurs with probability 0.30 (0.17). An increase in earnings is the main reason for better off among the high income group. In contrast, among the low income group, increases in benefits are as important as increases in earnings (Panel B). Higher expenditures is a more important reason for being worse off for the low income group, with a proportion of answers equal to 0.64, but it still is the most important category for the high income group, with 0.46.

2.2.3 Persistence

In order to investigate the extent to which the changes in financial situation are persistent, in Panel A of IV we report the probability of year t responses conditional on year t - 1responses by the same individual. Out of those who reported being better off in year t - 1than in year t - 2 (first row), 44% reported being better off at t than at t - 1, 39% reported being about the same, and the remainder 17% reported being worse off. In Panel A the main diagonal always has the highest value, so that in the data there is persistence in *changes* in financial situation, with some households benefiting from consecutive years of improvement, and others facing consecutive years of deterioration in their finances. In addition to this persistence, the probabilities off the main diagonal are economically large, so that there is meaningful time series variation in the responses of each individual.

In Panel B of Table IV we investigate the persistence in changes in financial situation, by reason given for the change. We focus on the two largest categories, namely earnings and expenditures increases/decreases.⁴ The first row of Panel B reports the transition probabilities for individuals who in year t reported being better off than in year t - 1 due to higher earnings. Out of these, 36% report being better off at t + 1 than at t again for the same reason, so that they benefit from consecutive years of earnings increases. And 16% are

⁴More detailed information on the transition probability matrix is provided in the Appendix, Table AI.

better off due to earnings increases for three years in a row. The persistence of an earnings decrease is smaller: only 18% report an additional decrease at t + 1, and this proportion drops to 4% when we condition on an earnings decrease for three consecutive years.

[Table IV here]

Interestingly, for changes in expenditures we observe exactly the opposite pattern, with increases being much more persistent than decreases. Of those individuals who in t are worse off due to an increase in expenditures, 33% of them face a further deterioration in their financial situation at t + 1 for the same reason. And 15% are hit by this event yet again two years later. On the other hand, being better off due to a decrease in expenditures is an event that is much less likely to repeat itself in consecutive years. Overall these results show that the main factors driving both improvements and declines in financial situation (increases in expenditures, respectively) often compound themselves over time, i.e. have significant persistence in growth rates.

2.3 Emotional condition

The survey includes information on the respondents emotional/psychological condition. Each year individuals are asked how they have been feeling over the last few weeks, including whether they have been finding it difficult to face problems, whether they have been feeling depressed or unhappy, and whether they have been losing much sleep due worry. Individuals who find it difficult to face problems, may not appropriately plan for the future and be more exposed to events that change their financial situation. Individuals who are unhappy and depressed may increase their spending in an attempt to make them feel better, leaving them in a worse financial situation. In addition, depressed individuals may be less productive and focused at work affecting their ability to earn. The loss of sleep may affect individual's ability to concentrate and make good financial decisions. Table V reports the answers to the emotions questions

[Table V here]

There is significant variability in the answers to the questions on being depressed. The fraction of individuals who report that they are no more depressed or unhappy than usual is 0.44, but a large fraction of 0.35 responds not at all, and 0.21 of the observations are for those who respond rather more (0.17) and much more (0.04). There is a similar degree of variability in the answers to the question of whether individuals are losing sleep due to worry. In contrast a large majority of 0.80 of the observations to the question of whether individuals are finding it difficult to face problems are for the same as usual category. But even for this question, about one in ten individuals report more difficulties than usual.

There is likely to be a considerable degree of subjectivity in the answers to the questions on emotional condition. Furthermore, what each individual considers to be their usual is likely to be different from one individual to the next. Therefore, in the empirical analysis we will control for individual fixed effects in all of the regressions. We are interested in exploiting the variation over time in the responses of the same individual.

Using the answers to the emotions questions we construct dummy variables that take the value of one if the household head answers rather more or much more than usual and zero otherwise (Diff. face problems \uparrow , Loss of sleep \uparrow , and Depressed \uparrow). In a symmetric procedure we construct dummy variables that take the value of one if the household head answers not at all, less so or much less so and zero otherwise (Diff. face problems \downarrow , Loss of sleep \downarrow , and Depressed \downarrow).

2.4 Summary statistics

In the empirical analysis we also use other variables including age and health status, income and cost of living measures. In Table VI we report summary statistics for these variables and for the dummies for emotional conditions. We report their average values in the full sample and their averages conditional on the realized change in financial situation (and the reason for the change). In this Table both the variables and the realized change in financial situation are measured in the same year t, so that these conditional means should be interpreted in the same manner as contemporaneous correlations. Later on, in the regression analysis we will use lags and instrumental variables to address endogeneity and reverse causality. The second column reports means across all observations in our sample, the third and fourth columns consider observations in which individuals report being better off and better off due to an earnings increase, respectively. Finally the last two columns include individuals who report being worse off and worse off due to higher expenditures.

The number of observations reported in the first row of Table VI correspond to observa-

tions for which we have information on whether there has been a change in financial situation. For some of the other variables there is sometimes missing information, which reduces the number of observations available for the regression analysis.

Emotions. The first three rows of Panel A of Table VI report the average values for the dummy variables capturing a decline in emotional well-being. The unconditional means in the second column show that for one in ten (one in five) observations individuals report having more difficulties facing problems (or are more depressed). These proportions are significantly larger among those who are worse off financially: one in five have difficulties facing problems and almost one in three are unhappy or depressed. On the other hand individuals who are financially better off have less difficulty facing problems, less loss of sleep due to worry and are less depressed (last three rows of Panel A).

Health status and age. In the survey individuals are asked to rate their health compared to people of their own age. The possible survey answers range from excellent health to very poor health. The first five rows of Panel B of Table VI report the average values for dummy variables for different levels of health. Individuals who report being better off financially are on average healthier than the sample mean, more so when compared to those who report being worse off. For example, 73% of those who report being better off have excellent or good health. The corresponding value for those who report being worse off is only 61%. A worse health status may affect the ability of individuals to work and generate earnings, and there may be medical expenses that they need to meet. Naturally there is variation in health status that is related to age.

Individuals who report being better off are on average much younger than those who report being worse off, 42.6 versus 49.3 years old, respectively. A large proportion of individuals are better off due to higher earnings, and earnings profiles are on average steeper earlier in life. The average age for those who report being better off due to higher earnings is 37.4.

[Table VI here]

Income and cost of living. Our measure of income is obtained by adding the labor income, benefit income, social security income, transfers and asset income of the head of the household and his/her partner, if present. We use the retail price index to convert nominal variables into their real counterparts. In order to mitigate the influence of outliers we winsorize income (and other continuous variables) at the 5th and 95th percentiles of their respective distributions. As expected those who report being better off tend to have higher income levels than those who report being worse off, with a percentage difference between the two as high as 30%.

Similarly to the PSID, our data contains information on the amount the household has spent on food at home. We compute a measure of its relative importance by scaling it by household income. Food at home is a particularly interesting good because it is a necessity, i.e. it has a low price elasticity. When food prices increase households may not be able to cut down significantly on this expenditure and as a result they will be financially worse off. There is significant heterogeneity in the data in the income shares of food. The average foodto-income ratio is 20.3% but the 25th percentile is only 9.89% while the 75th percentile is 25.3%. Those individuals who report being worse off spend a larger fraction of their income on food, than those who report being better off: 22% versus 17%.

The last row of Table VI reports the average value for food price inflation. In any given year, the values for food inflation are the same for all individuals. Therefore, any variation in means across the different columns in Table VI is driven by differences in the year in which households report being better or worse off. Consistent with the above hypothesis, across the four groups, the average food price inflation values are highest for individuals who report being worse off due to higher expenditures.

2.5 Sample attrition and cross validation

The BHPS sample was chosen to be representative of the overall population. Nevertheless, one potential concern is that sample attrition may not be random. For example, those individuals who become financially worse off may be more or less likely to drop out from the sample. We can test for this by computing the probability that an individual is no longer in the data set in year t, conditional on being there in year t - 1. Across the full sample this probability is 8.5%. For all four of our major categories the attrition rates are very similar. For those who report being significantly better off due to an increase (decrease) in earnings (expenditures) the corresponding number is 8.4% (8.6%). For those who report that they are significantly worse off due to an increase (decrease) in expenditures (earnings) the attrition rate is 8.2% (8.1%). These results indicate that selection due to attrition is not a particular

concern for our analysis.

Our dataset includes information on earnings which we use to gain some insights on the quantitative magnitudes behind the qualitative answers. More precisely we have computed the average percentage change in income for individuals who report a change in financial situation due to a change in earnings. Those who report being better off (worse off) due to an earnings increase (decrease) had an average 8.7% (-7.4%) change in income during the year.⁵ The BHPS also contains information on income in the month prior to the interview which could arguably provide a better measure of the household's financial situation at the time that the survey was carried out. In fact those who state that they are better off (worse off) due to an earnings increase (decrease) report an average 12.7% (-13.8%) change in their lastmonth's income relative to the one obtained thirteen months ago. These numbers speak to the importance of the self-reported changes in financial situation as reflecting very important events for households' finances.

3 The effects of emotions on household finances

We now study the effects of emotions on changes in financial situation. We start by discussing our choice of econometric model before presenting the results.

3.1 Econometric approach

We use a standard binary choice model. The outcome variable y_{it} is equal to one if individual i in year t reports a given change in financial situation (and zero otherwise). We model:

$$Prob(y_{it} = 1 | \mathbf{x}_{it}, u_i) = F(\mathbf{x}_{it}, u_i)$$
(3)

where \mathbf{x}_{it} is a vector of observable covariates and u_i is an unobserved individual specific effect. One common approach to modeling the unobserved individual heterogeneity (u_i) is the random effects model. An alternative approach which does not require us to make assumptions on how the individual effects are related to the covariates \mathbf{x}_{it} is the fixed effects model. This model cannot in general be estimated due to the incidental parameters problem. One important exception is the logit distribution. Under this specification the fixed effects are

⁵Those who report no significant change in financial situation had an average earnings increase of 2.4%.

removed from the estimation to avoid the incidental parameters problem, and the analysis is thus conditional on the unobserved u_i which are not estimated. The fixed effects logit estimator of the regression parameters (β) gives us the effect of each element of \mathbf{x}_i on the log-odds ratio:

$$Ln\left[\frac{Prob(y_{it}=1|\mathbf{x}_{it}=x'')}{Prob(y_{it}=0|\mathbf{x}_{it}=x'')} / \frac{Prob(y_{it}=1|\mathbf{x}_{it}=x')}{Prob(y_{it}=0|\mathbf{x}_{it}=x')}\right] = \beta(x''-x')$$
(4)

In Appendix A.1 we elaborate further on these alternative econometric models and report the results of Hausman tests that we use to chose among them. We conclude that the random effects estimators are inconsistent and therefore use the conditional FE logit model.

3.2 Regression results

3.2.1 Emotions and financially worse off

We estimate a fixed effects logit regression in which the dependent variable is the dummy variable that takes the value of one if household *i* is financially worse off at time *t* (and zero otherwise, denoted $F_{it} \downarrow$). Among the set of explanatory variables, in addition to the individual fixed effects (u_i) , we include variables that characterize the household at time t-1. These include the variables that measure emotional well-being. The values for these variables are pre-determined at time *t* when we measure the changes in financial situation. The remaining explanatory variables are year fixed effects (d_t) , a second order polynomial in age, a second order polynomial in year t-1 log income, and dummies for year t-1 health status (denoted $d_{i,t-1}^H$). The second order polynomial in age controls for life-cycle effects. The equation that we estimate is:

$$Prob(F_{it} \downarrow = 1 | \mathbf{x}_{it}, u_i) = F(\text{Diff. face problems}_{i,t-1} \uparrow, \text{Loss of sleep}_{i,t-1} \uparrow, \text{Depressed}_{i,t-1} \uparrow, \text{Age}_{it}, \text{Age}_{it}^2, \text{Income}_{i,t-1}, \text{Income}_{i,t-1}^2, d_{i,t-1}^H, d_t, u_i)$$

The second column of Table VII shows the estimation results. The t-statistics reported below the estimated coefficients are clustered by individual. The first three rows show the estimated coefficients on the emotions variables. Individuals who at time t - 1 report that they were having more difficulties than usual facing problems, are more likely to at time t become financially worse off. Similarly, individuals who at time t - 1 reported that they were losing more sleep due to worry than usual and who were more depressed than usual are more likely to at time t become financially worse off, although for the latter variable the estimated coefficient is not significantly different from zero. The difficulty facing problems variable may measure the ability of individuals to plan for the future. The loss of sleep due to worry may affect individuals' ability to focus and concentrate and make adequate financial decisions.

The estimated coefficients are economically significant: log odds ratios of 0.12 and 0.09 on the difficulty facing problems and loss of sleep variables, respectively. A log odds ratio of 0.09 means that individuals who are losing more sleep due to worry have a 0.09 higher ratio of the probability of being financially worse off, relative to those who are not losing more sleep due to worry. In terms of equation (4) above, x'' corresponds to Loss of sleep \uparrow equal to one and x' corresponds to Loss of sleep \uparrow equal to zero. From Table I the unconditional probability of being financially worse off is 0.24, so that the odds ratio in the population is 0.24/0.76 = 0.32. A 0.09 increase in the log of this ratio to 0.346 implies a probability of being financially worse off of 0.257, or a 7% increase relative to the unconditional mean.⁶

[Table VII here]

One channel through which emotional well-being may affect household finances is through households' spending. For instance, individuals who are having difficulties facing problems may not plan their budget carefully, and are therefore more likely to end up spending too much. Given that most individuals who report being financially worse off cite higher expenditures as the main reason for the change in their financial situation we investigate this channel more carefully.

⁶In this model we cannot report the traditional marginal effects since the estimation does not recover the distribution of the individual fixed effects. Since both the dependent variable and main explanatory variables are zero-one dummies the estimated coefficients (the log-odds ratios) already have a strong economic interpretation as just discussed. But in appendix Table AII we report predicted probabilities for the fixed effects logit model under the assumption that the fixed effects are zero and for a pooled logit model which does not control for unobserved heterogeneity. Both of these calculations fail to correctly adjust for individual heterogeneity which is why we have included them in the appendix, but the predicted probabilities are economically meaningful. For example, an individual who has more difficulties facing problems has a 6% higher probability of being financially worse off than an individual who has no more difficulties facing problems. This corresponds to an increase of 24% in the baseline probability of being financially worse off, computed as the average of the two sets of predicted probabilities that we have calculated in the first row if Table AII, or (38.7% + 9.4%)/2 = 24%.

In the third column of Table VII we report the results of a fixed effects logit regression in which the dependent variables is a dummy variable that takes the value of one if individuals at time t are financially worse off due to higher expenditures (and zero otherwise). Similar to the previous regression the estimated coefficients on the time t-1 difficulty facing problems and loss of sleep variables are significant providing supporting evidence for the higher expenditures channel. Interestingly the coefficients are very similar in the two regressions, indicating that emotions also seem to have an impact on being worse because of other reasons, such as lower earnings.

3.2.2 Controlling for lagged changes in financial situation and expectations

As we have seen in the previous section, in the data there is persistence in household changes in financial situation. An individual who is in a worse off financial situation at t - 1 is more likely to find himself/herself in a worse off financial situation at t. We already include individual fixed effects in the regression to capture persistence, but in column four we further introduce the lagged dependent variable among the set of explanatory variables. The estimated positive and statistically significant coefficient on the lagged dependent variable confirms that individuals who at time t - 1 are financially worse off are again more likely to be financially worse off at time t. More importantly, the estimated coefficients on the time t - 1 emotions variables remain both statistically and economically significant showing that these play a role in future changes in financial situation beyond that of past changes. Furthermore, the estimated coefficients are remarkably similar to those in column two, when we did not include the lagged dependent variable in the regression.

Even though the emotion variables are evaluated at time t - 1, and the outcome variable is measured at time t, there is still a reverse causality concern if individuals at time t - 1 are having difficulties facing problems (or are losing sleep due to worry) due to an expectation of a future deterioration in household finances. That expectation is then realized at time t thus delivering an ex-post correlation between time t - 1 emotions and time t change in financial situation. This reverse causality argument suggests that the estimated coefficients on the emotions variables would be driven by an omitted variable: household expectations. We are able to address this concern directly since the BHPS has information on expectations. In one of the survey questions individuals are asked to look ahead, and to report on how they think they will be financially a year from the date of the survey. The three possible answers are: significantly better off, significantly worse off, or about the same. We will explore household expectations in detail in Section V, but we use them here to tackle the question of whether emotions simply capture the effects of the omitted expectations variable.

In column five of Table VII we report the results from a regression where we also include a dummy variable that takes the value of one if at time t - 1 the individual expected to be worse off at time t. The coefficient on the lagged financial expectation variable is large and highly statistically significant, which speaks to the ability of individuals to form expectations. Recall that we are including individual fixed effects in the regressions, so that the expectation of worse financial situation variable captures time variation in this (and in the dependent variable) for a given individual. In other words, the effects of individuals who always respond that they expect to be worse off are captured by the individual fixed effects.

More importantly when we include the expectations variable the significance of the variables capturing the individuals' emotional condition remains unaffected. Moreover the coefficients on these variables are almost unchanged from the previous specifications. These results show that emotions are a determinant of future changes in household financial situation, beyond the lagged change in financial situation itself and after controlling for expectations, income, age, health status and individual and year fixed effects.

3.2.3 Emotions and financially better off

In the last four columns of Table VII we report the results of regressions that try to explain the role that emotions play in the likelihood that individuals become financial better off $(F_{it} \uparrow \text{equal to one, and zero otherwise})$. One channel through which emotions may affect changes in household finances is through individuals productivity at work and their ability to earn. To investigate this we include regression results specifically for those individuals who are financially better off due to an earnings increase. The emotions dummies take the value of one if at time t-1 the individual reports that he/she has been having less difficulties facing problems than usual (and zero otherwise), if he/she is losing less sleep due to worry than usual, and if he/she is less depressed than usual. As before we include in the regressions individual fixed effects, year fixed effects, a second order polynomial in age, a second order polynomial in year t - 1 income and dummies for health status. The equation that we estimate is: $Prob(F_{it} \uparrow = 1 | \mathbf{x}_{it}, u_i) = F(\text{Diff. face problems}_{i,t-1} \downarrow, \text{Loss of sleep}_{i,t-1} \downarrow, \text{Depressed}_{i,t-1} \downarrow, \text{Age}_{it}, \text{Age}_{it}^2, \text{Income}_{i,t-1}, \text{Income}_{i,t-1}^2, d_{i,t-1}^H, d_t, u_i)$

In column eight we also include the lagged dependent variable, and in column nine we further include a dummy variable to control for lagged expectations.

The estimated coefficients on the emotions variables are consistent across specifications, but they are only statistically significant for the first of the variables considered: individuals who at time t - 1 are having less difficulties facing problems than usual are more likely to at time t be financially better off (and to be so due to an increase in earnings). This suggests that the ability of individuals to address problems and to plan ahead is important not only for keeping household expenditures under control but also in workplace. The estimated coefficients on the other two emotions variables are small and not statistically significant. This suggests that emotions play less of a role in positive changes in financial situation than in negative ones.

The estimated coefficient on the lagged expectations variable is positive and highly statistically significant, but the estimated coefficient on the difficulty facing problems variable is almost unaffected by its inclusion in the regression. As before, the inclusion of individual fixed effects in the regression ensures that the estimated effects arise from variation across time for the same individual.

4 The effects of changes in financial situation on emotions

In this section we study the effects of changes in financial situation on emotions. Therefore the dependent variables are now those that capture emotional well-being at time t. We first discuss the econometric approach that we use.

4.1 Econometric approach

As documented below we were able to identify valid (i.e. strong) instruments for several of the changes in financial situation, so that in this section we estimate instrumental variables regressions. The instrumented changes in financial situation at time t allow us to evaluate the causal effects of such changes on time t emotions.

The main reasons for changes in financial situation are higher/lower earnings and higher/lower expenditures (Table II). We instrument changes in household financial situation due to changes in earnings using regional unemployment rates by age. We expect local unemployment to be correlated with changes in individual earnings while being exogenous to the individual. We obtain unemployment rates for eighteen UK regions and for five different age groups over time from the Office of National Statistics. We then use the information in the BHPS on the location of the household, the age of its head, as well as the year of the survey to merge our household panel data with the year/regional/age unemployment rates. When carrying out this analysis we exclude retirees, which are unlikely to be affected by unemployment shocks.

We use a second set of instruments to capture shocks to changes in financial situation due to changes in expenditures in year t. With equation (2) in mind, we exploit shocks to the price of goods that constitute a large fraction of the household's expenditure. In the BHPS we have information on the amount spent on food at home. The underlying assumption is that when food prices increase households who spend a larger fraction of their income on food are more likely to be financial worse off due to an expenditure shock. Since price shocks are naturally exogenous to the household, they constitute a valid instrument. Food at home has the advantage of being a necessary good, for which the demand elasticity is likely to be very low, so that this mechanism should be particularly strong. The set of instruments is then the year t - 1 share of the household income that is spent on food, the year t food price inflation, and the year t - 1 share of household income spent on food interacted with the year t food price inflation.

As an alternative to the instrumental variables approach we estimate logit regressions with the lagged changes in financial situation as explanatory variables. These variables are pre-determined at time t when we measure emotions. The results are reported in Table AIII of the Appendix and the conclusions are essentially the same. We focus our discussion here on the results from the instrumental variables regressions.

4.2 Results

The outcome variables are whether individual i in year t has been feeling more depressed or unhappy than usual, whether he/she has been losing more sleep than usual due to worry, and whether he/she has been having more difficulties facing problems. For each of these we report the results of regressions for which we instrument for an improvement in financial situation due to an increase in earnings (Earnings_{it} \uparrow) and for regressions where we instrument for a deterioration in financial situation due to an increase in expenditures (Expenditures_{it} \uparrow).

We have also estimated instrumental variables regressions for changes in financial situation due to a decrease in expenditures and due to a decrease in earnings, but for these regressions we could not reject the null hypothesis of weak instruments, so that we do not report them. In all of the regressions we capture individual specific traits with individual fixed effects, and we include a second order polynomial in age, a second order polynomial in year t - 1 income, health status measured at t - 1, and year fixed effects, so that food price inflation is dropped from the regression. We estimate the following six regressions:

$$Y_{it} = \alpha + \beta \times \widehat{X}_{it} + \gamma_1 \times \operatorname{Age}_{it} + \gamma_2 \times \operatorname{Age}_{it}^2 + \gamma_3 \times \operatorname{Income}_{i,t-1} + \gamma_4 \times \operatorname{Income}_{i,t-1}^2 + d_{i,t-1}^H + u_i + d_t + \varepsilon_{it} + \varepsilon_{$$

for each combination of:

$$Y_{it} = \{\text{Dif. face problems}_{it} \uparrow, \text{Loss of sleep}_{it} \uparrow, \text{Depressed}_{it} \uparrow\}$$

and

$$X_{it} = \{ \text{Earnings}_{it} \uparrow, \text{Expenditures}_{it} \uparrow \}$$

where \widehat{X} denotes the instrumented variable and ε_{it} is the residual.

The estimation results in Table VIII show that a deterioration in household finances due to higher expenditures leads to individuals becoming more depressed and to losing more sleep due to worry (second and fourth columns of Table VIII, respectively). The estimated coefficients are economically meaningful, equal to 0.06 in both cases. The coefficient on the higher expenditure variable for the regression explaining difficulties facing problems is not statistically significant. Since the dependent variables are now capturing psychological well-being it is particularly interesting to analyze the importance of health status. The estimated coefficients on the health status dummies are positive and tend to increase with a decline in health. The omitted category is excellent health so that the estimated coefficients measure the additional effect relative to this base case. For instance, the results in column two of Table VIII show that individuals in poor health have a higher probability of becoming more depressed or unhappy than those in excellent health. These effects are in addition to those that may be captured by the individual fixed effects (that capture the persistence in health status).

In the bottom part of the Table we report the results for a test of weak instruments. The Cragg-Donald Wald F statistic is larger than the Stock-Yogo critical value of 10% so that we reject the null hypothesis of weak instruments.

[Table VIII here]

On the other hand, we find much weaker evidence for a causal link between an improvement in financial situation due to an increase in earnings and the household's emotional state. First of all, in this case we only reject the null of weak instruments when we exclude year-fixed effects from the regressions, so those are the results that we report in columns 3, 6 and 8. The only significant coefficient is the one in column 3, referring to the likelihood that the individual becomes depressed after an improvement in financial situation due to an earnings increase. The point estimate is negative and economically large, -0.29. However if we include time fixed effects in this regression, column 4, the coefficient only becomes marginally significant and, as initially explained, we can no longer reject the hypothesis of weak instruments.

Overall these instrumental variable regressions provide evidence in support of the hypothesis that deteriorations in financial situation due to an increase in expenditures have a causal impact on emotional well-being, while improvements due to higher income appear to have a much weaker effect, if any. It would be interesting to explore if the crucial difference is between improvements and deteriorations in household finances, or between changes in expenditures and changes in income. Unfortunately our instruments are only valid for these two particular combinations so that we cannot answer this question. Nevertheless these estimates are important since, when combined with the results in the previous section, they provide empirical support for a potential vicious circle in household finances. A deterioration

in household finances leads to a reduction in emotional well-being which in turn increases the probability of a further deterioration in household finances.

5 Expectations, financial situation and emotions

In the previous sections we have provided evidence on feedback effects between household finances and emotions. As previously mentioned, the BHPS survey also contains information on household expectations. Individuals are asked to look ahead, and to report on how they think they will be financially a year from the date of the survey (significantly better off, significantly worse off, or about the same). However, individuals are not asked to report on the reason for the expectation (earnings, expenditure, etc.). We use the information contained in the answers to the expectations question to study the links between household finances, expectations, and emotions. We first study the relation between changes in financial situation and expectations, before turning our attention to the role of emotions.

5.1 Summary statistics on expectations

Panel A of Table IX reports the unconditional distribution of expectations in our sample. The majority of individuals (almost two thirds) expect their financial situation to remain unchanged over the following year. One in four expect to be significantly better off. And only one in eight expect to be significantly worse off. If we compare these proportions with the distribution of realized changes in financial situation reported in Table I, they suggest that on average individuals appear to be remarkably good at anticipating improvements in financial situation: the average expectation and the average realization are both 24%. On the other hand, individuals appear to under-estimate the probability of becoming worse-off: 12% in expectation versus 24% in realization.

[Table IX here]

Naturally the average aggregate results are only suggestive. In Panel B we compare actual individual financial expectations at time t, with their own subsequent realizations, i.e. realized changes in financial situation at time t + 1. The results reveal a more complex picture than what is suggested by the averages. The first row of Panel B shows that among those individuals who at time t expect to be better off at time t + 1, 45% are indeed better off at time t + 1, 20% are worse off, while for the remainder 35% there is no significant change in their financial situation. Therefore, while the aggregate numbers suggested that individuals are very good at anticipating improvements in their financial situation, we now find that slightly more than half of those who expect their financial situation to improve in the following year, actually later find themselves in the same or in a worse financial situation. And while the aggregate results in Panel A suggested that individuals tend to under-estimate the likelihood that they become worse off, again the results in Panel B show a more complex picture. Finally, among those who expect to find themselves in the same financial situation in the following year, the percentages of those who end up better off and worse off are very similar (17% versus 20%, respectively). Later on we will use this information to construct measures of the accuracy of household expectations and study their determinants.

5.2 The role of emotions and financial situation in expectations formation

In this section we study how financial situation and emotions relate to individuals' expectations.

5.2.1 Univariate analysis

The first row of Table X reports the unconditional distribution of individuals' financial expectations in year t for year t + 1. Panel A reports similar expectations but conditional on the year t change in their financial situation (and the reason for the year t change). A very small proportion of those who are better off at t expect the reasons that led them to be better off to be reversed: only 6% of them expect to be worse off at t + 1 than a t (first row of Panel A). The vast majority of individuals expect to be at least as well off at t + 1, with a considerable proportion of 42% expecting their financial situation to improve even further in the following year.

[Table X here]

In contrast, a more significant proportion (28%) of those who are worse off in year t than in year t - 1 expect this worse financial situation to be a temporary event. This is particularly the case for those individuals who are worse off due to an earnings decrease:

42% of them expect to be better off in year t + 1 than in year t. But even for the group of individuals who are worse off at t due to an earnings decrease, the majority of them expect no change in year t + 1 (44%) or a further worsening of their financial situation (14%).

It is also interesting to note that those who are worse off due to an increase in expenditures tend to be more negative going forward than those who are worse off due to lower earnings: the proportion of those who expect to be even worse off is 32% among the former and only 14% among the latter. These differences are broadly consistent with the results in Table IV on the persistence of the different events, so that they do not necessarily provide evidence of incorrect expectations. This is an issue to which we will return to in section 5.3.

In Panel B of Table X we report the distribution of individuals' financial expectations in year t for year t + 1 conditional on the year t emotional status. Relative to the unconditional mean reported in the first row of Table X, we see that those who are particularly more (less) depressed, or losing sleep due to worry, or having difficulty facing problems, are all more (less) likely to think that their financial situation will deteriorate in the future. Interestingly, the impact of emotions on the likelihood of expecting an improvement in financial situation is more mixed. Those who are more depressed and who are losing more sleep due to worry are more likely to think that their financial situation will improve in the following year (compared to the unconditional mean shown in the first row of Table X), but for those that are less depressed or losing less sleep over worried there is no effect. Also for those that have a higher difficulty facing problems we find the opposite pattern. So, in a univariate analysis, lower emotional well-being is associated with a higher propensity to expect to be financially worse off in the future and in general a increase in the dispersion of individuals' expectations. In the next section we explore how these results change when control for other variables.

5.2.2 Fixed effects logit regressions

In order to study the role that emotions and changes in financial situation play in expectations formation we construct a dummy variable that takes the value of one if individual *i* expects at *t* to be financially worse off at t + 1 and zero otherwise $(E_{it}F_{i,t+1} \downarrow)$, and a similar dummy variable for those who expect to be better off $(E_{it}F_{i,t+1}\uparrow)$. We then estimate fixed effects logit regressions of each of these on time *t* emotions and changes in financial situation. These regressions describe the correlations between time *t* variables. In addition to individual fixed effects, we control for year fixed effects, a second order polynomial in age, a second order polynomial in income and dummies for health status:

 $Prob(E_{it}F_{i,t+1} \downarrow = 1 | \mathbf{x}_{it}, u_i) = F(\text{Diff. face problems}_{i,t-1} \uparrow, \text{Loss of sleep}_{i,t-1} \uparrow, \text{Depressed}_{i,t-1} \uparrow, \text{Age}_{it}, \text{Age}_{it}^2, \text{Income}_{it}, \text{Income}_{it}^2, d_{it}^H, d_t, u_i)$

 $Prob(E_{it}F_{i,t+1} \uparrow = 1 | \mathbf{x}_{it}, u_i) = F(\text{Diff. face problems}_{i,t-1} \downarrow, \text{Loss of sleep}_{i,t-1} \downarrow, \text{Depressed}_{i,t-1} \downarrow, \text{Age}_{it}, \text{Age}_{it}^2, \text{Income}_{it}, \text{Income}_{it}^2, d_{it}^H, d_t, u_i)$

The results are included in Table XI. The second column shows that at times when individuals are having difficulties facing problems, are losing more sleep due to worry or are more depressed, they are also more likely to expect to be financially worse off one year ahead. Similarly, when individuals report an improvement in emotional well-being, they are more likely to expect to be better off one year ahead (fifth column of Table XI). While these are simply correlations between emotions and expectations, they are particularly interesting since in the regressions we are controlling for individual fixed effects. They mean that for the same individual there is time-series variation in emotions that is related to time-series variation in expectations of their financial situation.

[Table XI here]

5.2.3 Instrumental variables regressions

To study the causal effects of changes in financial situation on expectations we use instrumental variables. We make use of the instruments that we have described in the previous section to instrument changes in financial situation, and we remove the emotions variables from the regressions since we do not have instruments for them. We estimate:

$$E_{it}F_{i,t+1} \downarrow = \alpha + \beta \times \widehat{X}_{it} + \gamma_1 \times \operatorname{Age}_{it} + \gamma_2 \times \operatorname{Age}_{it}^2 + \gamma_3 \times \operatorname{Income}_{it} + \gamma_4 \times \operatorname{Income}_{it}^2 + d_{it}^H + u_i + d_t + \varepsilon_{it}$$

where \widehat{X} denotes the instrumented change in financial situation. We estimate a similar equation for $E_{it}F_{i,t+1} \uparrow$ as a dependent variable.

The estimated positive coefficient on the higher expenditures variable reported in the third column of Table XI means that a deterioration in date t financial situation increases the likelihood that individuals expect to be worse off in year t + 1 than in year t. On the other hand, improvements in financial situation due to higher earnings reduces the likelihood that individuals expect at t to be worse off at t + 1 (fourth column).

The last two columns of Table XI report the results for instrumental variables regressions in which the dependent variable is a dummy variable that takes the value of one if individuals expect at t to be better off at t + 1 (and zero otherwise). Consistent with the previous results, a deterioration (improvement) in household finances leads to a reduced (increased) likelihood that individuals expect to be better off again in the following year. These causal effects of changes in financial situation on expectations may simply reflect the persistence of the reasons that led to the change in financial situation. In other words, it may the case that after a deterioration (improvement) in household finances in a given year t individuals become more likely to face a further deterioration (improvement) in the following year t+1, and that the impact of the changes in financial situation on expectations reflect this. We address the issue of the accuracy in households' forecasts next.

5.3 Financial situation, forecasting errors, and emotions

5.3.1 Forecasting errors and changes in financial situation

In order to study the accuracy of households' forecasts and how they are related to changes in financial situation we construct a dummy variable that takes the value of one if the individual i year t expectation for year t + 1 is correct and zero otherwise:

$$E_{it}F_{i,t+1}^{Correct} = \begin{cases} 1 & \text{if } E_{it}\Delta F_{i,t+1} = \Delta F_{i,t+1} \\ 0 & \text{if otherwise} \end{cases}$$

where $\Delta F_{i,t+1}$ denotes the change in financial situation. The expectation is correct if an individual expects at t to be better off/worse off/the same at t+1 and the year t+1 realization of their financial situation is such that he/she is better off/worse off/the same, respectively. Naturally, we do not expect households to have perfect foresight, but we are interested in

studying how the year t change in financial situation affects the accuracy of the forecasts that they make at this time. We regress the dummy variable for correct year t expectations on the year t change in financial situation. As before we make use of the instruments that we have for the latter and we estimate:

$$E_{it}F_{i,t+1}^{Correct} = \alpha + \beta \times \widehat{F}_{it} \downarrow + \gamma_1 \times \text{age}_{it} + \gamma_2 \times \text{Age}_{it}^2 + \gamma_3 \times \text{Income}_{it} + \gamma_4 \times \text{Income}_{it}^2 + d_{it}^H + u_i + d_t + \varepsilon_{i,t}$$

$$E_{it}F_{i,t+1}^{Correct} = \alpha + \beta \times \widehat{F}_{it} \uparrow + \gamma_1 \times \operatorname{age}_{it} + \gamma_2 \times \operatorname{Age}_{it}^2 + \gamma_3 \times \operatorname{Income}_{it} + \gamma_4 \times \operatorname{Income}_{it}^2 + d_{it}^H + u_i + d_t + \varepsilon_{i,t}.$$

where as before \widehat{F}_{it} denotes the instrumented change in financial situation (higher expenditures in the first equation and higher earnings in the second). The results for a worse financial situation due to higher expenditures are shown in the second column of Table XII. The estimated negative coefficient means that the higher expenditures event leads to reduced forecast accuracy. There is however an interesting asymmetry with improvements in financial situation: the estimated positive coefficient in the higher earnings variable means that this event leads to improved forecast accuracy.

[Table XII here]

The correct expectations dummy does not allow us to distinguish between expectations that are inaccurate because individuals expected to be better off than the realization and those that are inaccurate because individuals expected to be worse off than the realization. In order to do so we construct a dummy variable that takes the value of one if at time t the individual expected to be better off than the year t + 1 realized change, and zero otherwise:

$$E_{it}F_{i,t+1}^{Over-optimistic} = \begin{cases} 1 & \text{if } E_{it}\Delta F_{i,t+1} > \Delta F_{i,t+1} \\ 0 & \text{if otherwise} \end{cases}$$

This covers two cases: individuals who expected to be better off at t+1 but the year t+1

realized change is either the same or worse off, and individuals who expected an unchanged financial situation at time t + 1 but the realized change is worse off. Similarly, we construct a dummy variable that takes the value of one if at time t the individual expected to be worse off than their year t + 1 realized change, and zero otherwise:

$$E_{it}F_{i,t+1}^{Over-pessimistic} = \begin{cases} 1 & \text{if } E_{it}\Delta F_{i,t+1} < \Delta F_{i,t+1} \\ 0 & \text{if otherwise} \end{cases}$$

In the fourth and fifth columns of Table XII we regress these dummy variables on the instrumented changes in financial situation, namely on worse off due to higher expenditures. The estimated coefficients are positive and significant in both regressions, so that the higher expenditures event leads to individuals making more inaccurate forecasts in both directions. One possible explanation for these more inaccurate forecasts is that after a deterioration in household finances the uncertainty going forward is particularly high, so that they are more likely to make mistakes in both directions.

In the last two columns of Table XII we report the results for the case of an improvement in household finances due to higher earnings. The negative estimated coefficients imply that such improvement makes it less likely that households make inaccurate forecasts going forward, in either direction. In other words, individuals are better able to assess what an increase in earnings means for their finances going forward.

This contrasts with the fact that we have found that a deterioration in household finances due to higher expenditures leads individuals to make more inaccurate forecasts going forward, with an increased probability that at times individuals expect to be better off than the realized change and at other times they expect to be worse than the subsequent realization. Interestingly, in both cases the largest effect is on the over-pessimistic dummy. In other words, negative changes in financial situation are more likely to increase the frequency of negative forecasting errors than that of positive ones. Symmetrically, positive changes in financial situation tend to correct this by being more likely to reduce the frequency of negative of forecasting errors more than that of positive forecasting errors. This shows that individuals are relatively more (less) likely to become over-pessimistic following a current deterioration (improvement) in financial situation, which is consistent the evidence in Greenwood and Shleifer (2014) for expectations of returns. They show that investors are more likely to expect high (low) returns following positive (negative) return realizations. Kuhen (2015) provides experimental evidence that is consistent with these findings.

5.3.2 The role of emotions

We now explore if expectation errors are related to emotions, and if so what is the nature of that relationship. In order to investigate whether this is the case, we first calculate the errors in expectations as the difference between the expectation dummies and the predicted values from the IV regressions.

$$(E_{it}F_{i,t+1}^{Over-optimistic})_{residual} = E_{it}F_{i,t+1}^{Over-optimistic} - E_{it}\widehat{F}_{i,t+1}^{Over-optimistic}$$

$$(E_{it}F_{i,t+1}^{Over-pessimistic})_{residual} = E_{it}F_{i,t+1}^{Over-pessimistic} - E_{it}\widehat{F}_{i,t+1}^{Over-pessimistic}$$

This gives us the expectation errors that were not explained by changes in financial situation at time t, or the other controls included in the regression. We are interested in learning if the component of these expectations errors that we were not able to capture in the previous regressions is related to the individual's emotional state. We have four sets of expectations errors: expect a better/worse financial situation at t + 1 than the the corresponding realization, given higher expenditures/higher earnings year t events. We regress these (residual) expectation errors on the emotions dummies, controlling for individual fixed effects. Table XIII shows the estimation results.

[Table XIII here]

The second column shows the results for the dependent variable that takes a larger value for larger positive (residual) expectations errors, i.e. being overly optimistic. Individuals who at time t have more difficulties facing problems and who are more depressed are less likely to over-estimate their future financial situation, i.e. less likely to make (inaccurate) forecasts that ex-post turn out to be more optimistic than the actual (future) realization. Similarly, individuals who are less depressed are less likely to at time t have expectations that are overly pessimistic (third column of Table XIII). A similar conclusion emerges when we correlate the expectations errors that arise following an improvement in financial situation due to higher earnings with the emotions variables (last two columns of Table XIII). These results are correlations but they are interesting for two reasons. First, if the expectations errors are purely random they should be uncorrelated with the year t emotions variables. Second, the regressions control for individual fixed effects that capture individual traits. Therefore the results in this section provide evidence that time-series variation in individual emotions is related to the inaccuracy in individual forecasts in a meaningful way.

6 Conclusion

We have used almost two decades of household level panel data to study the main determinants of changes in household finances, how they affect and how they are affected by emotional status. We have found that individuals who have a lower ability to face problems than usual are in the future more likely to be affected by a deterioration in their finances. Furthermore, using an instrumental variables approach we found that those changes in financial situation in turn increase the likelihood that the household will be more depressed or will lose sleep due to worry. Changes in financial situation affect household expectations and in particular the likelihood of them making accurate forecasts. Following a deterioration in household finances due to higher expenditures individuals are more likely to make forecasting errors, while following an improvement due to an increase in earnings they are less likely to make forecasting errors. The forecasting errors are linked to the emotional condition. Our results have important implications for the understanding of the drivers of changes in household finances and expectations.

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Xu, Yilan and Daniel A. Briley, Brent W. Roberts, Jeffrey R. Brown, 2016, "The Genetic and Environmental Pathways between Personality Cognitive Ability and Financial Distress," Working Paper, University of Illinois. Figure 1: Household finances, expectations and emotions



Table I Financial situation.

This table reports the number of observations for which individuals in year t reported that they were financially significantly better off, no significant change, and significantly worse off than in year t-1, for t=1991,...,2008.

Financial situation in year t								
	Better off at t No change at t Worse off at t Tota							
Number of obs.	$28,\!830$	63,695	29,755	$122,\!280$				
Fraction of total	0.24	0.52	0.24	1.00				

Table II Reasons for change in financial situation.

Panel A	Bett	ter off	Panel B	Woi	rse off
<u>Reason better off</u>	# obs.	Fraction	<u>Reason worse off</u>	# obs.	Fraction
Earnings \uparrow	14,080	0.54	Earnings \downarrow	6,206	0.24
Expenditures \downarrow	$3,\!883$	0.15	Expenditures \uparrow	$13,\!530$	0.52
Benefits \uparrow	2,739	0.11	Benefits \downarrow	990	0.04
Inv income \uparrow	749	0.03	Inv income \downarrow	878	0.03
Windfall payment	781	0.03	One-off expend.	513	0.02
Good management	$1,\!310$	0.05			
Other reasons	2,507	<u>0.10</u>	Other reasons	$3,\!672$	<u>0.14</u>
Total better off	$\overline{26,049}$	1.00	Total worse off	$\overline{25,789}$	1.00

This table reports the reasons given by individuals for why they were financially better off (worse off) in year t than in year t-1.

Table IIIReasons for change in financial situation by age and income.

This table reports the reasons given by individuals for why they were financially better off (worse off) in year t than in year t-1 by the age of the household head and by income group. Low (high) income are those in the bottom (top) one third of the distribution of household income at t-1 for that year.

Age group					Iı	ncome grou	ıp
	<u>21-35</u>	<u>36-50</u>	51-65	≥ 65	Low	Medium	High
Panel A:	Change	in finan	icial situ	uation, fr	action of	total	
Better off	0.38	0.27	0.18	0.10	0.17	0.23	0.30
Same	0.38	0.48	0.57	0.68	0.60	0.53	0.46
Worse off	0.24	0.25	0.26	0.22	0.23	0.24	0.24
Panel B: F	Reason f	or bette	er off, as	s a fracti	on of bett	ter off	
Earnings \uparrow	0.66	0.62	0.41	0.05	0.34	0.54	0.63
Expenditures \downarrow	0.13	0.15	0.18	0.18	0.14	0.15	0.15
Benefits \uparrow	0.02	0.03	0.17	0.54	0.31	0.09	0.02
Inv Income \uparrow	0.02	0.02	0.04	0.07	0.03	0.03	0.03
Windfall payment	0.02	0.03	0.06	0.04	0.03	0.05	0.03
Good management	0.06	0.05	0.04	0.04	0.05	0.09	0.05
Other reasons	0.10	0.09	0.10	0.08	0.10	0.04	0.09
Panel C: I	Reason	for wors	se off, as	s a fracti	on of wor	se off	
Earnings \downarrow	0.30	0.28	0.31	0.05	0.11	0.25	0.35
Expenditures \uparrow	0.49	0.48	0.45	0.69	0.64	0.50	0.46
Benefits \downarrow	0.03	0.05	0.04	0.02	0.06	0.04	0.01
Inv Income \downarrow	0.00	0.01	0.04	0.10	0.04	0.05	0.02
One-off expenditure	0.04	0.02	0.01	0.01	0.01	0.02	0.03
Other reasons	0.14	0.16	0.14	0.13	0.14	0.14	0.13

Table IV Persistence in changes in financial situation.

Panel A reports the probability that individuals report a given change in financial situation in year t, conditional on their year t-1 answer, i.e. on whether in year t-1 they reported that they were significantly better off, no significant change, or significantly worse off than in year t-2. Panel B reports the probability that an individual gives the same reason for change in financial situation in year t and in each of the subsequent future years until t+k, for k=1,2,3.

Panel A: Fin. situation in year t conditional on year t-1 response							
	Better off at t	No change at t	<u>Worse off at t</u>				
Better off at t-1	0.44	0.39	0.17				
No change t-1	0.16	0.67	0.17				
Worse off at t-1	0.19	0.37	0.45				
Panel E	Panel B: Probability of consecutive realizations						
Event at t	Repeat at t+1	Repeat at $t+2$	Repeat at $t+3$				
Earnings \uparrow	0.36	0.16	0.07				
Expenditures \downarrow	0.13	0.03	0.00				
Earnings \downarrow	0.18	0.04	0.01				
Expenditures \uparrow	0.33	0.15	0.09				

Table V Emotions.

This table tabulates the answers to the emotions varia
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	Number of obs	Fraction					
Panel A: Depressed							
Not at all	41,291	0.35					
No more than usual	$51,\!526$	0.44					
Rather more	20,232	0.17					
Much more	4,791	<u>0.04</u>					
Total	$11\overline{7,840}$	1.00					
Panel B: Loss o	of sleep due to we	orry					
Not at all	38,357	0.33					
No more than usual	56,926	0.49					
Rather more	17,840	0.15					
Much more	4,069	0.03					
Total	$11\overline{7,192}$	1.00					
Panel C: Diffic	ulty facing proble	ems					
More than usual	9,918	0.08					
Same as usual	$93,\!861$	0.80					
Less so	$11,\!995$	0.10					
Much less	2,025	<u>0.02</u>					
Total	$11\overline{7,799}$	1.00					

Table VISummary statistics.

This table reports the mean for several variables for both the full sample and specific subsamples. The second column reports the mean for all observations, the third (fourth) column reports the means for observations corresponding to individuals who report being better off (better off due to earnings increase) in year t. The fifth (sixth) column reports the means for observations corresponding to individuals who report being worse off (worse off due to expenditures increase) in year t. All variables are measured at t.

Variable	<u>All obs.</u>	<u>Better off</u>	Earnings \uparrow	<u>Worse off</u>	Expenditures \uparrow				
Number of obs.	$126{,}539$	$28,\!830$	14,080	29,755	$13,\!530$				
$\underline{Panel A: Emotions}$									
Diff. face prob. \uparrow	0.12	0.09	0.06	0.18	0.18				
Loss sleep \uparrow	0.18	0.16	0.15	0.28	0.26				
Depressed \uparrow	0.21	0.18	0.16	0.32	0.31				
Diff. face prob. \downarrow	0.08	0.14	0.15	0.08	0.07				
Loss sleep \downarrow	0.33	0.36	0.37	0.26	0.26				
Depressed \downarrow	0.35	0.39	0.40	0.26	0.27				
Panel B: Health status, cost of living, and income									
Excellent health	0.22	0.28	0.32	0.19	0.18				
Good health	0.44	0.45	0.47	0.42	0.42				
Fair health	0.22	0.19	0.17	0.24	0.25				
Poor health	0.09	0.06	0.04	0.11	0.11				
Very poor health	0.03	0.02	0.01	0.04	0.04				
Age	50.4	42.6	37.4	49.3	51.2				
Real total inc (pounds)	22,967	27,584	31,012	$21,\!194$	20,661				
Food exp./Total inc.	0.203	0.170	0.155	0.217	0.222				
Food inflation	0.023	0.021	0.019	0.026	0.027				

Table VII

Logit fixed effects panel regressions for explaining changes in financial situation.

The dependent variables are dummy variables that take the value of one if the individual reports that he/she is financially worse off/better off in year t than in year t-1 and zero otherwise, a dummy variable that take the value of one if the individual reports that he/she is financially worse off due to higher expenditures in year t than in year t-1 (third column), and a dummy variable that take the value of one if the individual reports that he/she is financially better off due to higher earnings in year t than in year t-1 (seventh column). The fourth (eighth) column reports estimated coefficients explaining financially worse off (better off) controlling for being financially worse off (better off) in the previous year. The fifth (ninth) column reports estimated coefficients explaining for year t-1 expectations for the change in financial situation. T-statistics are shown below the estimated coefficients. We include a second order polynomial in age and lagged income, year fixed effects, and health status dummies in all the specifications (coefficients not reported).

	Dependent variable measured at t							
	Worse off	$\operatorname{Exp.}\uparrow$	Worse off	Worse off	$\underline{Better off}$	Earn.↑	<u>Better off</u>	<u>Better off</u>
Emotions at t-1								
Diff. face prob. \uparrow	0.12	0.11	0.11	0.10				
	(3.45)	(2.43)	(3.18)	(2.92)				
Loss sleep \uparrow	0.09	0.11	0.08	0.07				
	(3.21)	(3.08)	(2.84)	(2.44)				
Depressed \uparrow	0.04	-0.01	0.02	0.01				
	(1.39)	(-0.32)	(0.89)	(0.27)				
Diff. face prob. \downarrow					0.10	0.09	0.10	0.09
					(3.20)	(2.19)	(3.08)	(2.54)
Loss sleep \downarrow					-0.01	0.01	-0.01	-0.01
					(-0.52)	(0.38)	(-0.53)	(-0.39)
Depressed \downarrow					-0.01	0.03	-0.01	-0.03
					(-0.52)	(1.10)	(-0.60)	(-1.05)
Lagged dep. variab	ole							
Worse off at t-1			0.15	0.06				
			(7.66)	(2.94)				
Better off at t-1							0.04	0.01
							(2.23)	(0.49)
Expectations at t-1	L							
Exp. worse off at t				0.81				
				(29.34)				
Exp. better off at t								0.71
								(31.65)
<u>Other variables</u>								
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ind. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2nd order age pol.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2nd order inc. pol.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Health status dum.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	$74,\!524$	52,915	$74,\!255$	70,377	71,673	$45,\!936$	71,442	67,942

Table VIIIInstrumental Variables.

The dependent variables are the emotions variables. In the second and third columns the dependent variable is a dummy variable that takes the value of one if in year t the individual reports being more depressed than usual and zero otherwise. In the fourth and fifth column it is a dummy variable that takes the value of one if the individual reports that he/she is losing more sleep due to worry than usual. In the last two columns it is a dummy variable that takes the value of one if the individual reports having more difficulties facing problems than usual. The table reports ordinary least squares panel instrumental variables fixed effects regressions. The instrument used for changes in earnings is the unemployment rate in the region where the household resides for the age group that corresponds to the age the household head. The instruments used for changes in expenditures are the lagged food expenditure to income ratio of the household, the interaction between the lagged food-to-income ratio and food price inflation, and food price inflation. The base case for the health status dummies is excellent health. We report the Cragg-Donald Wald F statistic for weak instruments and the Stock-Yogo test critical value at 10% in parenthesis. We include year and individual fixed effects, a second order polynomial in age and a second order polynomial in lagged income in all the specifications (coefficients not reported).

Instrumented change in	Dependent variable measured at t						
financial situation at t	D	epressed	\uparrow	Loss s	$leep \uparrow$	Diff. face prob. \uparrow	
Expenditure \uparrow	0.06			0.06		0.01	
	(2.02)			(2.16)		(0.67)	
Earnings \uparrow		-0.29	-0.54		-0.16		-0.05
		(-2.51)	(-1.84)		(-1.46)		(-0.54)
<u>Health status at t-1</u>							
Good health	0.00	0.00	-0.01	0.00	0.00	0.00	0.00
	(0.66)	(-0.70)	(-1.17)	(0.54)	(-0.12)	(-0.92)	(-0.71)
Fair health	0.02	0.01	0.01	0.01	0.02	0.01	0.01
	(3.22)	(2.13)	(0.91)	(3.25)	(2.67)	(2.60)	(2.18)
Poor health	0.04	0.02	0.01	0.02	0.02	0.04	0.03
	(5.44)	(2.42)	(0.95)	(3.04)	(2.23)	(7.48)	(5.04)
Very poor health	0.05	0.04	0.03	0.03	0.02	0.06	0.05
	(4.95)	(2.68)	(1.59)	(3.22)	(1.71)	(7.05)	(4.84)
<u>Test for weak instruments</u>							
Cragg-Donald Wald F stat.	103.64	81.96	15.13	103.40	82.06	103.60	82.22
Stock-Yogo crit.val	(11.49)	(16.38)	(16.38)	(11.49)	(16.38)	(11.49)	(16.38)
Other control variables							
Year FE	Yes	No	Yes	Yes	No	Yes	No
Ind. FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2nd order age pol.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2nd order inc. pol.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	93,759	$61,\!224$	61,224	$93,\!622$	$61,\!175$	93,716	61,224

Table IXExpectations: Summary statistics.

Panel A reports the number of observations and proportion of the total for which individuals report that they expect to be significantly better off, significantly worse off, and about the same. Panel B reports the household financial situation in year t+1 conditional on their expectations in year t. The fourth row reports the number of observations for individuals who at time t+1 had a change in financial situation that they did not expect in year t. The last row of the table reports the proportion of individuals who had an unexpected change in their financial situation.

	Panel A: Fin. Expectations at t for t+1					
	Better off	Worse off	No change			
Number of obs.	28,266	$13,\!820$	74,972			
Proportion of total	0.24	0.12	0.64			
	Panel B: C	hange in fin.	situation at t+1 $$			
Fin. expectations at t for $t+1$	Better off	Worse off	No change			
Expect to be better off at $t+1$	0.45	0.20	0.35			
Expect to be worse off at $t+1$	0.12	0.53	0.35			
Expect to be same at t+1	0.17	0.20	0.63			

Table XChanges in financial situation, expectations and emotions.

The first row reports the unconditional mean of the financial expectations variable. Panel A reports household financial expectations in year t for their financial situation in year t+1, conditional on the year t change in financial situation and the reason for the change. Panel B reports household financial expectations in year t for their financial situation in year t+1, for individuals who reported that they were more (less) depressed than usual, for those who reported that they were losing more (less) sleep due to worry, and for those who reported that they had more (less) difficulties facing problems than usual.

Fin. expectations at t for year t					
	<u>Better off</u>	Worse off	No change		
Uncond. mean of fin. expectations	0.24	0.12	0.64		
Panel A: Change in	n fin. situati	ion at t			
Better off at t	0.42	0.06	0.52		
Earnings \uparrow	0.49	0.06	0.46		
Expenditures \downarrow	0.40	0.06	0.54		
Worse off at t	0.28	0.28	0.44		
Earnings \downarrow	0.42	0.14	0.44		
Expenditures \uparrow	0.22	0.32	0.45		
No change at t	0.14	0.07	0.79		
Panel B: En	<u>notions at t</u>				
Depressed \uparrow at t	0.27	0.15	0.58		
Depressed \downarrow at t	0.24	0.10	0.66		
Loss of sleep \uparrow at t	0.28	0.16	0.57		
Loss of sleep \downarrow at t	0.25	0.10	0.65		
Diff. face prob. \uparrow at t	0.22	0.17	0.60		
Diff. face prob. \downarrow at t	0.43	0.09	0.49		

Table XI

Expectations, financial situation and emotions: regression results.

The dependent variables are year t expectations. In the second, third and fourth columns the dependent variable is a dummy variable that takes the value of one if in year t the individual expects to be financially worse off in year t+1 and zero otherwise. In the the last three columns the dependent variable is a dummy variable that takes the value of one if in year t the individual expects to be financially better off in year t+1 and zero otherwise. The table reports logit fixed effects panel regressions (second and fifth columns) and instrumental variables regressions (remaining columns). The explanatory variables include the emotion variables and the variables that measure the change in financial situation at t which is the time at which the expectations are measured. We report the Cragg-Donald Wald F statistic for weak instruments and the Stock-Yogo test critical value at 10% in parenthesis. We include year and individual fixed effects, a second order polynomial in age, a second order polynomial in income and health dummies in all the specifications (coefficients not reported).

	Logit FE	Inst. var.	Inst. var.	Logit FE	Inst. var.	Inst. var.
	Expect at	t to be wors	se off at $t+1$	Expect at	t to be bett	er off at $t+1$
Emotions at t						
Diff. face prob. \uparrow	0.13					
	(3.14)					
Loss sleep \uparrow	0.11					
	(3.21)					
Depressed \uparrow	0.12					
	(3.37)					
Diff. face prob. \downarrow				0.24		
				(7.40)		
Loss sleep \downarrow				-0.01		
				(-0.31)		
Depressed \downarrow				0.07		
				(2.92)		
Change in fin. sit. at t						
Worse off	0.95			0.74		
	(35.22)			(29.88)		
Expenditures \uparrow		0.84			-0.24	
		(30.00)			(-8.16)	
Better off	-0.08			0.62		
	(-2.13)			(27.29)		
Earnings \uparrow			-1.15			0.87
			(-13.05)			(9.70)
<u>Test for weak instruments</u>						
Cragg-Donald Wald F stat.		102.09	14.99		102.09	14.89
Stock-Yogo crit.val		(11.49)	(11.50)		(11.49)	(11.50)
Other control variables						
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Ind. FE	Yes	Yes	Yes	Yes	Yes	Yes
2nd order age pol.	Yes	Yes	Yes	Yes	Yes	Yes
2nd order inc. pol.	Yes	Yes	Yes	Yes	Yes	Yes
Health status dum.	Yes	Yes	Yes	Yes	Yes	Yes
Number of obs.	57,918	92,158	66,892	73,099	92,158	66,892

Table XIIChanges in financial situation and expectation errors.

The dependent variable in the second and third columns is a dummy variables that takes the value of one if the individual had at time t correct expectations for the change in financial situation at time t + 1. In the fourth and sixth columns the dependent variable is a dummy variable that takes the value of one if at time t the individual expected a better financial situation at time t + 1 than the realized change at time t + 1. In the fifth and sixth columns the dependent variable is a dummy variable that takes the value of one if at time t the individual expected a better financial situation at time t + 1 than the realized change at time t time t the individual expected a better financial situation at time t + 1 than the realized change at time t + 1. The table reports estimation results for instrumental variable regressions.

	Expectations measured at t					
	Correct	Correct	Exp. better	Exp. worse	Exp. better	Exp. worse
Instr. variable at t	expect.	expect.	<u>than real.</u>	<u>than real.</u>	<u>than real.</u>	<u>than real.</u>
Expenditures \uparrow	-0.85		0.15	0.69		
	(-8.30)		(2.22)	(7.85)		
Earnings \uparrow		0.89			-0.14	-0.76
		(6.98)			(-1.61)	(-6.83)
<u>Test for weak instruments</u>						
Cragg-Donald Wald F stat.	319.46	12.80	20.05	20.05	12.80	12.80
Stock-Yogo crit.val	(11.50)	(11.51)	(11.50)	(11.50)	(11.51)	(11.51)
Other control variables						
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Ind. FE	Yes	Yes	Yes	Yes	Yes	Yes
2nd order age pol.	Yes	Yes	Yes	Yes	Yes	Yes
2nd order inc. pol.	Yes	Yes	Yes	Yes	Yes	Yes
Health status dum.	Yes	Yes	Yes	Yes	Yes	Yes
Number obs	85,722	$86,\!451$	85,722	85,722	$86,\!451$	$86,\!451$

Table XIIIExpectation errors and emotions.

This table reports the results of ordinary least squares panel fixed effect regressions of expectations errors on emotions. The expectations errors are obtained as the difference between the observed and predicted values calculated using the instrumental variables regressions reported in Table XII. We include individual fixed effects.

	Expend	litures ↑	Earnings \uparrow		
	Over-optimistic	ver-optimistic Over-pessimistic		Over-pessimistic	
Emotions at t					
Diff. face prob. \uparrow	-0.01		-0.02		
	(-1.65)		(-2.26)		
Loss sleep \uparrow	0.00		0.00		
	(0.25)		(-0.18)		
Depressed \uparrow	-0.02		-0.02		
	(-4.42)		(-4.27)		
Diff. face prob. \downarrow		-0.01		0.01	
		(-0.14)		(0.96)	
Loss sleep \downarrow		-0.01		-0.01	
		(-1.53)		(-1.85)	
Depressed \downarrow		-0.01		-0.01	
		(-3.33)		(-3.03)	
Other control variables					
Ind. FE	Yes	Yes	Yes	Yes	
Number of obs.	84,714	84,714	86,451	86,451	

Internet appendix for "Evidence on feedback loops between household finances, expectations and emotions"

Appendix A.1 Econometric specification

We use a standard binary choice model. The outcome variable y_{it} is equal to one if individual *i* in year *t* reports being financially worse off due to higher expenditures (and zero otherwise). We model the:

$$Prob(y_{it} = 1 | \mathbf{x}_{it}, u_i) = F(\mathbf{x}_{it}, u_i)$$
(5)

where \mathbf{x}_{it} is a vector of observable covariates and u_i is an unobserved individual specific effect. Let y_{it}^* be a latent variable determined by the model:

$$y_{it}^* = \mathbf{x}_{it}\beta + u_i + \epsilon_{it} \tag{6}$$

where ϵ_{it} is the residual. Whether individual *i* in year *t* is worse off due to higher expenditures depends on the value of this latent variable

$$y_{it} = 1 \quad if \quad y_{it}^* > 0$$
 (7)

$$y_{it} = 0 \quad if \quad y_{it}^* \le 0 \tag{8}$$

One common approach to modeling the unobserved individual heterogeneity (u_i) is the random effects model. The key assumptions are that: (i) the covariates \mathbf{x}_{it} and the individual effects u_i are independent; (ii) the covariates \mathbf{x}_{it} are exogenous; (iii) u_i has a normal distribution with mean zero and variance σ_u^2 ; and (iv) the outcomes $y_{i1}, y_{i2}, ..., y_{iT}$ are independent conditional on \mathbf{x}_{it} and u_i . We designate this traditional random effects model by **RE1**.

The assumption that the covariates are independent of the individual effects can be relaxed using the Mundlak-Chamberlain approach. In particular we can assume that:

$$u_i = \phi + \overline{\mathbf{x}_i} \gamma + \varepsilon_i \tag{9}$$

where $\overline{\mathbf{x}_i}$ is an average of \mathbf{x}_{it} over time for individual i, and ε_i is assumed to be uncorrelated with γ . This more general random effects model can be estimated by including the average of the covariates alongside the covariates among the explanatory variables. We designate this more general model by **RE2**. An alternative approach to modeling individual heterogeneity that does not require us to make assumptions on how the individual effects are related to the covariates \mathbf{x}_{it} is the fixed effects model:

$$y_{it}^* = \alpha_i + \mathbf{x}_{it}\beta + \epsilon_{it} \tag{10}$$

where α_i denotes the individual fixed effects. This model cannot in general be estimated due to the incidental parameters problem. When T is small the estimates of the fixed effects α_i are inconsistent and through the estimation procedure they contaminate the estimates of the β . One important exception for which it is possible to obtain consistent estimates is the logit model where we specify the function F(.) as the cumulative density function (cdf) for the logistic distribution:

$$F(\mathbf{x}_{it}\beta + u_i) = \frac{exp(\mathbf{x}_{it}\beta + u_i)}{1 + exp(\mathbf{x}_{it}\beta + u_i)}.$$
(11)

The functional form of the cdf for the logistic distribution allows us to eliminate the α_i from the estimating equation. Under this specification the identification relies on the specific functional form of the logistic distribution and uses only the individuals who change state. In other words, the fixed effects are removed from the estimation to avoid the incidental parameters problem, and the analysis is thus conditional on the unobserved u_i which are not estimated. We designate this conditional fixed effects model by **FE**.

The fixed effects logit estimator of β gives us the effect of each element of \mathbf{x}_i on the log-odds ratio:

$$Ln\left[\frac{Prob(y_{it}=1|\mathbf{x}_{it}=x'')}{Prob(y_{it}=0|\mathbf{x}_{it}=x'')}/\frac{Prob(y_{it}=1|\mathbf{x}_{it}=x')}{Prob(y_{it}=0|\mathbf{x}_{it}=x')}\right] = \beta(x''-x')$$

But since we do not know the values for α_i/u_i and their distribution is unrestricted we cannot estimate the individual probabilities or marginal effects.

We consider these three alternative specifications and use a Hausman test to choose between them. More precisely we separately estimate the three models and compare the conditional **FE** model with each of the two random effects models, **RE1** and **RE2**. Under the null of each of the **RE** models the **FE** estimator is still consistent but inefficient. We reject both the null hypothesis that $\hat{\beta}_{RE1} = \hat{\beta}_{FE}$ and the null hypothesis that $\hat{\beta}_{RE2} = \hat{\beta}_{FE}$ with values for the Hausman statistic of 524.88 and 59.60 respectively. Thus we can conclude that the random effects estimators are inconsistent and therefore use the conditional FE logit model. In all the estimations we cluster the standard errors by individual.

Appendix A.2 Predicted probabilities

The estimated coefficients in the fixed effects logit regressions are the log-odds ratios, which contain information on the economic importance of the explanatory variables. In this model we cannot estimate the traditional marginal effects since it does not recover the distribution of the individual fixed effects. In order to obtain additional evidence on economic magnitudes, in table AII we report predicted probabilities for the FE logit model under the assumption that the fixed effects are zero and for the pooled logit model which does not control for unobserved heterogeneity.

We computed the mean predicted probabilities for individuals with two possible values for the dummy variables that measure emotions. The second (third) column of Table AII reports the difference in average predicted probabilities across the two groups for the pooled logit (FE logit) model. The fourth (fifth) column reports this difference scaled by the unconditional mean of the dependent variable. The differences in predicted probabilities are generally economically very meaningful.

Appendix A.3 Predicted probabilities

In Table AIII we report the estimation results of fixed effects logit panel regressions of the emotion variables on lagged changes in financial situation and the reason for the change.

Appendix A.4 Predicted probabilities for the psychological variables

To obtain an alternative measure of the effects of the explanatory variables we have used the estimated regression coefficients to calculate predicted values for the different outcome variables (being depressed, losing sleep due to worry, and difficulty facing problems). As before, we calculate these predicted values using the values for the dependent variables observed in our data. In Table AIV we report the average difference in predicted values for individuals with different values for the dummies. As before we report both raw predicted differences and differences scaled by the unconditional mean of the outcome variables for both a pooled logit model and a FE logit model.

Appendix Table AI Transition probability matrix for change in financial situation, by reason given for change.

This table reports the probability that an individual gives a certain reason for change in financial situation in year t, conditional on the reason given in year t-1. The no change category refers to those individuals who reported no change in financial situation.

	Reason for better off at t			Reaso	No change		
Reason at t-1	Earnings \uparrow	Expenditures \downarrow	<u>Other</u>	Earnings \downarrow	Expenditures \uparrow	<u>Other</u>	at t
Earnings \uparrow	0.36	0.05	0.08	0.07	0.07	0.03	0.35
Expenditures \downarrow	0.18	0.13	0.13	0.05	0.08	0.03	0.4
Better off other	0.13	0.06	0.19	0.04	0.07	0.04	0.47
Earnings \downarrow	0.16	0.02	0.06	0.18	0.13	0.07	0.38
Expenditures \uparrow	0.08	0.03	0.06	0.05	0.33	0.07	0.39
Worse off other	0.09	0.03	0.07	0.07	0.2	0.17	0.37
No change at t-1	0.07	0.02	0.05	0.04	0.09	0.03	0.69

Appendix Table AII Predicted probabilities.

This table reports the impact of the emotions variables on the predicted probabilities calculated using the pooled logit and the FE logit models. The independent and dependent variables correspond to the regressions reported in Table VII. The second (third) column reports the difference in average predicted probabilities across the two groups for the pooled (FE) logit model. The third (fourth) column reports this difference scaled by the unconditional mean of the dependent variable. The last two columns report the results for T-tests of the equality of means.

	Difference High-Low $(\%)$		Diff./Ur	ncond. mean $(\%)$	p-value Diff. $= 0$		
Emotions at t-1	Logit	FE Logit	Logit	FE Logit	Logit	FE Logit	
	Dependent variable at t: Worse off						
Diff. face prob. \uparrow	9.4	2.3	38.7	9.4	0.0	0.00	
Loss sleep \uparrow	9.0	1.8	36.9	7.2	0.0	0.00	
Depressed \uparrow	8.6	1.4	35.5	5.8	0.0	0.00	
		Dependent	variable	at t: Expenditures	5 ↑		
Diff. face prob. \uparrow	5.3	2.2	45.7	18.5	0.0	0.00	
Loss sleep \uparrow	4.5	1.7	38.9	14.6	0.0	0.00	
Depressed \uparrow	4.1	1.0	35.0	8.6	0.0	0.00	
		Depende	ent variab	ole at t: Better off	_		
Diff. face prob. \downarrow	13.3	2.5	56.2	10.6	0.0	0.00	
Loss sleep \downarrow	1.0	-0.2	4.2	-0.8	0.0	0.04	
Depressed \downarrow	1.2	-0.5	5.1	-2.0	0.0	0.00	
		Depende	ent variab	le at t: Earnings ²	1		
Diff. face prob. \downarrow		2.6		21.1	0.0	0.00	
Loss sleep \downarrow		0.0		0.1	0.0	0.86	
Depressed \downarrow		-0.1		-1.0	0.0	0.21	

* The FE Logit predicted probabilities assume that the individual fixed effects are zero.

Table AIIIFixed effects Logit regressions: relation to lagged emotions

In the second column the dependent variables is a dummy variable that takes the value of one if in year t the individual reports being more depressed than usual and zero otherwise. In the third column it is a dummy variable that takes the value of one if the individual reports that he/she is losing more sleep due to worry than usual. In the last column it is a dummy variable that takes the value of one if the individual reports having more difficulties facing problems than usual. The table reports the estimated coefficients from panel logit regressions with individual fixed effects. The T-statistics are shown below the estimated coefficients. We include a second order polynomial in age and lagged income and year fixed effects in all the specifications (coefficients not reported).

	Dependent variable measured at t				
	$\text{Depressed} \uparrow$	Loss of sleep \uparrow	Diff. face prob. \uparrow		
Change in financial situation at t-1					
$\overline{\text{Earnings}} \uparrow$	0.02	0.03	-0.02		
	(0.49)	(0.92)	(-0.39)		
Expenditure \downarrow	-0.04	-0.05	-0.02		
	(-0.79)	(-0.78)	(-0.30)		
Earnings \downarrow	0.12	0.12	0.16		
	(2.79)	(2.60)	(2.88)		
Expenditure \uparrow	0.08	0.10	0.10		
	(2.41)	(2.91)	(2.42)		
<u>Other control variables</u>					
Year FE	Yes	Yes	Yes		
Ind. FE	Yes	Yes	Yes		
2nd order age pol.	Yes	Yes	Yes		
2nd order inc. pol.	Yes	Yes	Yes		
Health status dum.	Yes	Yes	Yes		
Number of obs.	$55,\!643$	$52,\!181$	38,343		

Appendix Table AIV Predicted probabilities for emotions.

This table reports the impact of the different changes in financial situation on emotions. The predicted probabilities are calculated using the pooled logit and the FE logit models. The second (third) column reports the difference in average predicted probabilities across the two groups for the pooled (FE) logit model. The third (fourth) column reports this difference scaled by the unconditional mean of the dependent variable. The last two columns report the results for T-tests of the equality of means.

Change in financial	Differen	ce High-Low (%)	Diff./Ur	ncond. mean (%)	p-valu	e Diff. $= 0$		
situation at t-1	Logit	FE Logit	Logit	FE Logit	Logit	FE Logit		
	$\boxed{ Dependent variable at t: Depressed \uparrow}$							
Earnings \uparrow	-1.9	0.0	-8.9	-0.2	0.0	0.8		
Expenditure \downarrow	0.0	0.0	0.0	0.1	1.0	0.9		
Earnings \downarrow	6.0	0.7	28.2	3.2	0.0	0.0		
Expenditure \uparrow	7.3	0.6	34.4	3.0	0.0	0.0		
	Dependent variable at t: Diff. face prob. \uparrow							
Earnings \uparrow	-4.2	-0.5	-35.2	-3.8	0.0	0.0		
Expenditure \downarrow	1.2	-0.1	9.7	-0.6	0.0	0.7		
Earnings \downarrow	2.6	1.0	21.9	8.0	0.0	0.0		
Expenditure \uparrow	5.5	0.7	46.0	5.9	0.0	0.0		
	Dependent variable at t: Loss sleep \uparrow							
Earnings \uparrow	-0.5	0.1	-2.8	0.4	0.0	0.5		
Expenditure \downarrow	0.2	0.0	0.9	-0.1	0.3	0.9		
Earnings \downarrow	5.6	0.6	30.3	3.3	0.0	0.0		
Expenditure \uparrow	6.6	0.7	35.7	4.0	0.0	0.0		

* The FE Logit predicted probabilities assume that the individual fixed effects are zero.