Oxford Economic Papers, 67(3), 2015, 826–845
doi: 10.1093/oep/gpv030
Advance Access Publication Date: 31 March 2015

OXFORD

Who cares about stock market booms and busts? Evidence from data on mental health

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Abstract

This article investigates the association between stock market activity and mental well-being, exploiting the availability of interview dates in the British Household Panel Survey to match changes in the FTSE 100 stock price index to respondents over the period 1991–2008. We present evidence that annual changes in the price index are associated with better mental well-being whilst greater uncertainty, proxied by volatility in the price index, is associated with poorer mental well-being—even after controlling for macroeconomic conditions. Our findings provide support of a wealth mechanism and also suggest that the stock market is a barometer of economic prospects and/or social movements and mood.

JEL classifications: J26, D12

1. Introduction

Subjective well-being data are increasingly used to inform public policy in the UK, where the government has launched a program to measure national well-being. To this end, the Office for National Statistics since 2011 routinely collects measures of subjective well-being in the large-scale Integrated Household Survey (IHS), including 'Overall, how satisfied are you with your life nowadays? Overall, how happy did you feel yesterday? Overall, how anxious did you feel yesterday? Overall, to what extent do you feel the things you do in life are worthwhile?'. A recent government paper also considers the possibility of evaluating social costs and benefits on the basis of subjective well-being data, thereby complementing more traditional preference-based approaches (Fujiwara and Campbell, 2011). Stemming from concerns that traditional measures of living standards, for example, GDP *per capita* figures, do not adequately reflect economic and social progress, well-being is now also firmly at the centre of international

policy discussions in measuring economic performance and social progress following the Commission on the Measurement of Economic Performance and Social Progress (Stiglitz *et al.*, 2009).

This article uses data on mental well-being to document an apparent widespread concern about the performance of the stock market, and shines further light on why people appear to care about stock market activity. A natural starting point when contemplating why stock market performance might correlate with mental well-being is to consider a wealth mechanism. For example, unexpected movements in stock prices have the potential to generate sizeable wealth shocks for stockholders. If the only consequence of large stock price movements is a change in financial wealth, a pure wealth mechanism emerges whereby the well-being of stockholders moves together with the stock market.

In addition to a pure wealth mechanism, stock market booms and busts may correlate with mental well-being because the stock market is a key indicator of macroeconomic performance. This raises the possibility that stock market activity correlates with perceptions of economic prospects and/or uncertainty and suggests that stock market movements may correlate with mental well-being regardless of stockholder status.

Finally, reverse causality may produce a correlation if social movements and mood influence stock market activity (Shiller, 1984; Prechter and Parker, 2007). To the extent that opinions and feelings spread throughout society, this possibility also implies that stock markets and well-being move together irrespective of stockholder status.

The recent stock market crash has spurred a growing literature on the impact of large declines in stock prices on individual behaviour and well-being (Coile and Levine, 2011; Goda *et al.*, 2011). Studies investigating links between the stock market crash and subjective measures of mental health and well-being consistently document a fall in well-being after the crash but provide conflicting accounts of who appears to care most about the sudden downturn. For instance, Deaton (2012) presents evidence indicating that the well-being of persons least likely to own stocks is most sensitive to stock prices during the crisis. In contrast, McInerney *et al.* (2013) find that the effects of the crash are confined to stockholders with sizeable asset holdings. Such differences matter because differential sensitivity to stock market activity is the key to understanding which mechanism underpins co-movement in stock market activity and well-being.

Our contribution in this article is threefold. Firstly, we use individual-level panel data over the period 1991-2008 to document an association between stock market performance and mental well-being under more general stock market conditions. Moreover, we assess the potential role of stock performance on well-being over and above other macroeconomic conditions often used in the literature, for example, see the seminal paper by Di Tella *et al.* (2003). Second, we investigate broader measures of stock market activity on mental well-being, including dividend payments, return risk, and proxies of uncertainty, with our results indicating that greater uncertainty is detrimental to mental well-being. Third, we show that differences in previous research may be explained by the extent to which proxies of stockholder status correlate with labour market outcomes. For example, we show that whilst there is a wealth effect, the stock market is also a barometer of economic prospects, with the latter effect observed where proxies of stock holder status are also indicators of labour market success.

The remainder of this article is structured as follows. The next section discusses how it might appear that people care about the stock market, Section 3 discusses our empirical approach and data, Section 4 discusses our results, whilst Section 5 concludes.

2. Links between the stock market and mental well-being

2.1 A pure wealth effect

Fluctuations in stock prices in recent years have been large and arguably largely unexpected. Hence, increases in stock prices may produce positive wealth shocks for stockholders, which suggests a positive correlation between stock prices and their well-being. Specifically, a pure wealth mechanism implies the only relevance of stock price movements for stockholder's well-being is through an effect on asset prices and wealth. Moreover, since non-stockholders without plans to own equities are unaffected when stock prices rise, whilst non-stockholders aspiring to own equities may experience negative wealth shocks, a pure wealth mechanism suggests a negative (if any) correlation between stock market performance and the well-being of non-stockholders.

A literature on the relationship between economic resources and well-being suggests that material circumstances are important, and specifically that wealthier individuals report higher levels of well-being (see, for example, Heady and Wooden, 2004). However, few papers are able to exploit exogenous variations in economic resources, with notable exceptions using lottery winnings (Gardner and Oswald, 2007) and political changes (Frijters *et al.*, 2004). A pure wealth mechanism suggests variations in stock prices may be tantamount to exogenous changes in the wealth of stockholders and aspiring stockholders, thus providing another avenue through which the effect of wealth on well-being can be analysed.

Existing research provides mixed evidence of a pure wealth (or any wealth) effect. For example, using Gallup Survey data, Deaton (2012) presents time-series plots of daily averages in satisfaction with living standards by household income level, which indicate a greater sensitivity of the satisfaction of non-stockholders (as proxied by low-income households) to the recent financial crisis. On the other hand, using information on financial assets, McInerney *et al.* (2013) find that the observed decline in reported mental health is largely driven by persons with sizeable equity wealth holdings.

2.2 A barometer of economic prospects, social movements, and social mood

In addition to possible wealth effects, other phenomena might induce a correlation between stock market activity and mental well-being. For example, stock prices may provide a barometer of economic prospects, social movements, and social mood. A key feature of these scenarios is the suggestion of a positive association between stock market performance and mental well-being that is independent of stockholder status. The following separates the discussion of economic prospects from social movements and mood, because they differ with respect to the direction of causality. In particular, the former suggests stock prices influence mental well-being, whereas the latter suggests societal well-being influences stock prices. In practice, feedback effects are also likely to exist, for example, societal well-being may worsen in response to a bleak economic outlook and stock prices may decline following reduced societal well-being. Trying to separately identify these scenarios in an empirical context poses significant challenges that we are not able to address in this article.

2.2.1 Economic prospects

The demand for a firm's stock by any investor is the outcome of a forwards-looking assessment of that firm's prospects, and the stock market aggregates of these demands, such that the prevailing stock price provides a consensus view of that firm's future profitability.

Stock market indices, such as the FTSE 100, provide similar summaries for groups of firms listed on the stock exchange. Hence, the stock market reflects concerns held by market participants about macroeconomic conditions and prospects, and as such, may shape individual perceptions of economic prospects and/or uncertainty. In particular, people may feel more confident about economic prospects and upwardly revise their income expectations during stock market booms, or people may feel more uncertain about economic prospects as stock markets become more volatile. In turn, revisions to income expectations and uncertainty would influence consumption and leisure decisions, suggesting that any correlation between stock prices and well-being might disappear once changes in consumption and leisure are taken into account. That said, events that arguably influence confidence and/or uncertainty over economic prospects, such as job loss or long-term ill health, produce larger-than-warranted declines in reported financial well-being (Pudney, 2011), suggesting a correlation may persist. Di Tella *et al.* (2001, 2003) and Charles and DeCicca (2008) also document negative effects of increased risk of job loss, as measured via unemployment rates in national or local labour markets and well-being. Since these authors control for personal economic circumstances in their analysis, their findings suggest that perceptions of economic confidence and/or uncertainty may directly affect well-being.

According to the efficient market hypothesis (Fama, 1970), stock prices reflect 'all available information' relevant to firm performance and profitability, and hence stock market movements are unpredictable. This implies that if it were possible to construct and control for 'all available information' in our analysis, stock prices would have no effect on mental well-being. This need not diminish the role of the stock market given that stock prices are likely to be the most readily accessible source of information for most people, with the FTSE 100 stock price index reported daily in television news bulletins, in newspapers and online. On the other hand, a correlation may still be observed even if we could take into account 'all available information'. For example, media reporting of stock prices may induce focussing effects (see, for example, Kahneman *et al.*, 2006), with exposure to news of economic performance increasing the salience of economic conditions in evaluations of well-being. A recent crop of papers also suggest that expectations over future stock market performance are shaped by recent history (Hurd *et al.*, 2011; Hurd and Rohwedder, 2012), which raises the possibility that how people process and interpret stock market activity may differ from rationality. For example, feedback effects—from which high prices generate enthusiasm and raise expectations of even higher prices—might operate (Shiller, 2003), or people may believe that stock markets convey unique signals of economic prospects.

Finally, at any point in time stock prices may not reflect 'fundamental values'. Well-documented market anomalies include, for example, the day of the week effect (Harris, 1986), the January effect (Rozeff and Kinney, 1976), and the tax-loss selling hypothesis (Reinganum and Shapiro, 1987). If stock prices matter only insofar as they convey information on 'fundamental values', the existence of market anomalies simply creates measurement error and biases estimates towards zero. If focussing effects or extrapolative expectations matter, stock prices may influence well-being irrespective of whether they provide an accurate reflection of 'fundamental values' on any particular day.

Murgea and Reisz (2012) investigate the association between stock prices, the Chicago Board Options Exchange Volatility Index (VIX), and well-being, taking the view that as stock options are more valuable in uncertain times, the VIX is a proxy of uncertainty. Indeed, they find evidence of a positive correlation between stock prices and well-being,

with a negative association for the VIX, though neither effect is statistically significant when both terms are simultaneously considered.

2.2.2 Social movements and moods

Given the difficulty in valuing speculative assets, it is often argued that stock prices may be subject to 'social movements' (Shiller, 1984) or 'social mood' (Prechter and Parker, 2007). When investors lack definitive evidence on the value of stocks, their own appraisals may be influenced by the opinion of others. The spread of opinions, via human contact and to a lesser extent other media, generate social movements that are manifested in stock market activity. Similarly, psychological evidence suggests that emotions and mood matter in decision making, particularly for complex decisions involving risk and uncertainty (see Nofsinger, 2005; Olsen, 2006, for reviews). The social mood hypothesis suggests that when faced with uncertainty, people unconsciously herd so that social mood (i.e., feelings of optimism and pessimism) may spread via herding behaviour and influence stock market activity (Prechter and Parker, 2007). In summary, the stock market may provide a reflection of how people feel as opposed to influencing how people feel.

What drives the formation and changes in opinion and mood? Whilst these may be tied to a particular event, they may also arise spontaneously (Shiller, 1984; Olsen, 2006). This suggests that stock markets may react to feelings of economic insecurity, and in addition, a plethora of circumstances unrelated to economic conditions, such as sporting events (Edmans *et al.*, 2007), the weather (Saunders, 1993), seasonal affective disorder (Kamstra *et al.*, 2003), and terrorist attacks (Glaser and Weber, 2005). Nevertheless, evidence presented in Dowling and Lucey (2008) suggests a weaker role of investor mood in the determination of UK stock prices.

3. Methods and data

3.1 Empirical model

We begin by providing a general description of how stock price movements correlate with mental well-being, initially estimating the following equation:

$$H_{idwt} = \alpha \%\Delta FTSE_{id_{-1}wt} + \beta' z_{idwt} + \theta_d + \theta_w + \theta_t + v_{idwt} \quad (1)$$

where H_{idwt} is a measure of the mental well-being of individual i, on a particular interview day d, in a given survey week w and year t, hence dwt is the interview date. $\%\Delta FTSE_{id_{-1}wt}$ corresponds to the percent change in FTSE 100 stock price index over a given period (excluding the day of interview).[1] Specifically, for any given day d, we calculate the percent change in the stock market as:

$$\%\Delta\, FTSE_d = \frac{FTSE_{d_{cv}} - FTSE_{d-k_{ov}}}{FTSE_{d-k_{ov}}} \quad (2)$$

where $FTSE_{d_{cv}}$ is the closing value on day d and $FTSE_{d-k_{ov}}$ is the opening value on day d–k, which could represent one day or up to one year earlier. Only $\%\Delta\ FTSE_{d-1}$ is

1 We have also analysed changes in the FTSE All Share price index and find similar results.

matched to individuals interviewed at day d to rule out the possibility that current mood levels influence our measure of stock market activity (although we note that mood levels are likely to correlate across days).[2] Initially, we investigate the influence of high (1 day, 1 week, and 4 weekly) and low frequency (26 and 52 weekly) changes in the index (respectively denoted %ΔFTSE (1 day), %ΔFTSE (1 week), %ΔFTSE (4 week), %ΔFTSE (26 week) and %ΔFTSE (52 week)) on mental well-being.

We focus on percent changes in the stock market index, as opposed to its level, because the latter specification may produce a meaningless regression given that the FTSE contains a unit root, that is, drifts over time, and well-being is stationary, that is, has a constant mean.[3] This problem was first noted in the seminal paper of Di Tella *et al.* (2003), where as a consequence, much of their analysis conditioned happiness levels on the growth rate of trended macroeconomic variables, such as GDP and inflation. Moreover, a focus on percent changes retains the principle of diminishing marginal returns to wealth. For example, an annual growth rate of 4% implies that someone with £10,000 of equity wealth increases their holdings by £400 at the end of the year. This figure rises to £2,000 for someone whose initial investment is £50,000. Should the growth rate increase by 1 percentage point to 5%, the former individual will see their assets grow by an additional £100 (from £400 to £500), whilst the latter individual will see their assets grow by an additional £500. Thus our empirical specification is consistent with diminishing marginal returns to wealth since a larger increment in wealth is required to improve the well-being of the latter (wealthier) individual. Whilst taking the log of the stock price index also ensures diminishing marginal returns to wealth, it would also be a trended variable.

Finally, the vector z contains plausibly exogenous demographic characteristics such as age, household composition, education level, and region of residence. It also contains variables likely to be correlated with wealth shocks and/or economic conditions, such as labour market outcomes, and economic resources. The inclusion of these latter variables improves statistical precision with little impact on the size of estimated coefficients. All specifications include dummy variables to capture the day of the week (θ_d), the survey week θ_w) and the survey year θ_t). Finally, v_{idwt} is a random error term, clustered by individual and date of interview. Two-way clustering of the standard errors is important because we match daily price movements to the date that the individual is interviewed and therefore need to take into account possible clustering at the level of aggregation of our explanatory variable, that is date of interview (dwt in terms of eq. (1)) in addition to individual-level clustering.

2 For individuals interviewed at the weekend (just over 10% of the sample), we match the same values to respondents interviewed on the Friday preceding the weekend to respondents interviewed on the Saturday and Sunday.

3 Details of the unit root tests are available from the authors on request. Whilst we could estimate a model in differences to remove the unit root problem, this approach may also be problematic since well-being is stationary and 'over-differencing' is likely to generate a non-invertible moving average process in the disturbance terms, v_{idwt}, which will no longer be white noise (see Plosser and Schwert, 1977).

3.2 Data

Data are taken from the British Household Panel Survey[4] (BHPS) between 1991 and 2008. The BHPS is a nationally representative survey of 5,500 households[5] (over 10,000 individuals) that collects wide ranging socio-economic and demographic information on household members.

BHPS interviews begin on 1 September each year with around 85% of interviews completed by early November. The General Health Questionnaire (GHQ), which is a clinically validated screening instrument for non-psychotic psychiatric illness (Goldberg, 1972), and is frequently used to assess mental distress (see *inter alia* Clark, 2003; Gardner and Oswald, 2007) appears in the self-completed questionnaire administered to all household adults. It has 12 items, which are as follows: 'Here are some questions regarding the way you have been feeling over the past few weeks. Have you recently . . .' (1) 'lost sleep over worry?', (2) 'felt constantly under strain?', (3) 'felt you couldn't overcome your difficulties?', (4) 'been feeling unhappy or depressed?', (5) 'losing confidence in yourself?', (6) 'been thinking of yourself as a worthless person?', (7) 'been able to concentrate on what you are doing?', (8) 'felt that you were playing a useful part in things?', (9) 'felt capable of making decisions about things?', (10) 'been able to enjoy your day-to-day activities?', (11) 'been able to face up to your problems?', and (12) 'been feeling reasonably happy, all things considered?'. For each item individuals can select one of four answers to indicate the prevalence and intensity of problems, and answers can be aggregated to produce a 0–36-point Likert index of mental well-being. In our analysis higher GHQ scores indicate better psychological health.

Data on the FTSE 100 stock price index are obtained from Thomson Reuters Datastream and have been adjusted for inflation using the OECD's consumer price index (CPI). Figure 1 plots annual changes in the stock price index over the period analysed, which covers two boom and bust phases (late 1990/early 2000 and mid-2000/late 2000) in the stock market. An earlier version of this article provides specific details of the construction of all stock market variables, our proxy of stockholder status, and our checks on how randomly allocated interview dates are. Summary statistics for our sample are presented in Table 1.

4. Results

4.1 The correlation between stock prices and mental well-being

Table 2, Panel A presents various estimation results documenting a correlation between stock market activity and mental well-being. For brevity we report only the estimated coefficient on stock price terms (a selection of extended results are available in Table A1 in the Appendix), and we multiply coefficients/standard errors on stock market variables by 100

4 University of Essex. Institute for Social and Economic Research, British Household Panel Survey: Waves 1–18, 1991–2009 [computer file], 7th edn. Colchester, Essex: UK Data Archive [distributor], July 2010. SN: 5151.

5 To maintain representativeness of the British population, sample members are followed over time even as they change address and/or form new households. If sample members form new households, all adults in these households are also interviewed. Furthermore, children of household members are interviewed once aged 16. Note that booster samples for Scotland and Wales are added in 1999 and in 2001 for Northern Ireland, but we restrict attention to original sample members.

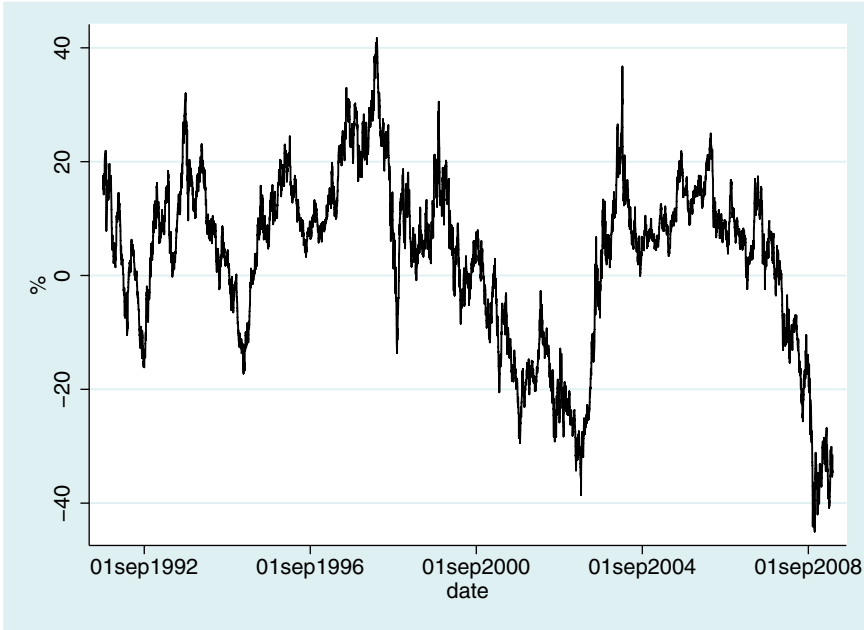

Fig. 1. Annual changes in FTSE 100 stock price index
Source: Thompsom Reuters Datastream

for presentation. Columns (1)–(3) report estimated correlations between high-frequency changes in the stock market and mental well-being whilst columns (4) and (5) report estimated correlations for low-frequency changes. There is no discernible correlation between high-frequency changes in the stock price index and mental well-being despite widespread reporting of daily changes in the FTSE 100 stock price index in the media. On the other hand, low-frequency changes correlate with mental well-being. Column (4) indicates that a 1 percentage point increase in the percent change in stock prices across a half yearly period is associated with a 0.0071 unit increase in GHQ scores. Column (5) indicates that when a percentage point increase occurs over the longer period of one year, the increase in the GHQ is 0.0068 unit. Given the average yearly change in stock prices in our sample is 3.9%, this change amounts to less than 1% of the mean GHQ score.[6] By taking the ratio of the coefficients reported on stock prices and monthly household income, as reported in Table A1, it can be seen that the economic magnitude stemming from fluctuations in stock market returns is around 3% that of monthly household income.

One reason we fail to document a correlation between low-frequency movements in the stock market and mental well-being is that day-to-day activity in the stock market may go unnoticed by those without a keen interest in stock prices unless representing very unusual activity. For example, usually very sharp increases/declines or sustained positive/negative outcomes generates intense media scrutiny. This suggests potential non-linearities in the

6 We have also explored how this observed correlation changes across different lags and leads in stock market activity. There is evidence of a stronger correlation between stock market values measured prior to the interview date. Details are available upon request from the authors.

Table 1. Summary statistics

	Mean	SD	Min	Max
GHQ	24.9	5.37	0	36
% Δ FTSE (1 day)	−0.02	1.45	−9.71	8.96
% Δ FTSE (1 week)	−0.13	2.87	−21.0	18.3
% Δ FTSE (4 week)	−0.50	5.44	−27.2	18.7
% Δ FTSE (26 week)	−0.70	11.1	−38.8	35.0
% Δ FTSE (52 week)	3.89	14.6	−45.0	40.3
Dividend return (52 week)	6.93	1.22	4.14	9.93
SD(% Δ FTSE (52 week))	7.40	2.30	2.36	16.8
SD(% Δ FTSE (1 day))	1.12	0.75	0.33	5.21
SD(FTSE)	239	129	74.7	716
Gousehold head	0.50	0.50	0	1
Female	0.54	0.50	0	1
Age	43.2	16.8	16	79
Partner	0.68	0.47	0	1
Divorced/separated	0.07	0.25	0	1
Single	0.20	0.40	0	1
2 adults	0.56	0.50	0	1
3 adults	0.18	0.39	0	1
4 + adults	0.12	0.32	0	1
1 child	0.13	0.33	0	1
2 children	0.12	0.32	0	1
3 + children	0.04	0.20	0	1
Kids aged 0–4	0.13	0.34	0	1
Kids aged 5–11	0.15	0.36	0	1
Kids aged 12–15	0.10	0.29	0	1
High ed	0.48	0.50	0	1
Medium ed	0.25	0.43	0	1
Self-employed	0.08	0.26	0	1
Employed	0.55	0.50	0	1
Unemployed	0.04	0.19	0	1
Student	0.06	0.23	0	1
Long-term sick	0.03	0.18	0	1
Retired	0.16	0.37	0	1
ln(weekly work hours + 1)	2.17	1.75	0	4.61
ln(monthly household income)	7.57	0.78	0	11.20
interest/dividend < £100	0.20	0.40	0	1
interest/dividend £100–999	0.21	0.41	0	1
interest/dividend >= £1,000	0.07	0.26	0	1
Homeowner	0.75	0.43	0	1
ln(house value + 1)	8.57	4.97	0	15.8
Saver	0.42	0.49	0	1
ln(monthly savings + 1)	1.77	2.24	0	9.22
Weekday (Monday = 1)	3.17	1.70	1	7
Survey week	7.01	4.42	1	39
Survey year	1999	5.15	1991	2008

Notes: Sample comprises 142,265 observations. Base categories are non-household head, male, widowed, one household adult, no children, low education, other labour market status, no interest/dividend, non-homeowner, non-saver.

Table 2. FTSE 100 stock price index and mental well-being

	% Δ				
	1 day (1)	1 week (2)	4 week (3)	26 week (4)	52 week (5)
Panel A					
FTSE	−0.20	0.18	0.28	0.71**	0.68**
	(0.98)	(0.53)	(0.33)	(0.33)	(0.31)
Panel B					
Large positive Δ FTSE	0.04	0.14	−0.07	0.38**	0.33*
	(0.08)	(0.09)	(0.09)	(0.15)	(0.17)
Normal positive Δ FTSE	0.03	−0.06	0.06	0.16	0.19*
	(0.06)	(0.07)	(0.07)	(0.10)	(0.10)
Normal negative Δ FTSE	0.05	−0.01	−0.04	0.05	0.06
	(0.06)	(0.07)	(0.06)	(0.09)	(0.08)

Notes: Standard errors clustered by individual and interview date. Dependent variable: GHQ score (0 = very poor mental health, 36 = excellent mental health). Columns are multiplied by 100 for presentation. See Section 3.1 for details of empirical specification. The base category for dummmy variables presented in Panel B is very 'large' negative changes in the stock price index. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$.

association between stock prices and mental well-being. Indeed, as Panel B of Table 2 shows, large positive changes in the FTSE have a large (and statistically significant) influence on mental well-being relative to large negative changes in the FTSE. However, we find little evidence that negative changes of more typical values have any differential effect on mental well-being compared to large negative changes.[7]

We now explore which components of the GHQ are most affected by the stock market, as in Metcalfe *et al.* (2011) who examine the role of the terrorist attacks of 11 September 2001 on mental well-being. To investigate whether certain GHQ items are particularly sensitive to stock market performance, we create dummy variables for each item to indicate a lack of symptoms as detailed from questions given in Section 3.2 (i.e., no problems with sleep, no problems in feeling happy). Clearly, there is a degree of overlap between the ONS measures in the IHS (as detailed in Section 1) and some of the elements of the GHQ provided in the BHPS. Table 3 suggests that four items appear to be important drivers of the observed correlation in stock market activity and mental well-being. Individuals appear to experience less unhappiness/depression, feel more confident, and are capable of making decisions and facing their problems in times of rising stock markets. For example, based on a 1 standard deviation increase in % Δ FTSE (52 week) (see Table 1), the probability that the individual does not experience problems of feeling unhappy/depressed increases by almost 1 percentage point.[8]

4.2 The role of other stock market metrics

Changes in stock prices is only one of several indicators of stock market performance. In this sub-section we investigate whether other stock market metrics are correlated with

7 We define 'large' changes as being at least 1.75 standard deviations from the mean calculated over the period 1988–2012. We are unable to use 2 standard deviations from the mean because very few people in our BHPS sample are faced with 'large' annual changes in stock prices.

8 Based on the calculation $100 \times 0.0006 \times 14.6 = 0.88$.

Table 3. Which component of GHQ?

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A	**Not experiencing problems with or feelings of:**					
	Sleep loss	Under strain	Overcoming difficulties	Unhappy/ depressed	Confidence loss	Loss of self-worth
% Δ FTSE (52 week)	−0.01	0.02	0.03	0.06**	0.04**	0.02
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
Panel B	**Not experiencing problems or difficulties with:**					
	Concentration	Role in life	Making decisions	Enjoying activities	Facing problems	Feeling happy
% Δ FTSE (52 week)	0.03	0.03	0.04**	0.03	0.04**	0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)

Notes: See notes to Table 2. Dependent variable equals 1 if no problems are reported for that GHQ item. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

mental well-being. For example, the total return on investments comprises both changes in stock prices and dividend payments. In addition, stock market investments carry risk, usually measured as the spread of returns around the mean (see Elton *et al.*, 2007). We therefore add a proxy of the dividend return over the past year (i.e., the dividend as a percentage of the original price) which we denote 'dividend return (52 week)' and a proxy of risk faced on investment returns using the dispersion of annual returns over the past year (denoted SD(% Δ FTSE (52 week))).

In addition to 'return' metrics, we also consider 'uncertainty' metrics. As noted in Haddow *et al.* (2013), changes in the index may proxy changes in economic prospects whilst stock market volatility may proxy changes in uncertainty with respect to those prospects. As our first proxy of uncertainty, we consider the standard deviation of daily returns over a four-week period (denoted SD(% Δ FTSE (1 day))), which is used to measure volatility in Schwert (1989), amongst others. His analysis suggests that this measure of stock price volatility increases during periods of recessions. Moreover, SD(% Δ FTSE (1 day)) is also highly correlated with the FTSE 100 Implied Volatility Index (FTSE IVI), which is the UK counterpart of the VIX. Whilst measures based on stock options such as the VIX and FTSE IVI are typically used as proxies of uncertainty (see Murgea and Reisz, 2012; Haddow *et al.*, 2013), the FTSE IVI is only available from 2000. Figure 2 shows how SD(% Δ FTSE (1 day)) and FTSE IVI compare with each other and how they relate to annual changes in the stock market price index. For ease of comparison, we demean and normalize each series by its standard deviation, so plotted values reflect the number of standard deviations away from the mean for any realization of SD(% Δ FTSE (1 day)) or FTSE IVI. We refer to values exceeding 2 standard deviations from the mean as spikes in activity. Both series spike following sharp declines in the stock price index, with spikes observed in late 1998, late 2001, mid- to late 2002/early 2003, and late 2008/early 2009. Sharper spikes are also observed for SD(% Δ FTSE (1 day)) compared with FTSE IVI.

We also consider an alternative proxy of uncertainty, incorporating a more extensive history of stock market activity. Specifically, we construct the standard deviation of the stock price index over the past year (denoted SD(FTSE)). Figure 2 indicates SD(FTSE)

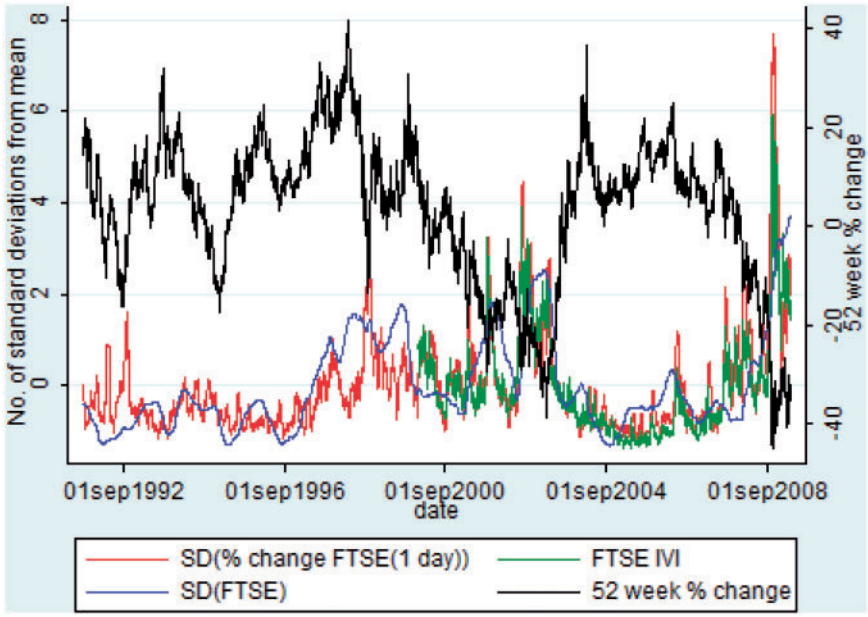

Fig. 2. Proxies of economic uncertainty
Source: Thompsom Reuters Datastream.

spikes once in late 2002/early 2003, towards the end of a prolonged stock market decline, and once at the onset of the recent financial crisis. Spikes in SD(FTSE) appear to capture unusual periods in stock market activity that coincide with high levels of uncertainty and gloominess about the future, with such periods attracting significant media attention.

Results are presented in Table 4. In columns (1) and (2) there is little evidence that neither dividends nor investment risk are correlated with mental well-being. Whilst increased uncertainty, measured via volatility in daily returns, is negatively associated with mental well-being, this effect is extremely imprecisely determined. In contrast, volatility in the stock price index is both negative and statistically significant. Perhaps one reason we fail to find a statistically significant association with SD(% Δ FTSE (1 day)) is that this proxy of uncertainty is more volatile, spikes more frequently, and thus may capture events of less gravity. It may also be the case that SD(% Δ FTSE (1 day)) provides a proxy of uncertainty over a shorter horizon or that notable activity in SD(% Δ FTSE (1 day)) (i.e., mid-2002) falls outside of the BHPS survey period.

4.3 Robustness: controlling for changes in personal circumstances and other macroeconomic indicators

In this paper we present evidence that stock market performance measures correlate with mental well-being. In Table 5, we verify that our results are robust to the inclusion of other relevant personal and macroeconomic variables. A key advantage of panel data is that we can control for changes in personal economic circumstances, such as labour market outcomes and income or wealth, which are likely to be correlated with stock market activity. Results presented in column (1) suggest that estimated effects remain almost unchanged and retain statistical significance—despite losing one year of data per individual to calculate

Table 4. Other stock market metrics

	Return measures		Uncertainty measures	
	(1)	(2)	(3)	(4)
% Δ FTSE (52 week)	0.72*	0.69**	0.67*	0.65**
	(0.38)	(0.31)	(0.36)	(0.31)
Dividend return (52 week)	−1.52			
	(9.40)			
SD(% Δ FTSE (52 week))		1.36		
		(2.01)		
SD(% Δ FTSE (1 day))			−0.19	
			(4.63)	
SD(FTSE)				−0.08*
				(0.05)

Notes: See notes to Table 2. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$.

Table 5. Including personal economic characteristics and macroeconomic variables

	(1)	(2)	(3)	(4)
% Δ FTSE (52 week)	0.66*	0.73**	0.68**	0.89**
	(0.35)	(0.33)	(0.33)	(0.38)
SD(FTSE)	−0.09*	−0.08*	−0.08*	−0.09*
	(0.05)	(0.05)	(0.05)	(0.05)
Additional variables included:				
Δ in labour market/economic resources	yes	no	no	yes
National economic conditions	no	yes	no	yes
Regional economic conditions	no	no	yes	yes
N	125,365	142,265	133,162	125,365

Notes: See notes to Table 2. Column (1) includes changes in labour market status and hours worked, income, home ownership status, and housing wealth. Column (2) includes annual changes in quarterly GDP *per capita*, annual changes in monthly industrial production, inflation, and consumer confidence, whilst column (3) includes regional unemployment rates and house prices. Column (4) adds all variables simultaneously. $*p < 0.1$, $**p < 0.05$, $***p < 0.01$.

changes in economic circumstances. For brevity, we continue to report only the stock market effects, but full results including all variables are available in Appendix Table A1.

In column (2) we include macroeconomic variables, as in Di Tella *et al.* (2003), such as annual changes in quarterly GDP *per capita*, annual changes in monthly industrial production, inflation, and consumer confidence,[9] (all available from the OECD), which are arguably correlated with stock market activity. However, the results reveal that the influence of

9 The consumer confidence indicator we use is based on an assessment of the economic situation. The question asked for the compilation of this indicator is 'How do you expect the general economic situation in this country to develop over the next 12 months? It will (++) get a lot better (+) get a little better (=) stay the same (-) get a little worse (–) get a lot worse (N) don't know.' The confidence indicator is expressed as the balance of positive over negative results.

stock price movements on mental well-being remains even after controlling for proxies of national economic activity commonly used in the well-being literature.

Since it may be the case that mental well-being is influenced to a greater extent by local, as opposed to national economic conditions, we also control for the male regional unemployment rate (available from the Office for National Statistics, ONS) and annual changes in regional house prices (available from the Department of Government and Local Communities).[10] Again the estimated relationship between stock market performance and individual well-being is robust in terms of statistical significance and economic magnitude, where macroeconomic indicators have little effect on mental well-being, although increases in regional unemployment rates reduce well-being, which is consistent with Charles and DeCicca (2008).

To explore the economic significance of the results, we calculate the marginal rate of substitution between stock market prices and regional unemployment rates. Using the results reported in Appendix Table A1 the ratio of the two coefficients implies that the percentage point change in the growth rate of stock prices required to compensate for a percentage point change in the unemployment rate is $0.07/0.0089 = 7.89$, which is twice the size of the average annual change in stock prices observed in our sample (see Table 1).

4.4 Extensions: heterogeneous effects of stock market performance

Previous research on the impact of the stock market crash on subjective measures of mental health and well-being documents a decline in well-being after the crash but arrives at different conclusions with respect to which groups are most sensitive to the downturn, and therefore the mechanism responsible for the co-movement between the stock market and well-being. In this section, we reconcile findings of previous research, under more general stock market conditions, by showing that (i) low-income individuals and (ii) stockholders are more sensitive to stock market activity. More generally, we show that who is observed to be most sensitive to stock market performance measures depends on the extent to which proxies of stockholder status correlate with labour market outcomes. We proceed by estimating the following equation:

$$\begin{aligned} H_{idwt} = {} & \alpha_1 \%\Delta FTSE_{id_{-1}wt} + \alpha_2[\%\Delta FTSE_{id_{-1}wt} \times (G_{idwt} = 1)] \\ & + \alpha_3 SD(FTSE)_{id_{-1}wt} + \alpha_4[SD(FTSE)_{id_{-1}wt} \times (G_{idwt} = 1)] + \alpha_5(G_{idwt} = 1) \\ & + \beta' z_{idwt} + \theta_d + \theta_w + \theta_t + \theta_{t(G_{idwt}=1)} + v_{idwt} \end{aligned} \tag{3}$$

where G_{idwt} denotes belonging to a particular group (i.e., proxies of stockholder status or job insecurity). This model is sufficiently flexible to allow for differential effects of stock market activity and general macroeconomic conditions but constrains all other variables to have the same effect across groups to retain statistical power. We would argue it is important to allow for differences in general macroeconomic conditions across groups because, for example, persons invested in the stock market may be differentially exposed to changes in the macroeconomy via other investments they might hold, and because the composition of any group may change over time owing to cohort effects, or where group membership is

10 Fluctuations in regional house prices will conceivably affect household wealth and hence may be expected to have an influence on well-being operating directly via a wealth effect. Conversely, higher house prices might reflect a better neighbourhood and hence influence well-being irrespective of a wealth effect.

Table 6. Heterogenous effects of stock market activity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: full sample	**High income**		**Stockholder**		**Degree**		**Age ≥40**	
	=1	=0	=1	=0	=1	=0	=1	=0
% Δ FTSE (52 week)	0.17	1.26***	0.81*	0.47	1.05	0.60*	0.47	0.91**
	(0.42)	(0.49)	(0.47)	(0.45)	(0.81)	(0.34)	(0.45)	(0.44)
SD(FTSE)	−0.10	−0.07	−0.09	−0.08	−0.01	−0.10*	−0.03	−0.15**
	(0.06)	(0.07)	(0.07)	(0.06)	(0.10)	(0.05)	(0.07)	(0.06)
Panel B: employees only	**High income**		**Secure job**		**Degree**		**Prof. occ.**	
	=1	=0	=1	=0	=1	=0	=1	=0
% Δ FTSE (52 week)	0.18	0.95*	0.87*	0.14	0.80	0.49	−0.31	1.14**
	(0.56)	(0.57)	(0.52)	(0.63)	(0.97)	(0.45)	(0.63)	(0.52)
SD(FTSE)	−0.08	−0.18*	−0.08	−0.15*	0.03	−0.17**	−0.04	−0.20**
	(0.08)	(0.09)	(0.07)	(0.09)	(0.13)	(0.07)	(0.09)	(0.08)

Notes: See notes to Table 2. See Section 4.4 and eq. (3) for details of the empirical specification. Each column reports the overall effect for each group. For example, Panel A, column (1) reports $\alpha_1 + \alpha_2$ which corresponds to the effect of changes in stock prices for high-income individuals, whilst column (2) reports α_1 for low-income individuals. High income refers to an average household income across the period that is greater than the median, stockholder refers to private pension arrangements and equity holdings. Secure job refers to an average satisfaction with job security score across the period that is greater than the median. Professional occupation refers to managerial, professional, and technical occupations. $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

endogenous to stock market performance. This analysis identifies stock market effects by comparing whether members of a particular group interviewed in a particular year are more likely to report better well-being when facing large stock market movements compared with members of the same group interviewed in that year facing small stock market movements. Note that when we present results based on eq. (3), we report overall effects for each group, for example we report α_1 for persons with $G_{idwt} = 0$ and we report the linear combination $\alpha_1 + \alpha_2$ for persons with $G_{idwt} = 1$.

In Panel A of Table 6, we consider four proxies of stockholder status. Following previous empirical contributions, in columns (1)–(4), we compare sensitivity to stock market activity according to average household income over the period analysed and to stockholder status, which is constructed using respondents' pension arrangements (available from 1992) and equity holdings (available in 1995, 2000, and 2005).[11] In columns (5)–(8) we compare sensitivity to stock market activity using education and age to proxy stockholder status, (see for example Guiso *et al.*, 2008), which unlike income and stock holding, could be argued to be exogenous to stock market activity. On the other hand, similar to income, education and age may confound the propensity to hold stocks with labour market status

11 The BHPS asks respondents whether they have contributed to a personal pension scheme, and the year they began making contributions. We use this information to identify people with defined contribution (DC) pension arrangements, who are indirectly invested in the stock market via their pension scheme, where we assume the retired annuitize DC pension wealth on retirement. We use ownership of investment trusts, personal equity plans, shares and company stocks to measure who is directly invested in stock markets, matching this information to other years using an imputation procedure. We are unable to impute any information for 700 individuals in our sample.

and, in particular, labour market resilience in economic downturns. Indeed, recent evidence points towards low-skilled workers faring worse in recessions (Coile and Levine, 2011; Disney *et al.*, 2015), and a larger drop in consumption amongst younger persons (Crossley *et al.*, 2013).

Results show that poorer individuals, who are less likely to own stocks, are more sensitive to changes in stock prices. At the same time, there is also evidence that stockholders appear to be more sensitive to changes in stock prices than are others.[12] We therefore find evidence supporting previous (conflicting) research findings using a single data source. Turning to the exogenous proxies of stock holder status, we find a correlation that is larger in magnitude (albeit imprecisely determined) for changes in stock prices across degree-level educated individuals, although it is the smaller correlation observed for less educated individuals that is statistically significant. There is, however, clearer evidence that less educated individuals are more sensitive to the proxy of uncertainty. Last, it appears as though younger individuals are more sensitive to stock market activity than others.

A defining element of these various proxies of stockholder status is the extent they are indicators of labour market market outcomes. In Panel B of Table 6, we continue with the theme that sensitivity to stock market performance may be linked to differential risks of job loss by (i) considering only persons in employment and therefore at risk of job loss and (ii) considering proxies of job security explicitly, such as indicators of low skill (income, education, and occupation) as well as average satisfaction with job security over the period analysed. Interestingly, across the board, the estimated effect of uncertainty is twice as large for individuals facing a higher risk of job loss compared with others. The evidence for changes in stock prices is more mixed. However, taken together with all the evidence presented in this article, stock market activity appears to fuel wealth shocks and beliefs about economic prospects, with different proxies of stockholder status providing alternative perspectives on this.

5. Conclusion

This article examines the association between the stock market and mental well-being in the UK over a relatively long time period which encapsulates stock market booms and busts. Typically the literature that has focussed on well-being over time and at different points of the economic cycle has tended to rely on data pooled over several countries, for example, Di Tella *et al.* (2001, 2003). We believe that this is the first article to focus on tracking individual-level well-being within a representative panel over a long time horizon that considers whether there is a role for stock market prices over and above a broad range of macro controls often used in the literature. Our research is of interest to policy makers given an increased focus on the determinants of well-being and the potential for rising stock markets to generate gaps in well-being across different groups of people. Our findings suggest that low-frequency changes in the FTSE 100 stock price index (i.e., six monthly and annual) are positively correlated with mental well-being, whilst annual volatility in the stock price index is associated with poorer mental well-being. Using a proxy

12 Note that we find little evidence that stockholders are more sensitive to other stock market metrics, such as dividends and return risk, that we might *a priori* expect stockholders to care more about.

of stockholder status, we present evidence of a larger effect of stock market activity on the well-being of stockholders compared with others, which is consistent with a wealth effect. However, we also find evidence that stock market movements shape the well-being of non-stockholders, suggesting the existence of an 'economic barometer' and/or 'social mood' effect. Further analysis suggests that those with fewer skills and potentially lower resilience to changing economic conditions may be particularly sensitive to stock market fluctuations. Future research might focus on identifying the causal link between stock market activity and well-being, and in particular resolving the likely endogeneity of stockholder status, as well as unpacking the role of economic barometer from that of social movements and/or mood.

Acknowledgements

We are grateful for excellent comments received from two anonymous reviewers and the associate editor of the journal. We also thank Sarah Brown, Alex Bryson, Ian Gregory-Smith, Tessa Peasgood, Catherine Porter, Jennifer Roberts, Nicolas Van de Sijpe, and participants at the RES Women's Committee Mentoring Meeting, Work Pensions and Labour Economics (WPEG) annual conference, New Directions in Welfare conference, and seminar participants at Keele University and the University of Stirling for useful comments. The usual disclaimer applies.

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Appendix

Table A1. A selection of extended regression results

	(1)		(2)		(3)	
% Δ FTSE (52 week)	0.68**	(0.31)	0.65**	(0.31)	0.89**	(0.38)
SD(FTSE)			−0.08*	(0.05)	−0.09*	(0.05)
Household head	−0.38***	(0.08)	−0.38***	(0.08)	−0.37***	(0.08)
Female	−1.49***	(0.08)	−1.49***	(0.08)	−1.50***	(0.09)
Partner	0.41**	(0.18)	0.41**	(0.18)	0.41**	(0.19)
Divorced/separated	−0.36*	(0.20)	−0.36*	(0.20)	−0.34*	(0.20)
Single	0.43**	(0.19)	0.43**	(0.19)	0.44**	(0.20)
2 household adults	−0.16	(0.13)	−0.16	(0.13)	−0.14	(0.14)
3 household adults	−0.40***	(0.14)	−0.40***	(0.14)	−0.38**	(0.15)
4 + household adults	−0.42***	(0.15)	−0.42***	(0.15)	−0.37**	(0.16)
1 child	−0.11	(0.12)	−0.11	(0.12)	−0.10	(0.13)
2 children	0.07	(0.16)	0.07	(0.16)	0.05	(0.17)
3 + children	−0.10	(0.22)	−0.10	(0.22)	−0.16	(0.24)
Kids aged 0–4	0.01	(0.11)	0.01	(0.11)	0.03	(0.11)
Kids aged 5–11	0.13	(0.10)	0.13	(0.10)	0.16	(0.11)
Kids aged 12–15	−0.07	(0.10)	−0.07	(0.10)	−0.09	(0.11)
High ed	0.10	(0.09)	0.10	(0.09)	0.11	(0.10)
Medium ed	0.14	(0.10)	0.14	(0.10)	0.14	(0.11)
Self-employed	0.83***	(0.17)	0.83***	(0.17)	0.67***	(0.22)
Employed	0.82***	(0.15)	0.82***	(0.15)	0.67***	(0.20)
Unemployed	−1.03***	(0.15)	−1.03***	(0.15)	−0.78***	(0.21)
Student	0.86***	(0.15)	0.86***	(0.15)	0.95***	(0.19)
Long-term sick	−4.01***	(0.24)	−4.01***	(0.24)	−4.26***	(0.28)
Retired	0.24*	(0.14)	0.24*	(0.14)	0.19	(0.17)
ln(weekly work hours + 1)	−0.03	(0.04)	−0.03	(0.04)	−0.02	(0.05)
ln(monthly household income)	0.22***	(0.04)	0.22***	(0.04)	0.18***	(0.05)
interest/dividend < £100	0.11**	(0.05)	0.11**	(0.05)	0.10*	(0.06)
interest/dividend £100–999	0.24***	(0.06)	0.24***	(0.06)	0.24***	(0.06)
interest/dividend >= £1,000	0.49***	(0.10)	0.49***	(0.10)	0.46***	(0.10)
Homeowner	0.07	(0.66)	0.07	(0.66)	−0.11	(0.74)
ln(house value + 1)	0.02	(0.06)	0.02	(0.06)	0.03	(0.06)
House value missing	−0.10	(0.20)	−0.10	(0.20)	−0.11	(0.23)
Saver	0.31**	(0.14)	0.31**	(0.14)	0.54***	(0.18)
Saver missing	0.58*	(0.31)	0.58*	(0.31)	0.37	(0.60)
ln(monthly savings + 1)	0.07**	(0.03)	0.07**	(0.03)	0.04	(0.04)
ln(monthly savings + 1) missing	0.19	(0.12)	0.19	(0.12)	0.14	(0.16)

(continued)

Table A1. Continued

	(1)	(2)	(3)	
Δ employed			0.37***	(0.10)
Δ self-employed			0.49***	(0.13)
Δ unemployed			−0.07	(0.13)
Δ retired			0.08	(0.11)
Δ long-term sick			0.64***	(0.19)
Δ student			0.23	(0.14)
Δ ln(weekly work hours + 1)			0.01	(0.04)
Δ homeowner			0.05	(0.09)
Δ ln(monthly household income)			0.10***	(0.03)
Δ ln(house value + 1)			0.11	(0.08)
Δ ln(house value + 1) missing			0.04	(0.11)
Δ saver			−0.32***	(0.07)
Δ saver missing			0.27	(0.38)
Δ ln(monthly savings + 1)			0.04**	(0.02)
Δ ln(monthly savings + 1) missing			0.09	(0.13)
Regional unemployment rate			−0.07**	(0.03)
% Δ regional house prices (52 week)			−0.17	(0.43)
% Δ GDP (52 week)			−6.30*	(3.55)
% Δ industrial production (52 week)			−0.94	(2.46)
% Δ Inflation (52 week)			0.90	(9.17)
Δ Confidence			0.27	(0.58)
Age dummies	yes	yes	yes	
Region dummies	yes	yes	yes	
Day, week and year dummies	yes	yes	yes	
N	142,265	142,265	125,365	

Notes: See notes to Table 2. Column (1) replicates Panel A, column (5) of Table 2, column (2) replicates column (4) of Table 4, column (3) replicates column (4) of Table 5. Coefficients on % Δ GDP (52 week), % Δ industrial production (52 week), % Δ Inflation (52 week), Δ Confidence, and % Δ regional house prices (52 week) have been multiplied by 100 for presentation. Note that standard errors are inappropriate for monthly/quarterly national and annual regional variables and only the regional unemployment rate remains statistically significant when clustering standard errors at the appropriate level for that variable, that is, individual and region. $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.