

**BORN TO BE MILD? COHORT EFFECTS DON'T (FULLY) EXPLAIN WHY  
WELL-BEING IS U-SHAPED IN AGE**

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ABSTRACT

The statistical analysis of cross-section data very often reveals a U-shaped relationship between subjective well-being and age. This paper uses fourteen waves of British panel data to distinguish between two potential explanations of this shape: a pure life-cycle or aging effect, and a fixed cohort effect depending on year of birth. Panel analysis controlling for fixed effects continues to produce a U-shaped relationship between well-being and age, although this U-shape is flatter for life satisfaction than for the GHQ measure of mental well-being. The pattern of the estimated cohort effects also differs between the two well-being measures and, to an extent, by demographic group. In particular, those born earlier report more positive GHQ scores, controlling for their current age; this phenomenon is especially prevalent for women.

Keywords: Subjective Well-Being, Cohorts, Fixed Effects, Panel Data.

JEL Codes: C23, I3, J11.

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# BORN TO BE MILD? COHORT EFFECTS DON'T (FULLY) EXPLAIN WHY WELL-BEING IS U-SHAPED IN AGE

## 1. Introduction

Interest in subjective well-being across the social sciences has developed in parallel with both the greater availability of panel data, where the same individuals are followed over time, and the wider use of statistical tools to better model individual fixed effects. These statistical techniques consist of the use of panel data, or cross-section analysis with very careful controls (for example, "twin" studies, where the initial distribution of the genetic pack of cards can be controlled for: see Bouchard *et al.*, 1990, Kohler *et al.*, 2005, and Tellegen *et al.*, 1988). The application of these techniques allows subjective well-being to be split up into a permanent or fixed part, and a transitory component that depends on life events. Recent contributions in this spirit include Lucas *et al.*, (2003 and 2004), Frijters *et al.* (2004), Van Praag and Ferrer-i-Carbonell (2004), and Zimmerman and Easterlin (2006).

This interest in the effect of fixed individual characteristics has spilled over into the analysis of the relationship between well-being and age: in an econometric world plagued by accusations of endogeneity, age, sex and ethnicity typically stand out as exogenous variables, and have consequently received a great deal of attention. Early work emphasised that older individuals tended to be happier/more satisfied than younger individuals. More recent analyses have refined this approach by considering non-linear relationships between well-being and age. The results here differ somewhat between economics and psychology.

Mroczek and Kolarz (1998) find that positive affect follows an upwardly curved profile with age, while Mroczek and Spiro (2005) suggest that subjective well-being follows an inverted U-shape, peaking at around retirement age. At the same time, a vigorous literature in Economics has introduced terms in age and age-squared into well-being regressions, producing strong

evidence of a U-shaped relationship which typically bottoms out somewhere between the mid-thirties and the mid-forties.<sup>1</sup> Curves of this type have now been identified many times in a wide variety of datasets across different countries.<sup>2</sup>

Two popular competing interpretations of this U-shaped relationship have been proposed. One is that it reflects the passage of individuals through various stylised life events; another is that it reflects a cohort effect, so that individuals born in the 1950s, say, have (and always will have) particularly low levels of subjective well-being (hence producing a U-shape in cross-section analysis of 1990s data). This paper uses two measures of well-being in fourteen waves of British panel data to test the hypothesis that the age:well-being U-shape is a pure cohort phenomenon. Two types of test are presented, the first indirect, although intuitive, and the second direct. The tests are carried out on both unbalanced and balanced panel data.

The first intuitive test is based on the estimated minimum point of the U-shape. If this latter is picking up a cohort phenomenon, then the point of lowest well-being should move to the right by one year from data wave  $t$  to wave  $t+1$ . The age of minimum well-being should therefore be thirteen years greater in Wave 14 than in Wave 1. This turns out not to be the case. The conclusion is that there is an “aging phenomenon” in well-being: this is something that we will all (statistically) go through, no matter when we were born.

The second test is direct. Panel well-being regressions are estimated which control for unobserved individual fixed effects. These regressions, which hold all cohort effects constant, continue to produce U-shaped relationships between age and well-being. It is important to underline that the age effect here is obtained by examining the different levels of well-being of

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<sup>1</sup> The sample in Mroczek and Spiro (2005) actually consists of veterans over the age of 40, so that their finding of an upward-sloping profile is not inconsistent with a U-shape over all ages.

<sup>2</sup> A non-exhaustive list includes Clark and Oswald (1994), Clark *et al.* (1996), Oswald (1997), Theodossiou (1998), Winkelmann and Winkelmann (1998), Di Tella *et al.* (2001), Frey and Stutzer (2002), Helliwell (2003), Blanchflower and Oswald (2004), Frijters *et al.* (2004), Senik (2004), Van Praag and Ferrer-i-Carbonell (2004), Clark (2005), Graham (2005), Long (2005), Shields and Wheatley Price (2005), Propper *et al.* (2005), Powdthavee

the same individual at different ages. Again, the conclusion is that the U-shaped relationship between age and well-being is at least partly driven by aging, rather than being a pure cohort effect.

The remainder of the paper is organised as follows. Section 2 describes the two tests of cohort effects, and the data on which they will be carried out. Section 3 contains the main results regarding the persistence of the U-shaped relationship between well-being and age. Last, section 4 concludes.

## 2. Cohort or Life-Cycle?

Empirical work which introduces age as one of the explanatory variables in the analysis of subjective well-being (such as life satisfaction or happiness) very often finds a U-shaped relationship, minimising somewhere in the mid-thirties to the mid-forties. As highlighted in Frey and Stutzer (2002), there is less agreement over why this U-shape so consistently results. One interpretation is that, loosely speaking, the U-shape reflects the different events that occur to individuals over the life cycle, which have a fairly systematic relationship to their age. This reading is found in Argyle (1989), Hayo and Seifert (2002) and Blanchflower and Oswald (2004). Alternatively, we might argue that, controlling for observables, well-being is broadly flat over the life-cycle, with the U-shape coming from unobserved individual heterogeneity or cohort effects.<sup>3</sup> In this case, with our data from the 1990s, the hypothesis is that those in the late 1950s/early 1960s birth cohorts report lower well-being scores than do those born earlier or later.

Cross-section data does not allow us to distinguish between the life-cycle and cohort components of well-being. Neither can twin data, as age and year of birth (the cohort effect) are

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(2005), Lelkes (2006) and Uppal (2006).

<sup>3</sup> This is the conclusion reached by Easterlin and Schaeffer (1999), using twenty years of cohort data from the General Social Survey. Cribier (2005) is an evocative account of the differences in life experience between two

identical across matched subjects. Progress can however be made with repeated cross-section or panel data in which we have repeated observations on individuals of the same birth cohort, over different ages, allowing the two effects to be identified separately. The increasing availability of long-run panel data has been a huge boon for the social sciences. This is particularly the case with respect to research on aging or the life-cycle.

Blanchflower and Oswald (2007) use long-run repeated cross-sectional data from the US and Europe to independently model the effect of age (in five-year blocks) and birth cohort (in ten-year blocks) on measures of subjective well-being. Heuristically, over a long enough time period, they will observe people of the same age (group) but born in different birth cohorts. This allows the separate identification of the two effects.

This paper appeals to the same kind of identification strategy, using fourteen waves of British panel data to distinguish between life-cycle and cohort effects. We consider two separate tests of the hypothesis that the U-shape represents a cohort effect.

The first, indirect, test relies on the prediction of the “cohort” explanation that the whole U-shape should move one year to the right per year. In the current paper’s BHPS data, the unhappy people who were born in 1955 will be unhappy at age 36 in Wave 1 (in 1991), but equally unhappy at age 37 in Wave 2, and so on. One measure of the position of the U-shaped relationship is its minimum. The first test thus consists in seeing whether the point of minimum well-being shifts to the right by one year per wave.

The second, direct, test involves controlling explicitly for fixed effects in panel well-being regressions. These fixed effects will include by definition the individual’s year of birth: her cohort. Any effect of age variables in fixed-effect well-being regressions must then reflect life-cycle or aging effects: systematic changes in well-being that happen to all individuals (no matter

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cohorts of French workers born only 14 years apart.

when they were born) as they age.

### ***Data***

The data come from the first fourteen waves of the British Household Panel Survey (BHPS), a general survey initially covering a random sample of approximately 10 000 individuals in 5 500 British households. The Wave 14 sample consists of around 15 000 individuals in 9 000 households.<sup>4</sup> The BHPS includes a wide range of information about individual and household demographics, employment, income and health. More information on this survey is available at <http://iserwww.essex.ac.uk/ulsc/bhps/>. There is both entry into and exit from the panel, leading to unbalanced data. The BHPS is a household panel: all adults in the same household are interviewed separately. The wave 1 data were collected in late 1991 - early 1992, the wave 2 data were collected in late 1992 - early 1993, and so on. The analysis in this paper refers to individuals aged between 16 and 64, and will be carried out on both unbalanced and balanced panel data.

The central question addressed here is whether individual well-being changes systematically over the life cycle.<sup>5</sup> Two measures of subjective well-being are considered: the twelve-item version of the General Health Questionnaire (GHQ-12), which appears in all waves of the BHPS, and overall life satisfaction, which appears in Waves 6-10, and then 12-14. There are 2 836 individuals who provided a GHQ score at every wave of the BHPS, so that the balanced panel analysis can be carried out on a maximum of 39 704 observations. Equally, 4015 individuals provided eight separate life satisfaction scores, for a maximum balanced sample consisting of 32 120 life satisfaction observations. In practice, the balanced regression analysis

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<sup>4</sup> The wave 1 sample was drawn from 250 areas of Great Britain. Additional samples of 1,500 households in each of Scotland and Wales were added to the main sample in 1999, and in 2001 a sample of 2,000 households was added in Northern Ireland.

uses slightly fewer observations due to missing values for some of the explanatory variables.

The GHQ-12 (see Goldberg, 1972) reflects overall mental well-being. It is constructed from the responses to twelve questions (administered via a self-completion questionnaire) covering feelings of strain, depression, inability to cope, anxiety-based insomnia, and lack of confidence, amongst others (the twelve questions are reproduced in Appendix A). Responses are made on a four-point scale of frequency of a feeling in relation to a person's usual state: "Not at all", "No more than usual", "Rather more than usual", and "Much more than usual".<sup>6</sup> The GHQ is widely used in medical, psychological and sociological research, and is considered to be a robust indicator of the individual's psychological state. The between-item validity of the GHQ-12 is high in this sample of the BHPS, with a Cronbach's alpha score of 0.90.

This paper uses the Caseness GHQ score, which counts the number of questions for which the response is in one of the two "low well-being" categories. This count is then reversed so that higher scores indicate higher levels of well-being, running from 0 (all twelve responses indicating poor psychological health) to 12 (no responses indicating poor psychological health).<sup>7</sup> The distribution of this well-being index in the BHPS sample is shown in the first panel of Appendix B. The median and mode of this distribution is 12: no responses indicating poor psychological health. However, there is a long tail: one-third of the sample have a score of 10 or

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<sup>5</sup> More precisely: whether subjective well-being changes systematically in a way that cannot be explained by the standard set of explanatory variables (covering income, employment, health, demographics etc.).

<sup>6</sup> One worry is that the GHQ is singularly unsuitable for this kind of analysis, as its constituent parts are explicitly phrased in terms of comparisons to usual. It is worth noting that the empirical literature on GHQ scores treats them unambiguously as indicators of the level of well-being, and it was for this purpose that the instrument was designed. On a practical level, the employed's GHQ is more strongly correlated with job satisfaction levels in the BHPS data than with job satisfaction changes. Last, with fourteen years of balanced panel data, a relatively direct test of the usefulness of the GHQ score in this respect can be envisaged. If events become more "usual" as an individual ages then the standard deviation of GHQ scores (and of its individual components) will fall with age. There is no evidence of this phenomenon in balanced BHPS panel data.

<sup>7</sup> Alternatively, the responses to the GHQ-12 questions can be used to construct what is known as a Likert measure. This is the simple sum of the responses to the twelve questions, coded so that the response with the lowest well-being value scores 3 and that with the highest well-being value scores 0. This count is then reversed, so that higher scores indicate higher levels of well-being. The measure thus runs from 0 (all twelve responses indicating the worst psychological health) to 36 (all responses indicating the best psychological health). Practically, the results are

less, and thirteen per cent have a score of 6 or less.

The second measure is satisfaction with life, which appears in Waves 6-10 and 12-14 of the BHPS. Respondents are asked “*How dissatisfied or satisfied are you with your life overall*”, with responses measured on a scale of one (not satisfied at all) to seven (completely satisfied). The distribution of replies is shown in the second panel of Appendix B. The median score is five, with a mode of six and a mean of 5.2.

The following section considers how both of these well-being measures are related to age, both with and without controls for cohort effects.

### 3. Well-Being and Age: Pooled and Panel Results

#### *Well-Being and Age in Pooled Data*

Table 1 sets the scene by presenting the results from what are by now fairly “standard” well-being equations, here estimated on pooled data. All of the regressions in this paper are estimated using linear techniques. The pooled analysis in Table 1 comes from OLS estimation; the panel results below come from “within” regressions. It can, of course, be objected that the assumption of cardinality required for OLS is unlikely for well-being measures (is someone with a life satisfaction score of six exactly twice as happy as someone with a life satisfaction score of three?). However, Ferrer-i-Carbonell and Frijters (2004) have shown that, practically, the difference between the ordinal and cardinal estimation of subjective well-being is small compared to the difference between pooled and panel results. More pragmatically, all of the results presented in this paper can be reproduced using appropriate ordinal estimation methods (ordered probit for the pooled analysis, and conditional fixed effect logits for the panel regressions).

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very similar between the Caseness and Likert measures.



Column 1 of Table 1 shows the results from pooled cross-section regressions of GHQ scores, while column 2 carries out the same analysis for life satisfaction. The regressions include age and age-squared as explanatory variables, as well as a number of other controls. The very significant coefficients on age (negative) and age-squared (positive) reveal that, *ceteris paribus*, well-being is U-shaped in age. Some simple algebra shows that the age of minimum well-being is 39 for GHQ and 41 for life satisfaction.

The estimated coefficients on the other right-hand side variables are all fairly standard in the empirical literature on well-being. Unemployment, marital status and health have large impacts on both measures of well-being in the expected direction. There are, however, three variables which have opposing effects on GHQ and life satisfaction. Both income<sup>8</sup> and self-employment are associated with higher life satisfaction scores, but also greater mental stress. On the contrary, men report lower life satisfaction scores, but also less mental stress.<sup>9</sup> One last point to note in the context of well-being and age is that it is contentious to include health as a right-hand side variable<sup>10</sup>, although this practice is widespread in the literature. Including health does imply that we are comparing individuals of different (working) ages, but with the same level of health. We will return to this issue below.

*Test 1: Does the U-shape move to the right by one year per survey wave?*

If the U-shape in age is a cohort phenomenon, then the whole distribution of well-being should shift to the right by one year per wave. This hypothesis can be tested by re-running Table 1's regressions separately for each of the fourteen waves of the BHPS, and calculating the

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<sup>8</sup> Income is measured in real terms, having been deflated by the CPI.

<sup>9</sup> Nolen-Hoeksema and Rusting (1999) conclude in their survey article that women exhibit higher incidence rates for almost all of the mood and anxiety disorders, but in general report higher levels of happiness.

<sup>10</sup> Blanchflower and Oswald (2004) explicitly do not control for health in their statistical analysis.

estimated age of minimum<sup>11</sup> well-being in each wave. The results are summarised in Figure 1. Were the U-shape to be a pure cohort phenomenon, the estimated age of minimum well-being would increase by one year per wave, tracing out a 45-degree line. Figure 1 shows little evidence of this for either of our well-being measures. Although the estimated minimum of GHQ does rise a little at the very beginning of the sample period, there is no strong trend thereafter.

The BHPS is an unbalanced panel. It is therefore theoretically possible that the pattern of well-being amongst those who enter and exit the data has disguised the true relationship between well-being and age. To investigate, the bottom panel of Figure 1 repeats the analysis using balanced panel data (over all fourteen waves for the GHQ, and over eight waves for life satisfaction). The balanced results again provide little support for the hypothesis that the age distribution shifts to the right by one year per wave.<sup>12</sup>

This evidence points to at least some role for a pure life-cycle effect, whereby well-being for the same individual evolves systematically with age. It should be borne in mind, however, that the age of minimum well-being, which is the ratio of two estimated coefficients, is likely measured with a certain degree of error; as such we cannot consider Test 1's results to be definitive, but rather suggestive. What follows is a direct test of the importance of cohort effects which escapes this criticism.

### *Test 2: Introducing individual fixed effects.*

A perhaps simpler approach to the question is to introduce controls for unobserved heterogeneity. To allow for a flexible relationship between well-being and age, ten age dummies are created. The first refers to age 16-19, then 20-24, 25-29 and so on up to 60-64. The youngest

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<sup>11</sup> Alternatively, interaction terms between age and wave can be introduced into Table 1's regressions; these give qualitatively very similar results.

<sup>12</sup> Blanchflower and Oswald (2004) carry out a similar test on American General Social Survey data, and conclude

age group is the omitted category, so all of the estimated coefficients in Table 2 are to be read as relative to the well-being of the youngest.

Table 2 shows three sets of regression results for both GHQ and life satisfaction. The first two regressions are estimated on pooled data. The first of these includes only the age dummies on the right-hand side, and thus provides a non-parametric unconditional estimate of the relationship between well-being and age. Well-being is U-shaped, with minimum well-being occurring at age 40-44 for both measures. The second column then introduces the other demographic controls used in Table 1. These controls make the U-shape more pronounced, if anything, and do not change the age of minimum well-being.

The last column introduces individual fixed effects. The estimated coefficients on the age dummies in column 3 therefore represent the different levels of well-being reported by the same individual as they go through the life cycle. Of course, even with fairly long-run panel data, we do not observe the complete sequence of ages for any respondent. In the BHPS, any one individual can appear in a maximum of four different age categories in the GHQ regressions (over 14 waves) and three different age categories in the life satisfaction regressions (between waves 6 and 14).

The main result from this panel analysis is that, even controlling for individual fixed effects, well-being continues to show a U-shaped relationship with age. This is true for both GHQ and life satisfaction, although the U-shape is more pronounced for the former than for the latter. The age of minimum well-being, controlling for fixed effects, is in the forties for both measures. The estimated relationships between well-being and age in pooled and panel data are illustrated in Figure 2. It is notable that the left-hand side of the “U” in the life satisfaction regressions depends entirely on the drop in well-being between ages 16-19 and 20-24.

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that there is only slight evidence that the minimum moves to the right over time. The GSS is not, however, a panel.

Thereafter, life satisfaction stays fairly flat up until the end of the forties.

As with test 1, which looked at the estimated age of minimum well-being by wave, it is important to take panel exit and entry into account. Table 3 therefore repeats the analysis described in Table 2, but now estimated only on the balanced sample (4000 individuals for the GHQ score, and just under 3000 for life satisfaction). Even in this much smaller balanced sample, the top panel of Table 3 shows a persistent U-shaped relationship between age and GHQ. In the bottom panel, the relationship between age and life satisfaction is now less evident. Even so, the U-shape persists in the estimated coefficients, which are jointly significant. In addition, the real test of the U-shape is whether the ends are greater than the middle, loosely speaking. This test passes at around the one per cent level comparing both the oldest and the youngest age-groups to those in their mid-forties.

#### *Interpreting the results.*

Well-being continues to be U-shaped in age even after cohort effects (via individual fixed effects) have been controlled for. As such, the well-being of any one individual, no matter when they were born, will trace out the profile given by the “panel” lines in Figure 2 as they age. While it is easy to think of some aspects of life which might systematically be more difficult between the ages of 35 and 45, it is worth emphasising that the multivariate analyses controls for a number of these (labour force and marital status, home ownership, and number of children). One open question is therefore what lies behind the life cycle events that hit hard between the ages of 35 and 45. One possibility might be stress at work (perhaps combined with young or adolescent children), although useful questions measuring such phenomena are not always present in large-scale datasets.

As a by-product of the regression in column 3 of Table 2, we can look at the distribution

of the estimated fixed effects by birth cohort. Specifically we calculate the average value of the individual fixed effects by year of birth: these are presented graphically in Appendix C. A small number of birth years for which there were fewer than 20 individuals in the cell have been dropped: this applies particularly to the graphs by level of education. The shape of the cohort effects presented in Appendix C can actually be inferred from Figure 2. In the latter, both of the pooled and panel results GHQ curves are U-shaped, and the distance between the two curves is greater for the older age-groups than for the younger age-groups: in other words, those born earlier report higher levels of well-being on the GHQ scale, independent of their current age.<sup>13</sup> This is indeed what we see in the top left panel of Appendix C: those born earlier have higher levels of SWB. Even so, the size of this estimated cohort effect is not overwhelmingly large: the difference between in cohort effects between those born in the 1930s and those born in the 1970s is about one-eighth of a GHQ point, on the 0-12 scale. By way of comparison, this is the size of the estimated effect of divorce on well-being in the pooled cross-section estimates in Table 1, but only about one-third of the size of the effect of separation or unemployment.

The same visual test for the life satisfaction curves in Figure 2 suggests that the fixed effects are U-shaped. The pooled results are markedly U-shaped, but the panel results are less so. The difference between them is the fixed effect, which must therefore itself have a U-shaped distribution. In this case, it does seem to be true that those born around the late 1950s to early 1960s have (fixed) lower levels of life satisfaction. Again, this is what we see in Appendix C.<sup>14</sup>

Why do the fixed effects have this pattern? Any attempt at explanation will be speculative, as by definition fixed effects reflect unobserved differences between individuals. With respect to the GHQ, one such piece of speculation as to why those born earlier have, *ceteris*

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<sup>13</sup> Easterlin (2006) reaches a similar conclusion for happiness in US cohorts.

<sup>14</sup> Blanchflower and Oswald (2007) also find a U-shaped pattern of birth cohort effects in life satisfaction, using 27 years of Eurobarometer data.

*paribus*, higher levels of mental well-being appeals to social comparisons. Researchers in a number of social science disciplines have emphasised the importance of comparisons to reference groups (Adams, 1965, Frank, 1989, Kapteyn, van Praag and van Herwaarden, 1978, and Pollis, 1968). It seems likely that one type of comparison may occur with respect to the past, and perhaps even to a certain defined period (parents' situation during the individuals' childhood, or the individual's first job, for example). Secularly rising living standards will then imply that older cohorts compare current outcomes to less well-off reference groups, and will consequently report higher well-being scores.<sup>15</sup> Alternatively, Rodgers (1982) posits that older cohorts might be happier as a result of having survived economic deprivation and other social hardships, whereas younger cohorts could have higher levels of needs once basic survival issues have been resolved.

#### *What Should We Control For?*

As mentioned above, there are a number of different ways of looking at the relationship between age and well-being. An analysis without any control variables, as in column 1 of Tables 2 and 3, produces a description of well-being at different ages, without taking into account the sex, income, housing etc. composition of different age groups. The analyses in the other columns of Tables 2 and 3 do include some standard right-hand side control variables, so that we are to an extent comparing like with like. There does remain, however, a question of how sensible the latter comparisons are. In particular, some of the control variables (income, marriage, labour force status) might be thought to be partly determined by well-being. To check whether any such reverse causality was behind the findings presented here, all of the regressions were re-run

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<sup>15</sup> Such comparisons to the past imply that, in the long run, the correlation between GDP per capita and individual well-being may well be small. For some recent empirical contributions to this debate, see Diener and Oishi (2000), Easterlin (1995) and Oswald (1997). This literature is surveyed in Clark *et al.* (2007).

retaining only exogenous explanatory variables (sex, wave and region). The qualitative results remained unchanged.

### *Is Everyone the Same?*

It is of interest to carry out the above analysis separately for different demographic groups. Specifically, Table 2's regressions were re-run for men and for women, and for three different educational groups (where high education corresponds to qualifications obtained in higher education, and medium education to A-Level, O-Level or Nursing qualifications). The estimated cohort effects are shown in Appendix C.

Both the estimated U-shape and the fixed effects profiles differ by demographic group. The U-shaped relationship between well-being and age is much more prominent for men than for women. In addition, the negative trend in the GHQ fixed effect (so that older cohorts are happier than younger cohorts) is found only for women. Note that this cannot reflect patterns of employment or number of children, as these variables are controlled in the regression. The profile is however consistent with changing work intensity for women, or increasing difficulty in ensuring an adequate work-life balance. Regarding education, the U-shape is stronger for the higher-educated than for the other groups, and the negative trend in the GHQ fixed effect is found only for the higher-educated. However, the U-shaped fixed effect in life satisfaction is found for all demographic groups.

## 5. Conclusion

This paper has used fourteen waves of British panel data to confirm that subjective well-being is U-shaped in age in pooled data. The application of panel analysis techniques allows us to distinguish the life-cycle or ageing component of this relationship from the fixed effect or

cohort part. The results show that, even controlling for individual fixed effects, both life satisfaction and GHQ scores remain U-shaped in age. The analysis of the fixed effect in GHQ scores reveals that individuals from earlier cohorts (i.e. those who were born earlier) will have, *ceteris paribus*, distinctly higher levels of subjective well-being, as measured by the GHQ-12 score, than those from later cohorts. This pattern is markedly different by sex, and by level of education. The fixed effects in life satisfaction exhibit a U-shaped relationship.

The main result of this analysis may be considered as essentially negative: whereas we previously thought that there was only one phenomenon to explain (the U-shape), there would now appear to be two: a U-shaped life-cycle or aging effect, and the cohort profiles. This paper has not explicitly tested any theories of why these data shapes pertain, although the GHQ fixed effects results are consistent with reference group theory, in that those born earlier may have lower standards of comparison, and with increasing work-life balance stress.

This paper's conclusions are based on British data, although the robust U-shaped relationship is found across two rather different measures of well-being (while weaker for life satisfaction than for the GHQ). It may be that other datasets will produce different results. The simple method used in this paper can be easily applied to any panel data set of sufficiently long duration. The growing empirical well-being literature should perhaps now pay more attention to the structure of the fixed effect, and in particular to its relationship with year of birth.



## Appendix A

The twelve questions used to create the GHQ-12 measure appear in the BHPS questionnaire as follows:

1. Here are some questions regarding the way you have been feeling over the last few weeks. For each question please ring the number next to the answer that best suits the way you have felt.

Have you recently....

a) been able to concentrate on whatever you're doing ?

*Better than usual*..... 1  
*Same as usual* ..... 2  
*Less than usual* ..... 3  
*Much less than usual*..... 4

then

- b) lost much sleep over worry ?
- e) felt constantly under strain ?
- f) felt you couldn't overcome your difficulties ?
- i) been feeling unhappy or depressed ?
- j) been losing confidence in yourself ?
- k) been thinking of yourself as a worthless person ?

with the responses:

*Not at all* ..... 1  
*No more than usual*..... 2  
*Rather more than usual*..... 3  
*Much more than usual* ..... 4

then

- c) felt that you were playing a useful part in things ?
- d) felt capable of making decisions about things ?
- g) been able to enjoy your normal day-to-day activities ?
- h) been able to face up to problems ?
- l) been feeling reasonably happy, all things considered ?

with the responses:

*More so than usual* ..... 1  
*About same as usual* ..... 2  
*Less so than usual* ..... 3  
*Much less than usual*..... 4

Appendix B

**The Distribution of Well-Being in the BHPS (Inverted Caseness index of the GHQ-12)**

<i>Well-being Score</i>	<i>Number of Observations</i>	<i>Cumulative Percentage</i>
0	2 218	1.6
1	1 829	3.0
2	1 958	4.4
3	2 226	6.1
4	2 558	7.9
5	3 080	10.2
6	3 774	13.0
7	4 618	16.4
8	5 753	20.6
9	7 767	26.3
10	11 210	34.5
11	18 977	48.5
12	70 088	100.0
<b>Total</b>	<b>136 055</b>	<b>100.0</b>
<b>Mean</b>	<b>= 10.08</b>	
<b>Median</b>	<b>= 12</b>	
<b>Mode</b>	<b>= 12</b>	

Source: BHPS Waves 1-14.

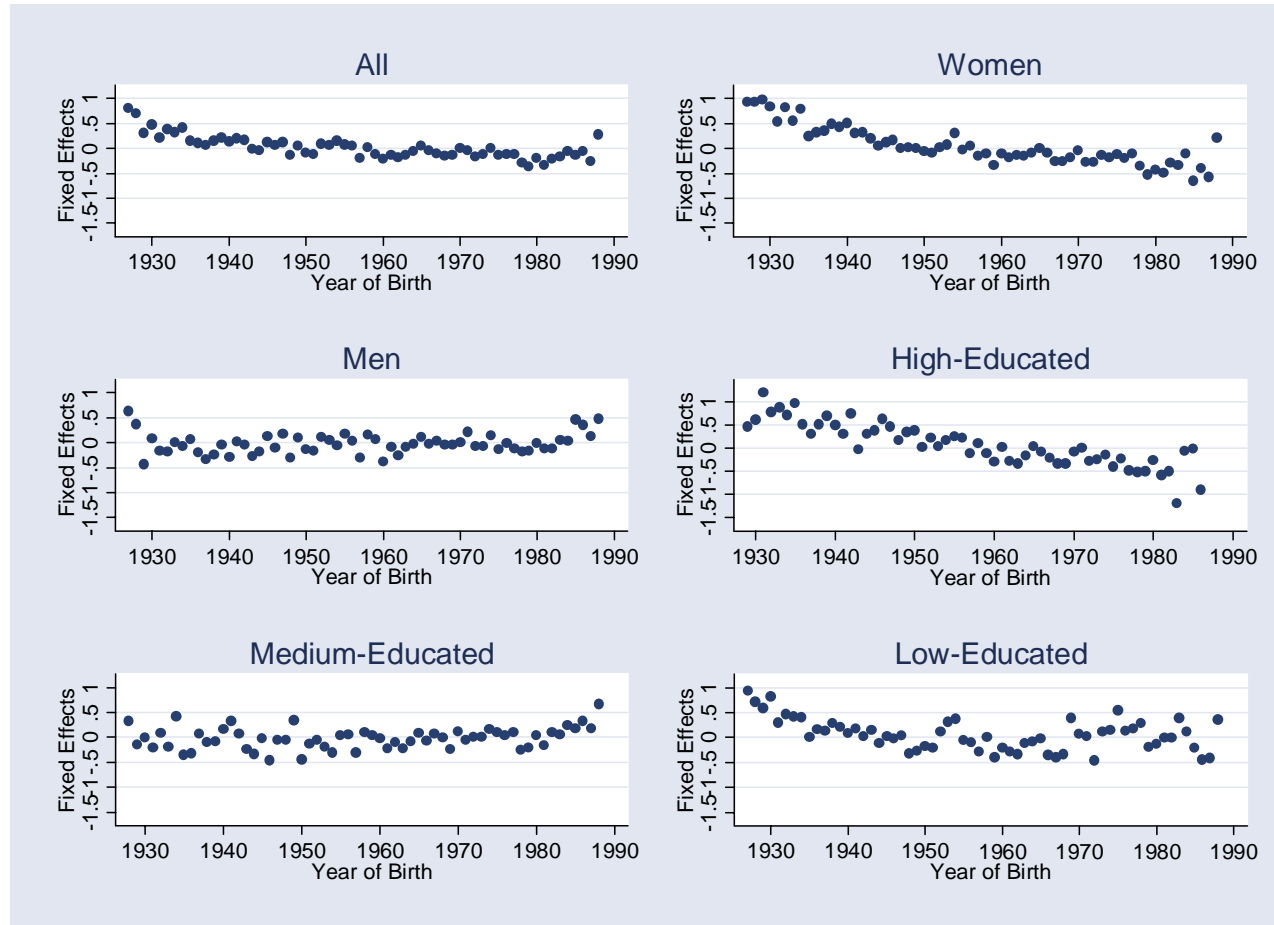
**The Distribution of Well-Being in the BHPS (Life Satisfaction)**

<i>Well-being Score</i>	<i>Number of Observations</i>	<i>Cumulative Percentage</i>
1	1 278	1.5
2	1 985	3.9
3	5 348	10.2
4	12 289	24.7
5	25 848	55.2
6	28 052	88.3
7	9 944	100.0
<b>Total</b>	<b>84 744</b>	<b>100.0</b>
<b>Mean</b>	<b>= 5.16</b>	
<b>Median</b>	<b>= 5</b>	
<b>Mode</b>	<b>= 6</b>	

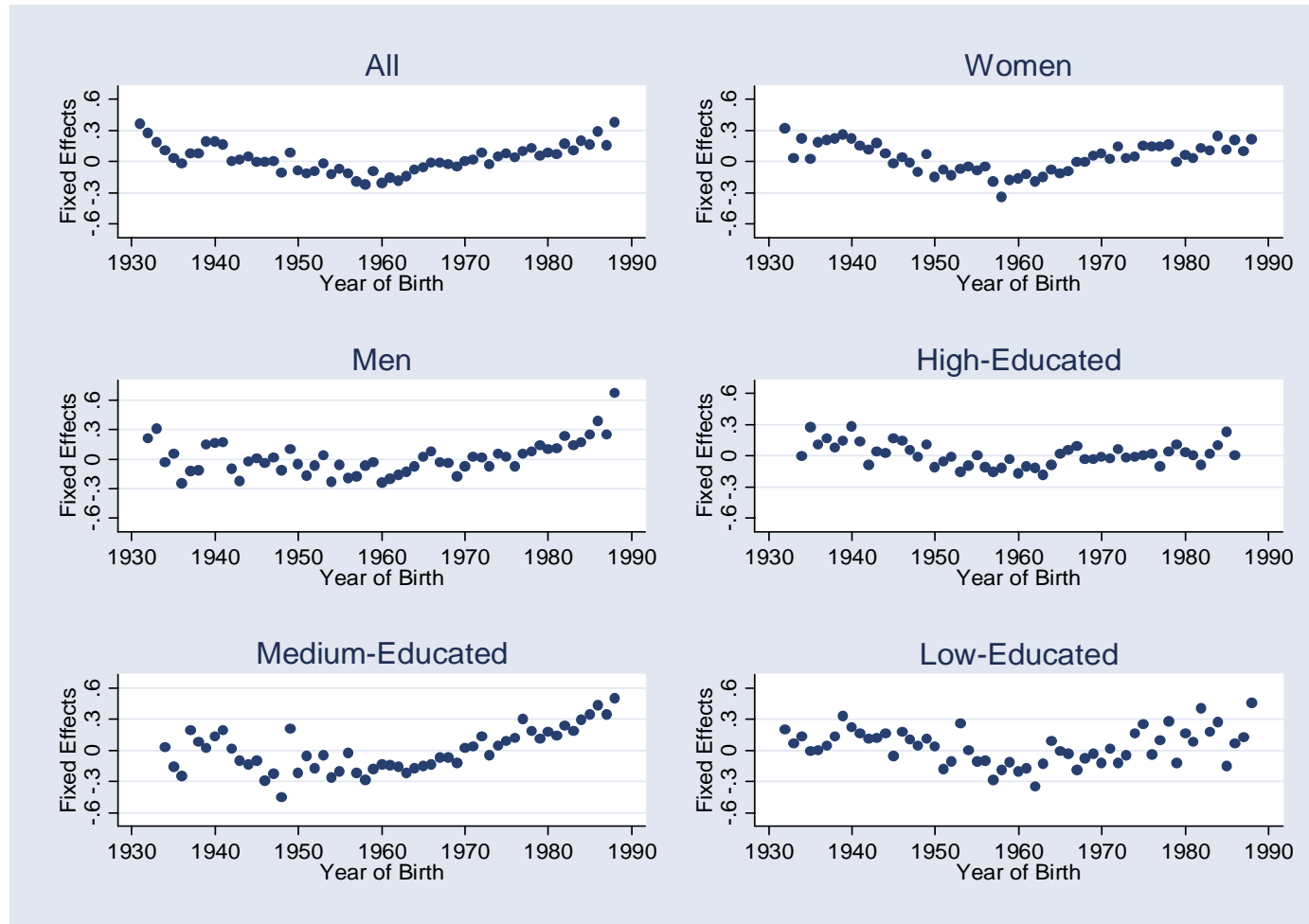
Source: BHPS Waves 6-10 and 12-14.

Appendix C

GHQ Fixed Effects by Year of Birth



Life Satisfaction Fixed Effects by Year of Birth



**TABLE 1. WELL-BEING REGRESSIONS. BHPS WAVES 1 TO 14 POOLED**

	Caseness GHQ	Life Satisfaction
Age	-0.089** (0.008)	-0.075** (0.004)
Age-squared/100	0.115** (0.010)	0.091** (0.005)
Total Income	-0.027* (0.011)	0.018** (0.005)
Self-Employed	-0.088* (0.043)	0.054* (0.023)
Unemployed	-0.985** (0.054)	-0.401** (0.032)
Retired	-0.062 (0.059)	0.107** (0.033)
Other Labour Force Status	-0.684** (0.037)	-0.202** (0.019)
Male	0.433** (0.029)	-0.092** (0.015)
Married	0.058 (0.042)	0.256** (0.022)
Separated	-0.917** (0.088)	-0.273** (0.044)
Divorced	-0.348** (0.064)	-0.098** (0.032)
Widowed	-0.627** (0.114)	-0.134* (0.059)
One Child	-0.023 (0.036)	-0.051** (0.018)
Two Children	0.095* (0.039)	-0.043* (0.020)
Three+ Children	0.056 (0.062)	-0.049 (0.031)
Renter	-0.166** (0.032)	-0.163** (0.017)
Education: High	-0.264** (0.037)	-0.119** (0.020)
Education: Medium	-0.100** (0.036)	-0.082** (0.020)
Health: Excellent	2.121** (0.034)	1.039** (0.017)
Health: Good	1.688** (0.031)	0.690** (0.015)
Wave Dummies	Yes	Yes
Region Dummies	Yes	Yes
Observations	132665	82096

Robust standard errors in parentheses. \* significant at 5%; \*\* significant at 1%

***Estimated Age of  
Minimum Well-Being***

**38.7**

**41.2**

**TABLE 2. POOLED AND PANEL WELL-BEING REGRESSIONS.**

	<b>GHQ</b>		
	<i>No controls</i>	<i>Demographic controls</i>	<i>Demographic controls plus Individual Fixed Effects</i>
Age 20-24	-0.088* (0.038)	-0.191** (0.041)	-0.184** (0.048)
Age 25-29	-0.038 (0.041)	-0.226** (0.047)	-0.302** (0.065)
Age 30-34	-0.169** (0.044)	-0.350** (0.054)	-0.427** (0.086)
Age 35-39	-0.266** (0.046)	-0.421** (0.059)	-0.487** (0.107)
Age 40-44	-0.334** (0.049)	-0.483** (0.062)	-0.571** (0.128)
Age 45-49	-0.297** (0.050)	-0.382** (0.063)	-0.579** (0.149)
Age 50-54	-0.252** (0.052)	-0.264** (0.064)	-0.466** (0.170)
Age 55-59	-0.135* (0.054)	-0.053 (0.066)	-0.324 (0.193)
Age 60-64	0.123* (0.054)	0.167* (0.071)	-0.167 (0.215)
Constant	10.234** (0.031)	9.199** (0.068)	9.724** (0.116)
Observations	136055	132665	132665

	<b>Life Satisfaction</b>		
	<i>No controls</i>	<i>Demographic controls</i>	<i>Demographic controls plus Individual Fixed Effects</i>
Age 20-24	-0.136** (0.022)	-0.180** (0.023)	-0.122** (0.025)
Age 25-29	-0.128** (0.024)	-0.271** (0.027)	-0.114** (0.035)
Age 30-34	-0.143** (0.024)	-0.334** (0.029)	-0.106* (0.046)
Age 35-39	-0.247** (0.025)	-0.435** (0.032)	-0.128* (0.055)
Age 40-44	-0.298** (0.026)	-0.497** (0.033)	-0.126 (0.065)
Age 45-49	-0.276** (0.027)	-0.470** (0.033)	-0.127 (0.074)
Age 50-54	-0.191** (0.028)	-0.393** (0.034)	-0.097 (0.084)
Age 55-59	-0.055 (0.029)	-0.231** (0.036)	-0.003 (0.094)
Age 60-64	0.137** (0.032)	-0.084* (0.041)	0.111 (0.105)
Constant	5.311** (0.017)	5.005** (0.036)	4.784** (0.080)
Observations	84744	82096	82096

Robust standard errors in parentheses. \* significant at 5%; \*\* significant at 1%.  
The regressions in Columns 2 and 3 include all of Table 1's controls (except for age and age-squared).

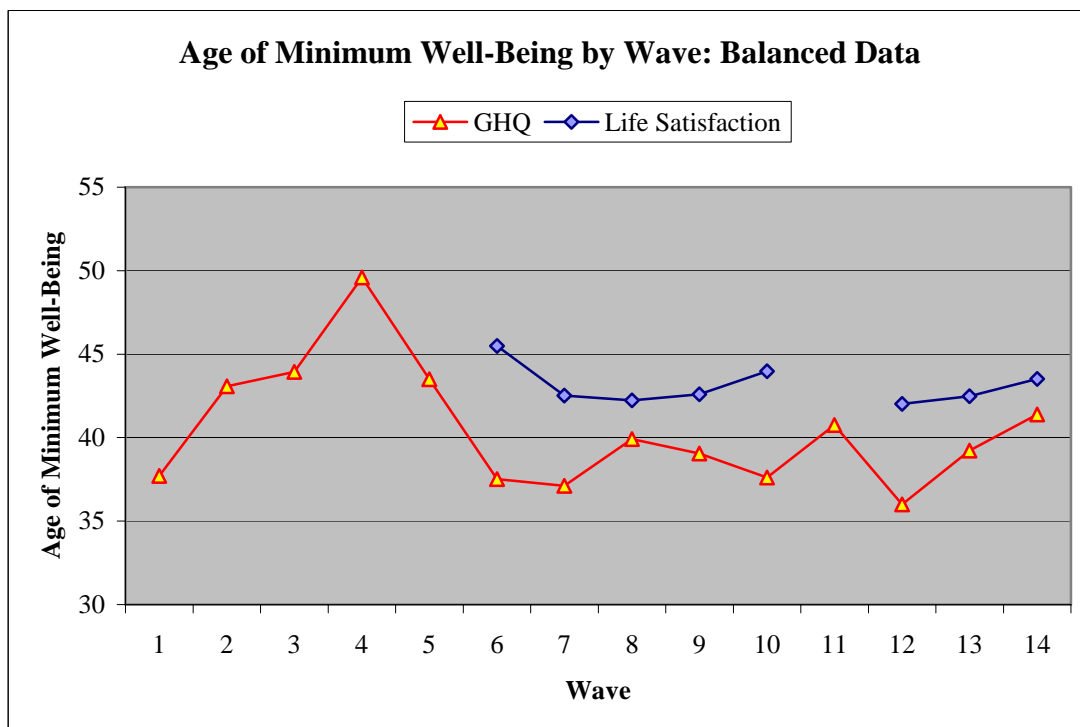
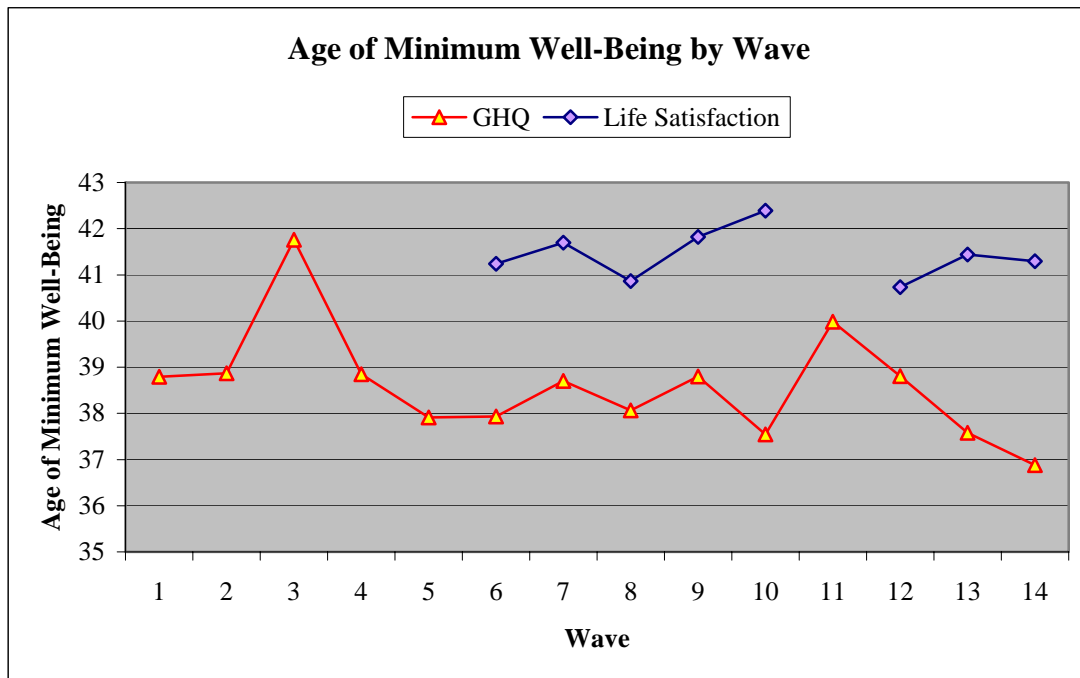
**TABLE 3. POOLED AND PANEL BALANCED WELL-BEING REGRESSIONS.**

	<b>GHQ</b>		
	<i>No controls</i>	<i>Demographic controls</i>	<i>Demographic controls plus Individual Fixed Effects</i>
Age 20-24	-0.308** (0.103)	-0.209 (0.108)	-0.182 (0.118)
Age 25-29	-0.410** (0.109)	-0.395** (0.120)	-0.475** (0.135)
Age 30-34	-0.593** (0.116)	-0.601** (0.132)	-0.716** (0.168)
Age 35-39	-0.544** (0.117)	-0.589** (0.141)	-0.763** (0.204)
Age 40-44	-0.672** (0.120)	-0.716** (0.145)	-0.902** (0.239)
Age 45-49	-0.705** (0.122)	-0.668** (0.147)	-0.903** (0.276)
Age 50-54	-0.498** (0.124)	-0.411** (0.152)	-0.659* (0.314)
Age 55-59	-0.414** (0.136)	-0.303 (0.170)	-0.553 (0.354)
Age 60-64	-0.067 (0.163)	-0.069 (0.209)	-0.298 (0.399)
Constant	10.631** (0.104)	9.413** (0.152)	9.822** (0.229)
Observations	39704	39280	39280

	<b>Life Satisfaction</b>		
	<i>No controls</i>	<i>Demographic controls</i>	<i>Demographic controls plus Individual Fixed Effects</i>
Age 20-24	-0.067 (0.049)	-0.134** (0.050)	-0.121** (0.042)
Age 25-29	-0.066 (0.054)	-0.227** (0.058)	-0.152** (0.053)
Age 30-34	-0.097 (0.055)	-0.299** (0.062)	-0.193** (0.067)
Age 35-39	-0.179** (0.055)	-0.391** (0.065)	-0.229** (0.081)
Age 40-44	-0.239** (0.055)	-0.467** (0.067)	-0.235* (0.094)
Age 45-49	-0.252** (0.057)	-0.454** (0.068)	-0.236* (0.108)
Age 50-54	-0.169** (0.058)	-0.388** (0.069)	-0.178 (0.122)
Age 55-59	-0.054 (0.060)	-0.269** (0.073)	-0.102 (0.136)
Age 60-64	0.150* (0.072)	-0.102 (0.091)	0.038 (0.153)
Constant	5.307** (0.048)	4.875** (0.071)	4.843** (0.120)
Observations	32120	31416	31416

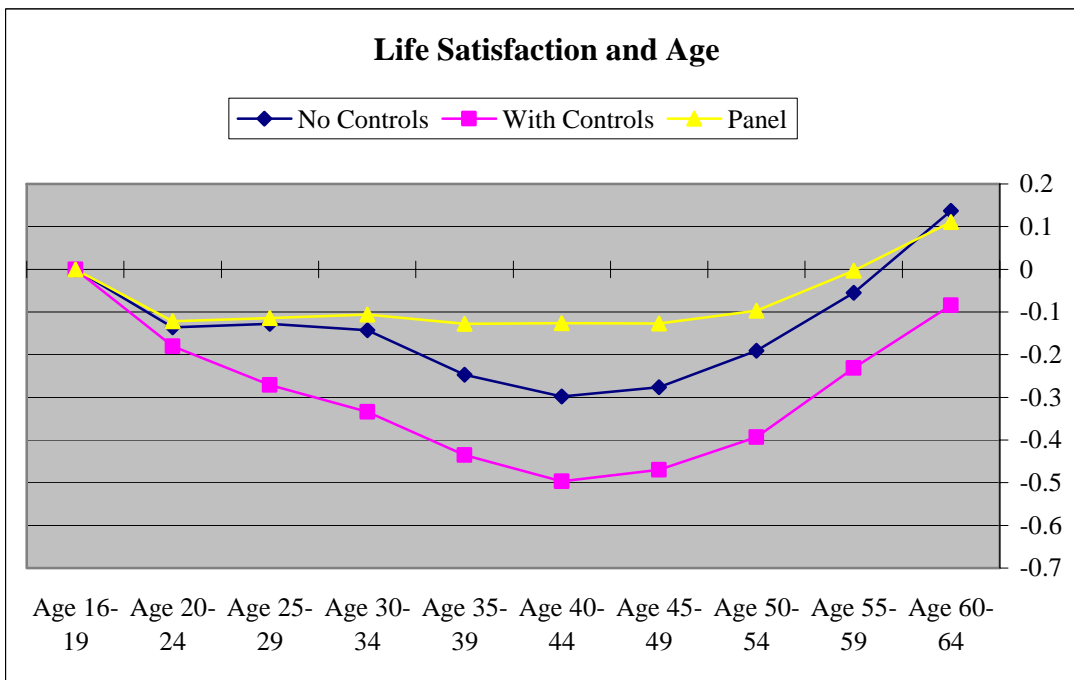
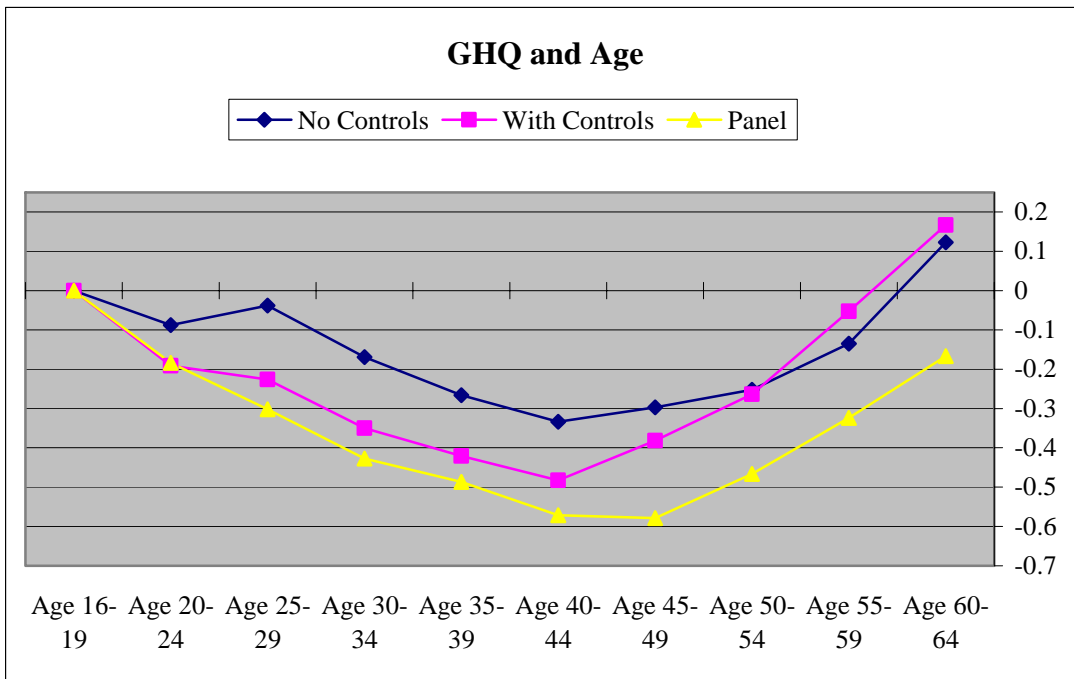
Robust standard errors in parentheses. \* significant at 5%; \*\* significant at 1%.  
The regressions in Columns 2 and 3 include all of Table 1's controls (except for age and age-squared).

**FIGURE 1. THE ESTIMATED MINIMUM OF THE U-SHAPE, BY WAVE**





**FIGURE 2. AGE AND WELL-BEING: POOLED AND PANEL RESULTS**



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