Is Happiness Contagious? Separating Spillover Externalities from the Group-Level Social Context

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Is Happiness Contagious? Separating Spillover Externalities from the Group-Level Social Context*

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Abstract

We investigate whether individuals feel happier when others around them are happier in broadly defined worker groups. This will be a formal test of spillovers in happiness. Answering this question requires a careful handling of the reflection problem, as it may not be possible to separate the endogenous spillover effects from contextual effects unless an appropriately designed identification strategy is employed. Implementing such a strategy and using the 2008 release of the British Housing Panel Survey (BHPS), we show that the group-level happiness does not have a statistically significant endogenous effect on individual-level happiness in the Great Britain. We report, however, statistically significant contextual effects in various dimensions including age, education, employer status, and health. These results suggest that higher group-level happiness does not spill over to the individual level in neither negative nor positive sense, while the individual-level happiness is instead determined by social context (i.e., the group-level counterparts of certain observed covariates). We also test the relevance of the "Easterlin paradox" and find that our result regarding the effect of income on happiness—controlling for social interactions effects—is the group-level analogue of Easterlin's original results.

JEL codes: C31, C36, D03, D62, I31.

Keywords: Happiness; spillover externalities; contextual effects; social ecologies; reflection problem; BHPS.

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1 Introduction

Studies in the intersection of social networks and happiness literatures find that "clusters of happiness result from the spread of happiness" [see, e.g., Fowler and Christakis (2008)]. The observed positive correlation between individual-level and group-level happiness scores is generally interpreted as an evidence of behavioral contagion. However, as Manski (1993) suggests, it is not that straightforward to separate behavioral spillover effects from the social context. In establishing a clear causal link between individual-level and group-level variables, it is crucial to make a distinction between the variables representing the influence that a group's characteristics have on its members and those variables representing the influence that a group's joint behaviors have on its members [Durlauf (2001)]. The literature names the former as *contextual* variables and the latter as *endogenous* ones. Failing to account for these differences will mask the identification of the true spillover effects. To answer the question whether happiness spreads as a result of behavioral contagion or not, one has to take these identification issues seriously.

Before formally describing the main hypothesis that we test in this paper, we would like to clearly conceptualize the type of social interactions we try to capture. Broadly speaking, there are two main directions one can follow in analyzing spillover effects. The **first** one focuses on the interactions within small groups of individuals who are directly connected. For example, depending on the data at hand, the analyst may want to know if happiness levels of the spouse, relatives, friends, acquaintances, neighbors, or co-workers affect the individual's own happiness level. This type of social interactions falls into the category of "network" or "peer" effects. The main empirical principle in this literature relies on directly observing two interacting individuals and, then, estimating the relevant correlations. Examples of papers in this strand of the literature include Lucas and Schimmack (2006), Bruhin and Winkelman (2009), and Powdthavee (2009).

The **second** type of social interactions—the one that we concentrate on in this paper—is concerned with more general social effects in larger reference groups. This strand of the

literature focuses on ecological settings constituted from social processes that involve collective aspects of community and work life.[1] Observing direct interactions between individuals is neither required nor needed. The only requirement is to carefully define the conditions and principles that form the environments in which individuals can absorb social spillovers. As Bramoulle et al. (2009) clearly describe, this type of social effects is based on the idea that "neighbors in the neighborhood do not affect me directly; what matters is the neighborhood itself."

We are primarily interested in the question whether there exist any happiness spillovers among employed workers in broadly defined social ecologies in the Great Britain.[2] Specifically, we want to test whether the observed positive correlation between the group-level and individual-level happiness is due to happiness spillovers or other factors. We use the British Household Panel Survey (BHPS)—a nationally representative micro-level dataset for the Great Britain—to answer this question. The BHPS embeds the General Health Questionnaire (GHQ), which measures the mental health and well-being levels of the respondents. This questionnaire consists of twelve different questions [see Appendix A for the details]. The last of these twelve questions explicitly asks about the happiness level of the survey respondent. Many papers in the empirical subjective well-being literature use this variable to quantify individual-level happiness. However, there is also a significant bulk of papers compressing the responses to all of the twelve questions to form a single—and more general—measure called "life satisfaction" or "general happiness." Although we believe that the specific question on happiness is more likely to pick up spillover effects, we also use the "general happiness" score, which measures the GHQ score as a whole, in our analysis for robustness purposes.

We construct industry $\times$ region cells as our reference groups using the BHPS. In terms of our conceptualization of social interactions, this means that we try to capture the social forces

[1] The term "ecological settings" (or "social ecologies") is introduced by developmental psychologists to bridge the gap between behavioral models that focus only on individual-level settings and those that focus only on macro-level settings. As it is originally defined by Bronfenbrenner (1974, 1979), a social ecology is a small enough setting that can capture the idiosyncratic aspects of a person's life and a large enough setting that can capture the collective interactions a person is exposed to in his/her immediate surroundings—i.e., family, workplace, local labor market, neighborhood, school, etc.

[2] This is also an economically meaningful question, because recent studies suggest that subjective well-being is positively correlated with labor productivity [Boeckerman and Ilmakunnas (2012), Oswald et al. (2013)]. If there exist significant social interactions effects and if happiness is a determinant of productivity, then the productivity of the worker is determined not only by her own happiness, but the aggregate happiness level in the environment she is associated with.

that operate among workers who are geographically close to each other and who are exposed to similar local labor market conditions specific to the industries they belong to. For example, suppose that a particular worker lives in the London area and works in construction; we're interested in how the happiness of other people who work in construction in London affect the worker's own happiness, controlling for the fact that construction workers in London share similar labor market shocks. As we explain above, this setting does not target how two particular workers influence each other's happiness levels in a certain industry $\times$ region cell; instead, we are trying to isolate the effect of the mean happiness level in the corresponding cell on the individual-level happiness. Based on our reference groups, the group-specific aspects we hypothesize are the regional norms in the community life and the relevant industry/location-specific labor market conditions in one's reference group. See Section 2 for a detailed explanation of this structure along with an assessment of the relevant papers in the literature employing a similar procedure.

The key statistical problem in estimating social spillovers is to separately identify the endogenous social effects and contextual social effects. The endogenous effect refers to the effect of the group-level (e.g., mean) happiness on the individual-level happiness. The contextual effect, on the other hand, refers to the effect coming from the group-level counterparts of the observables; such as the effect of mean age or mean education on the individual-level happiness. In this class of empirical work, endogenous versus contextual effects are often confounded. The main source of this confusion comes from the fact that it may not be possible to vary the endogenous variable independent from the contextual variable in the regression analysis. This is called the reflection problem and is well-known in the social interactions literature [see, e.g., Manski (1993, 1995, 2000)]. In separating the behavioral spillovers from the contextual effects, we use an instrumental variables argument motivated by an exclusion restriction. This strategy will systematically remove the dependency between these two types of social effects. To deal with the reflection problem that arises in the empirical analysis of social effects, there must be at least one individual-level characteristic, which does not correspond to a contextual effect when averaged out [Manski (1993)]. If there exists such a variable, it will serve

as an instrument to identify our desired results. The BHPS offers a candidate for such an instrument: the day of the week.[3] There is an emerging literature investigating if there is any correlation between the day of interview and the level of happiness scores self-reported by the respondents.[4] We exploit these correlations to construct a variable that rationalizes the use of an instrumental variables strategy to resolve the reflection problem.

Finally, we would like to understand if the well-documented negative relationship between "reference income" and own happiness score in the income comparisons literature still holds once we carefully control for endogenous and contextual social effects. Our empirical framework is capable of answering this sub-question paying particular attention to the arguments related to the Easterlin paradox. We confirm that Easterlin's findings hold at the group-level, controlling for social interactions.

The plan of the paper is as follows. Section 2 compares our paper to the relevant work in the related literature. Section 3 describes the dataset that we use. Section 4 introduces the concept of reflection problem to the reader, sketches out the empirical framework, and explains our identification strategy. Section 5 discusses the results in depth. Section 6 concludes.

2 Related Literature

The main objective in this paper is to test the existence of happiness spillovers. It will perhaps be useful at this stage to review the current state of the related literature and compare our paper to the relevant papers. To our knowledge, there are only a few papers attempting to estimate spillovers in happiness and the consensus is that happiness is contagious; that is, living close to a group of happier people increases individual-level happiness. For example, Fowler and Christakis (2008) find that happy people live in clusters. Using longitudinal data with detailed information on social networks, they show that happiness spillovers generate clusters of happy people.[5] In particular, they argue that these clusters are necessarily caused

[3] The BHPS records the date of each interview as day-month-year, allowing us to observe the day-of-the-week on which the interview occurs.

[4] See Taylor (2006), Akay and Martinsson (2009), and Helliwell and Wang (2013) for recent studies.

[5] They use the Framingham Heart Study social network to examine longitudinal interactions in small groups. "Ego" is the person whose behavior is being analyzed, while "alter," namely the reference group, is the person who is potentially influencing

by endogenous spillovers rather than contextual effects, because they observe that shocks to individual-level happiness spread into the network in a dynamic fashion and eventually affect group-level outcomes. Based on their estimates, when a friend living within 1.6 kilometers receives a positive happiness shock, the individual also feels happy with probability 0.25. They also report that these shocks are effective up to three degrees of separation in the society. A similar finding is documented by Hatfield et al. (1994) and Sato and Yoshikawa (2007), who argue that contagion effects might be relevant not only for happiness but for other emotions too.

The problem with these papers is that they do not explicitly address the reflection problem. In other words, they do not employ an appropriately designed identification strategy to separate endogenous effects from the contextual effects. Instead, they interpret the spread of the happiness shocks among one's connections as contagion. But, what if the happiness shocks that the members of a certain group receive are correlated? In particular, what if those shocks are correlated with the fundamental characteristics determining the group-formation principles in the society?[6] These papers do not address these questions. Although they do not claim causality in the results they report, contagion has strongly been suggested as the main mechanism leading to happiness clusters. To address the questions posed above (at least partially), the reflection problem has to be resolved.

One interesting paper attempting to estimate happiness spillovers by taking into account the reflection problem is Knight and Gunatilaka (2009). They perform this task using the Chinese rural survey. The reference groups in their paper are "villages," which is a broader definition relative to the social network structure analyzed by Fowler and Christakis (2008). They find that the average happiness in the village has a statistically significant positive effect on individual-level happiness. Based on the estimates they perform, the magnitude of the coeffi-

the behavior of the ego.

[6]For example, suppose that there are two groups in the society: group 1 and group 2. Group 1 consists of happier individuals, on average, than group 2. Suppose also that the average education level in group 1 is higher than that in group 2. Is it really the case that individuals in group 1 feel happier because they live in a group consisting of happier individuals, on average? Is it the case that individuals in group 1 feel happier because they live in a group consisting of more educated individuals, on average? Or, is it the case that the society is hit by a shock (say, a policy change) that is perceived more positively by the educated individuals, therefore, the average happiness in group 1 is larger than that in group 2? The first question is related to endogenous effects, the second is related to contextual effects, and the third is related to correlated effects.

cient measuring the effect of the group-level happiness on individual-level happiness is around 0.3. The empirical method they employ is an instrumental variables (IV) strategy. Specifically, they use father's and spouse's years of education as the instrument. As we describe in detail later, the group-level analogue of this instrument has to affect individual-level happiness only through group-level happiness. It is not difficult to argue that the instruments specified by Knight and Gunatilaka (2009) can violate this condition.[7]

Our paper is similar to Knight and Gunatilaka (2009) in that we also try to address the reflection problem using an IV strategy. Our paper differs from Knight and Gunatilaka (2009) in three major ways. First, we use a different IV, which we construct using the day-of-the-week information that the BHPS provides. Second, we capture a broader population and a wide variety of subgroups in that population. And, finally, we construct our reference groups in industry $\times$ region cells to capture the collective aspects of community and work life. Specifically, we cluster the geographical locations in the following eleven regions: London, South East, South West, East Anglia, East Midlands, West Midlands, North West, North East, Yorkshire and Humberside, Wales, and Scotland.[8] Nine industry categories are selected at one-digit level as follows: energy and water supplies; extraction of minerals and manufacture of metal goods, mineral products, and chemicals; metal goods, engineering, and vehicles; other manufacturing industries; construction; distribution, hotels, and catering (repairs); transport and communication; banking, finance, insurance, business services, and leasing; and other services. Combining the industry-region pairs, we obtain 99 reference groups.[9]

The selection of the reference groups to be used in empirical analysis has always been a source of debate and, still, there exists no natural prescription for determining the ideal set of groups to estimate social interactions [see, e.g., Durlauf and Ioannides (2010)]. However, as Akerlof (1997) suggests, social interactions are best detected in social environments with many broad dimensions, i.e., in environments with overlapping effects of factors such as spatial proximity,

[7] For example, the mean paternal education in the reference group may increase the happiness directly (both in *ex ante* and *ex post* terms), because more educated fathers may have bequeathed a higher wealth, a better neighborhood, or superior education opportunities.

[8] We exclude the Northern Ireland due to clustering issues [see BHPS, Volume A, 2–5].

[9] An alternative peer group selection strategy would be to use occupation groups rather than industries. But, it is well-known that occupation-level groupings may create extra noise in large datasets. We follow the conventional wisdom and use the industry-region combinations in formulating our reference groups.

neighborhood conditions, local labor market conditions, etc. Constructing the reference groups in the way we describe above is consistent with these fundamentals and has often been appealed in numerous influential papers in the literature. For example, Luttmer (2005) utilizes the outgoing rotation groups feature of the Current Population Survey and constructs industry × occupation cells to estimate the neighborhood effects of income on individual-level happiness in the United States. Similarly, Ferrer-i-Carbonell (2005) uses the German Socio-Economic Panel and constructs education × age × region cells to estimate the impact of the group-level income on individual-level subjective well-being in Germany. In a similar context, Glaeser et al. (1996) construct region-specific cells on a lattice to estimate the impact of neighbors' criminal-activity decisions on the agent's own decision to participate in crime in the United States. In another example, Stutzer and Lalive (2004) use data from Switzerland cantons and construct canton-level cells to estimate the effect of social norm to work (roughly, the rate of employment in one's neighborhood) on how quickly the unemployed individual finds a job, probably due to social pressure. These examples can be extended further. In all of these papers, large reference groups are constructed to capture the social influences in various contexts. If various spillover effects are detected in these settings, happiness spillovers may likewise be analyzed and detected. Hence, our paper can be classified in this strand of literature.

We find that endogenous spillovers—e.g., contagion—do not have a statistically significant effect on individual-level happiness scores when large worker groups are the concern. Instead, the observed correlations between group- and individual-level happiness scores are explained by group-level social context.

3 Data

3.1 Basic Facts

We use individual- and group-level data from the British Household Panel Survey (BHPS), covering the years 1992–2008. The BHPS provides information on individual, household,

and job-related characteristics in England, Scotland, Wales, and Northern Ireland. It yearly follows, in a panel structure, a nationally representative sample of households interviewing every adult member of sampled households and assigning a unique identification number for each respondent. The date of interview is recorded as day-month-year as well as the day-of-the-week on which an interview is conducted. Our analysis focuses on the working population only.[10]

In the BHPS data, psychological well-being measures are derived from the General Health Questionnaire (GHQ). See Appendix A for the details of the questionnaire. The GHQ is widely used in the United Kingdom as a subjective measure of minor psychiatric morbidity [Goldberg and Williams (1988), McCabe et al. (1996)] and is a reliable indicator of mental distress [Goldberg (1972), Goldberg (1978), Argyle (2001)]. It measures the overall life satisfaction of the survey respondents and detects if a respondent suffers from a health problem related to anxiety or depression.

We perform our empirical analysis using two different dependent variables: for the specific happiness question in the GHQ and for overall mental health (or life satisfaction) measure constructed using all 12 questions. Next we describe the details of these two variables. We start with the specific happiness measure. There is a particular question under the GHQ focusing on the individual-level happiness score: been feeling reasonably happy all things considered? The answer is coded on a four-point scale: ranging from "Disagree strongly" (coded 4) to "Agree strongly" (coded 1). This means that a higher score is associated with a lower level of happiness. Following the convention in the literature [see, e.g., Clark and Oswald (2002)], we call this variable the "overall happiness" score. Then, we use the more general measure derived from the entire GHQ, which we call the "general happiness" score. This measure includes the specific happiness question only as a component and also captures the other aspects of mental health and life satisfaction as a whole [see Appendix A]. We would like to emphasize, however, that our main variable of interest is the specific happiness measure and the more general measure is introduced for robustness purposes as well as for understanding

[10]Due to a potential measurement problem in Wave–1 [Rose (1999)], we drop Wave–1 and use the data from Wave–2 to Wave–18 in our empirical analysis.

the nature of the results.

For the individual- and job-related characteristics, we follow the literature using the BHPS data and control for gender, age, education levels, preferences over working hours, types of contract, size of establishment, promotion opportunities, union membership, and health status [see, e.g., Taylor (2006)]. We collapse the education levels into seven broad groups as follows: *higher degree* refers to postgraduate education, *first degree* refers to college education, *A-level*, *O-level*, and *other higher qualification* refer to high school graduates of different types (consistent with the UK education system), *vocational qualification* refers to teaching, nursing, commercial, apprenticeship, and the certificate of secondary education (CSE), and, finally, the ones with *no qualification*. We also construct a dummy variable "income," which is equal to 1 if the worker earns more than the median level of earnings in her reference group within the corresponding wave and is equal to 0, otherwise.

Table (1) presents the summary statistics of the final data that we use in our empirical analysis. The mean age of the respondents is around 40. Among the 97,372 observations, 51 percent are male, 55 percent are married, 33 percent are never married, 8 percent are divorced, 2 percent are separated, 2 percent are widowed, 3 percent have higher-degree, 13 percent have first-degree, another 13 percent have A-level degree, 20 percent have O-level degree, 28 percent have other higher qualifications, 11 percent have vocational qualifications, and the remaining 12 percent have no qualifications. 3 percent and 2 percent have temporary and fixed-term contract, respectively. 18 percent work in the public sector and 61 percent work in a company of size 200 workers or smaller. 21 percent are union members. 36 percent are subject to promotion prospects and opportunities. 7 percent prefer to work more hours and 27 percent prefer to work fewer hours. 25 percent report their health to be very good, whereas 16 percent report to be satisfactory. 51 percent earn above the median monthly income. The average overall happiness score is 1.98 out of 4, with a standard deviation of 0.58. Notice that there is another dummy variable in the table labeled Wednesday-Friday-Sunday. It is equal to 1 if the interview is conducted on any of these dates and it is equal to 0, otherwise. This dummy variable will serve as an instrument in our empirical analysis of social interactions. 36 percent

of the workers in our sample are interviewed on a Wednesday, Friday, or Sunday. All the means and the standard deviations reported in Table (1) are calculated using the BHPS frequency weights.[11]

3.2 The Day of the Week

In this section, we perform a preliminary empirical analysis to understand the basic correlations among the main exogenous determinants of happiness. The purpose is to have a suggestive opinion on the sources of happiness. As the happiness measure, both the overall happiness and general happiness scores are used [see above]. Happiness is specified to be a function of the demographic and household characteristics as well as job- and employer-related characteristics. Time and industry dummies are included. We also include dummy variables for the day of the interview (i.e., the day of the week on which the interview is conducted).

Following Clark and Oswald (1996), Clark (1997), and Taylor (2006), we run a random-effects ordered probit regression. See Table (2) for a complete list of control variables and the regression results. Consistent with the findings in the previous literature, we find that males (than females), younger workers (than older ones), married (than non-married), and less educated (than more educated) are happier workers controlling for time, industry, and job- and employer-related characteristics. These results hold for both happiness measures.

We also report correlations regarding the "day-of-the-week effect." There is no statistically significant day dummies. We find that Friday and Saturday are the days on which the self-reported happiness level is the highest. Sunday and Tuesday are the ones on which it is lowest. By using the BHPS dataset and a similar econometric framework, Taylor (2006) reports that respondents interviewed on a Friday report higher levels of happiness than those interviewed from Tuesday through Thursday. Akay and Martinsson (2009) measures the same relation by using German Socio-Economic Panel (GSOEP) under pooled random-effects and quasi-fixed ordered probit models. Their results yield a "blue" Sunday effect with the lowest level of happiness. We will build on this result in Section 4.3 to construct our instrumental variable,

[11] Until wave–11, for the original BHPS sample, the weight is "wLRWGHT." Afterwards, for all samples, "wLRWTUK1" is used. Our analysis also takes into consideration the complex survey design [see BHPS, Volume A, 2–5].

which we use to separately estimate endogenous spillovers and contextual effects.

4 Empirical Analysis

4.1 The Reflection Problem

We use a linear-in-means model of social interactions in our empirical analysis. However, this model is plagued with the well-known "reflection problem," which masks the econometric identification of social interactions [Manski (1993, 1995, 2000)].[12] The formal definition of the reflection problem is given in Section 4.2. But it will be useful to give the intuition in advance. In large reference groups, individuals behave simultaneously and this simultaneous behavior generates a group-level "mean" behavior that in turn affects individual-level behavior. In a linear-in-means model (see below), this simultaneity imposes a collinearity between the individual-level behavior and the group-level behavior. This is called the reflection problem. Identifying social interactions may not be possible in the presence of the reflection problem unless an appropriately designed empirical strategy is employed.

Without overcoming the reflection problem, it is not possible to separate the endogenous effects from contextual effects. The difference between these two effects is of primary importance. The endogenous effect is the effect of the group-level behavior on the individual-level behavior, whereas the contextual effect roughly refers to the effect of the environment on individual-level behavior. Separating these two effects is crucial, because it allows us to understand and separately assess the sources (or nature) of social effects. It is also possible to ignore this difference and refer to only one type of social interactions without a need to pay attention to the reflection problem.[13]. But we believe that the value of social interactions estimates diminishes significantly if one fails to correctly disentangle the sub-components. In this paper, one of our main goals is to put a careful effort to understand the sources of the observed positive correlations between individual- and group-level happiness scores.

[12] See Brock and Durlauf (2001b) and Soetevent (2006) for a detailed survey of the related empirical and theoretical literatures. See also Moffitt (2001).

[13] See, for example, Gaviria and Raphael (2001) and Trogdon et al. (2008).

There are two common ways to resolve this problem. **First**, one can construct a non-linear-in-means model of social interactions. Introducing non-linearity will naturally resolve the reflection problem, but the source of identification will solely be the functional form. Given the nature of the BHPS data, a non-linear model that comes to mind first is a standard ordered-choice model. Unfortunately, a formal framework for identifying social interactions in an ordered-choice model does not exist in the literature.[14] One can instead use semi- or non-parametric identification techniques, however, as Brock and Durlauf (2007) demonstrate, these methods produce limited results.[15] **Second**, one can use an appropriately designed instrumental variables strategy within the linear-in-means model. The key is that there must be at least one individual-level characteristic (i.e., an exclusion restriction), which does not correspond to a contextual effect when averaged out. If such a variable exists, it can serve as an IV to identify social interactions in a linear-in-means framework [see Ioannides and Zabel (2003) for an example]. A valid IV will remove collinearity and successfully resolve the reflection problem. In this paper, we follow the IV strategy to test the validity of endogenous versus contextual effects in the determination of individual-level happiness.

4.2 The Econometric Model

In this subsection, we present the formal model that we estimate along with a more systematic definition of the reflection problem. There is a large number of individuals indexed by i in the population and a smaller number of groups indexed by g. Each individual i is a member of a certain group g. Individuals self-report their happiness scores. The happiness level of an individual i, who is a member of the group g, is denoted with ω_{i_g}. A linear regression model aimed at investigating the determinants of self-reported happiness in the society can be formulated as follows:

$$\omega_{i_g} = \beta_0 + \beta_1 \boldsymbol{X}_{i_g} + \beta_2 \boldsymbol{Y}_g + Jm_g + \epsilon_{i_g}, \tag{4.1}$$

[14] There are clear-cut results to identify social interactions within binary [Brock and Durlauf (2001a)] or multinomial [Brock and Durlauf (2002)] discrete choice models. Whether ordered-choice models with social interactions can be identified econometrically or not is an open question in the literature. For theoretical attempts to model social interactions within an ordered-choice framework, see Aradillas-Lopez (2011) and Tumen (2011)

[15] See Tumen and Zeydanli (2013b) for a particular non-linear model that can guarantee identification under certain assumptions.

where $\boldsymbol{X}_{i_g}$ is a vector of individual-level observed characteristics of i, a member of the group g, $\boldsymbol{Y}_g$ is a vector of group-level observed characteristics in group g, $m_g = \mathbb{E}[\omega_{i_g}|g]$ is the mean self-reported happiness score in group g, and ϵ_{i_g} is an independent error term. This is the canonical linear-in-means framework often used in the empirical social interactions literature. It describes the individual-level outcome as a linear function of the individual-level observed characteristics, the group-level (mean) observed characteristics (i.e., the contextual effects), the endogenous (or behavioral) social spillovers, and a random error term. The difference between β_2 (contextual effect) and J (endogenous effect) is the key notion in this model. A naive OLS regression without paying attention to the difference between β_2 and J will likely result in non-identification. Our ultimate goal is to econometrically distinguish β_2 from J. To achieve this goal, one needs to clearly recognize and understand the identification problem.

The Appendix B provides a mathematical description of the main identification problem. But, we believe that briefly providing the intuition will enhance the exposition. Equation (4.1) describes the determinants of the self-reported individual-level happiness. Self-consistency requires that we should be able to back up m_g, for all g, when we take the group-level averages of ω_{i_g}'s; that is, $m_g = \mathbb{E}[\omega_{i_g}|g]$. This suggests that group members behave simultaneously and this simultaneous behavior form an endogenous environment described by m_g. Taking the average in both sides of the Equation (4.1) gives us

$$m_g = \beta_0 + \beta_1 \boldsymbol{X}_g + \beta_2 \boldsymbol{Y}_g + J m_g, \tag{4.2}$$

where $\boldsymbol{X}_g = \mathbb{E}[\boldsymbol{X}_{i_g}|g]$. Clearly, m_g can itself be expressed as a linear function of $\boldsymbol{Y}_g$ and m_g. Therefore, there is a clear collinearity problem that prevents us to separately identify J and β_2 (i.e., the endogenous versus the contextual social effects).

The punchline is that an appropriately designed identification strategy is needed to break the collinearity demonstrated above. A viable way to back up identification is to impose an exclusion restriction (i.e., an individual-level variable the mean of which does not correspond to a contextual effect). The Appendix B formally describes how an exclusion restriction can

separately identify J and β_2. The exclusion restriction is called an instrument. The next subsection describes our identification strategy as well as the details of how we construct our instrument.

4.3 Identification Strategy

Fortunately, the BHPS dataset allows us to construct an instrument just like the one described above. The date of each interview is recorded in the BHPS as day-month-year. Whether the day of the week on which the interview is conducted has a significant effect on self-reported happiness levels or not has become an active line of research in recent years. In this literature, Friday/Saturday have been typically reported to be the days with the highest happiness scores and Tuesday/Sunday to be the lowest. Our ordered probit estimates reported in Section 3 confirm this view. In the rest of this sub-section, we describe how we use the day-of-the-week idea to construct our instrument. Appendix C presents the intuition behind our IV strategy with a specific example.

We construct a binary variable D_i by assigning $D_i = 1$ for those who are interviewed on Wednesday, Friday, or Sunday and $D_i = 0$ otherwise. Below we explain how we choose these days and, then, we perform a robustness analysis under alternative day combinations. Three fundamental factors drive our choice of days in constructing D_i (the i-subscript is dropped in what follows).

1. D has to predict the individual-level happiness score reasonably well.

2. The selection of days has to be performed in such a way that it is free of the self-selection problem. For example, workers interviewed on Friday or Saturday may be more likely to feel happy since they like to work hard during the weekdays, weekends are the only available time for them to file their responses to the survey, and they may be more likely to report higher happiness scores.[16] A classical endogeneity problem may arise if this point is not paid attention. Our construction takes this into account.

[16] Most studies in the literature do not pay attention to this factor. See our companion paper, Tumen and Zeydanli (2013a), for the day-of-the-week effect estimates accounting for selectivity.

3. It has to justify the exclusion restriction; that is, it should not reflect a contextual effect when it is averaged out in the reference group. Clearly, the mean of D in the reference group does not correspond to a social context, whereas variables like age, education, gender, and so on do represent a relevant social context.

If these three criteria are met, then D is a reasonable candidate to be used in the construction of our instrument.

The choice of the days is the central issue in this construction. As we mention above, $D = 1$ if the interview is conducted on Wednesday, Friday, or Sunday, and $D = 0$ otherwise. The regression results confirm that the **first** criterion is met [see Tables (3) and (4)]. To satisfy the **second** criterion, it is necessary to construct D in such a way that the selectivity issue is avoided. The results reported in the literature as well as our estimations from the random-effects ordered probit model we document in Section 3 provide us guidance on this point. Friday/Saturday are the best days and Tuesday/Sunday are the worst ones in terms of self-reported happiness. The dummy variable has to be constructed in such a fashion that the $D = 1$ category should not oversample the good days or the bad days systematically. For example, putting workers surveyed in Fridays and Saturdays together into the $D = 1$ category may lead to a selection problem as described above, in criterion 2. For this reason, we pick one day from the good days, one from the bad days, and one from the intermediate days to construct D. We try a large number of alternative configurations [see Table (7) for robustness check] and decide that the best combination is: $D = 1$ if the survey is taken on Wednesday, Friday, or Sunday; and $D = 0$ otherwise. The **third** criterion holds by definition. The group mean of D cannot be regarded as a group-level characteristic, which means that its coefficient does not correspond to a contextual effect. In other words, it is meaningless to describe a group with the mean of D in that group.

5 Results and Discussion

Our main estimates are presented in Tables (5) and (6).[17] These tables report the translated coefficients (i.e., the coefficients extracted and processed from Tables (3) and (4) according to the identification framework described above), which are readily interpretable as social interactions estimates for the "overall happiness" and "general happiness" scores, respectively. As we describe in Section 3, the overall happiness measure is derived from the question in the GHQ specifically asking the happiness of the respondent, while the general happiness score corresponds to a compound measure derived from all twelve questions in the GHQ; thus, it includes components of mental health and life satisfaction in general. We would like to emphasize in advance that the results do not change significantly across these two measures, although the magnitude of the estimated coefficients may differ. This suggests that our main conclusions presented below are robust to a change in the measure of happiness. To maintain our focus on happiness spillovers, the discussion below concentrates only on the results for the overall happiness analysis—i.e., Table (5). The results can further be assessed under three categories: spillovers, contextual effects, and pay comparisons.

5.1 Spillovers

Studies in the social networks literature tend to interpret the observed positive correlations between group-level and individual-level happiness scores directly as "spillovers." However, the main sources of these correlations are not obvious and require a deeper empirical investigation. Most of the studies in this area (as well as the related comments in the popular media) do not pay attention to the—rather obscure—distinction between endogenous versus contextual effects. We employ Manski's identification framework to separate spillover externalities from group-level social context. Our results suggest that spillover effects are confounded with contextual effects in the empirical literature. Specifically, we find that happiness is *not* contagious among employed workers in broad reference groups.[18] Instead, the observed correlations

[17] Standard STATA packages are used in all estimations. Further details on the calculation procedures are available from the authors upon request.

[18] In a companion work [see Tumen and Zeydanli (2013b)], we perform a similar analysis for job satisfaction; that is, we separate behavioral spillovers from contextual effects for the BHPS measure of job satisfaction. Contrary to the present paper, we capture significant social interactions in job satisfaction using the same data and a similar empirical framework. This suggests

between group- and individual-level happiness scores originate from contextual effects. See Section 5.2 for a detailed documentation of these contextual effects.

The result that there are no endogenous spillovers in happiness among the employed workers is important for economic theory. Self-reported happiness is often regarded as a proxy for individual utility [Frey and Stutzer (2002)].[19] The standard Marshallian utility includes one's own consumption as the determinant of utility level. Several extensions along the Beckerian tradition include others' consumption and/or utility levels as other relevant determinants of individual-level utility. For example, the altruism research considers one's family members' consumption and utility levels as elements of individual utility [Becker and Barro (1988), Becker (1993)]. There are other examples including other intra-family relations, charitable behavior, merit goods and multi-person interactions, and envy and hatred [Becker (1974)]. In this paper, we test the hypothesis whether an individual worker cares about the utility levels of the other employed workers in his broad reference group. Our answer is a clear "no" (although we conjecture that the answer might change when the family members and close friends are concerned).

5.2 Contextual Effects

We find that, unlike the spillover effects, the group-level social context is a statistically significant determinant of individual-level happiness. Our regressions control for a comprehensive list of exogenous factors [see Tables (5) and (6)]. *First*, we show that individual-level happiness goes up with group-level age. In other words, a worker feels happier when she works close to older workers than younger ones. We also show that this age effect becomes less important as group-level age goes up. It is possible to convert the age variable into experience units following Mincer (1958, 1974). After this conversion, one can conclude that working close to a group of more experienced workers makes the individual happier.[20]

that employed workers care about whether workers in their reference groups are satisfied jobwise or not rather than whether they are happy or not. This maybe due to the profound conceptual differences between job satisfaction and happiness. Since we explicitly focus on employed workers in both papers, we conclude that "overall happiness of the employed" does not refer to "job satisfaction."

[19] See Kahneman and Krueger (2006) for an excellent discussion on the potential links between the classical utility theory and self-reported happiness scores. See Bertrand and Mullainathan (2001) and Ravallion and Lokshin (2001) for skeptical views.

[20] If happiness is positively correlated with productivity, then it is possible to conclude further that workers are more productive in a group of older (or more experienced) workers.

Second, we report that working in a group with a larger fraction of college-educated workers, workers with high-school education, and those with vocational degrees reduce individual-level happiness. There is no statistically significant relationship between individual-level happiness and working in groups with a larger fraction of workers with higher degrees (i.e., graduate education). The omitted education dummy is "no qualification," so these results should be interpreted relative to this omitted category. Workers with a graduate degree (or higher degree) has a very small share in our dataset—only 3 percent. Therefore, if one ignores the "higher degree" category, it is possible to conclude that working in a group with more educated workers reduces individual-level happiness. This may be due to a several reasons. Greater feeling of competition and pressure may be the driving force. It is also possible to interpret this within the context of income comparisons. Being more educated implies receiving higher wages, on average. Thus, working in a group of highly educated workers may be depriving the individual-level relative income perceptions, which may be the reason behind low feelings.

Third, we document that working close to a larger mass of public sector workers is a statistically significant source of unhappiness. This finding is interesting and it calls for further empirical investigation, because both the plain random-effects ordered probit and the social interactions regressions yield the result that the worker does not care being a public sector worker herself. *Fourth*, we find that working in a group of employed workers with greater promotion opportunities reduces individual happiness. We show, however, that having access to greater promotion opportunities is a statistically significant determinant of individual-level happiness. In other words, the individual likes to receive a promotion but she doesn't enjoy when others around her have promotion prospects. Envy, hatred, and pressures stemming from competitiveness may be the relevant sources of this result. Again, the perception of relative income maybe another relevant factor. *Fifth*, working close to a group of union-member workers increases individual-level happiness, while the worker does not like being a union worker herself. The interpretation may be the following. Being a union member may be associated with increased stress because of the process of collective agreements and the related implicit contracts enforcing joint behavioral acts. Working close to a group of union workers

may understandably increase individual-level well-being because everyone else in the group is exposed to the external effects from acquisitions of unionism. *Finally*, working in a group with a larger fraction of workers with very good health increases individual-level happiness, which suggests that group-level health has significant positive external effects on individual-level happiness. This finding is consistent with social contagion effects in weight. Individuals feel less overweight as the average weight in the region rises [Clark and Etile (2011)]. The current literature also supports the idea that individual-level health problems have less effect on happiness, when the problems are shared by others in the household.

5.3 Pay Comparisons

Our results regarding the relative income comparisons deserve special attention. We test the relevance of relative income comparisons as a determinant of individual happiness, controlling for social interactions effects. To achieve this goal, we construct a dummy variable taking the value 1 if the individual earns more than the median wage in the corresponding wave and 0 otherwise. We show that individual-level happiness is positively related with one's relative income perceptions and this relationship is statistically significant, controlling for social interactions effects. The formal social interactions framework we work with allows us to perform a test of the "Easterlin paradox" at the group level. According to Easterlin (1974, 1995, 2001), individuals with higher income levels tend to report higher happiness in a given country. At the international level, however, happiness scores do not vary significantly with country-level per capita GDP. Our results can be regarded as the "group-level analogue" of Easterlin's findings. We find that the worker cares the level of her own income in her reference group. But, the estimates of the group-level income coefficient yield the result that working in a group with higher absolute income (i.e., a greater fraction of high earners in the corresponding wave) does not have a statistically significant effect on individual-level happiness. In other words, workers with higher income levels tend to report higher happiness in a given group; at the group-level, however, self-reported happiness does not vary significantly with group-level income.

This paper is closely related to the papers in the neighborhood effects literature investigating the effect of relative income perceptions on happiness. Luttmer (2005) shows that higher earnings of the agents in one's reference group is associated with lower levels of self-reported individual-level happiness. Kingdon and Knight (2007) provide evidence that the "reference income" is a positive in one's utility when the family members are in the reference group, whereas it is a negative when the distant individuals are concerned. These papers, and others in this literature, focus exclusively on the neighborhood effects of income and affluence. They find that, when large neighborhoods are concerned, individual-level happiness is positively affected by one's relative income status in the neighborhood. Different from the literature, we ask if income comparisons still have any effect on individual happiness if one carefully controls for endogenous *and* contextual social interactions effects. There is a consensus in the related literature that relative income is an important determinant of happiness.[21] Our findings also confirm this view. Specifically, we find that earning above the median wage in the reference group is positively associated with happiness and the resulting correlation is statistically significant. We conclude that, controlling for endogenous as well as contextual social effects, relative income is a critical determinant of happiness.

5.4 Further Thoughts

There are a couple of limitations in the analysis. The first one is related to the reference group construction. The standard models used in this literature do not offer a systematic way, using which one can construct the reference groups "optimally." In other words, there is no systematic procedure one can employ to decide the characteristics of the groups, in which social interactions are the most effective [see, e.g., Brock and Durlauf (2001b) and Blume and Durlauf (2001)]. But this limitation is not specific to our paper. All social interactions estimates reported in the literature are plagued with a similar problem. To minimize these concerns, we choose our reference groups based on the conventions that have been developed in the related literature [see Section 2 for further discussion]. The second one is related to the first one; but it is distinct. It may be the case that the individuals' attachment to the

[21] See, for example, Easterlin (1974), van de Stadt et al. (1985), Clark and Oswald (1996), and Ferrer-i-Carbonell (2005).

reference groups is non-random; that is, individuals may be self-selecting themselves to the reference groups. If selection is a significant force, than the social interactions estimates may be biased [see, e.g., Blume et al. (2011)]. We try to address this issue in two ways: (*i*) we cluster standard errors at the group level to capture the possibility of correlated unobserved within-group effects and (*ii*) we work with large reference groups, since it is well-documented that the incidence of selectivity tends to get weaker as the reference groups get larger. For example, selection is probably quite strong in small friendship networks, but it is very likely to be small in industry $\times$ region cells covering the entire country. In sum, although some potential limitations may exist in the current study, we believe that they are either not specific to our paper or unlikely to affect our estimates significantly.

6 Concluding Remarks

The observed positive correlations between group-level and individual-level self-reported happiness scores are often interpreted as the *prima facie* evidence of "happiness contagion" in several literatures and in popular media. In this paper, we use a formal empirical social interactions model—à la Manski—to test the hypothesis whether the source of these correlations is endogenous spillover effects of happiness or not. We reject this hypothesis using the BHPS data for employed workers; that is, we show that there are no spillovers in happiness and the observed correlations between group- and individual-level happiness scores come from the contextual effects—mainly the group-level age, education, employer status, and health. This suggests that contextual social effects may have been confounded with spillover externalities in the literature.

We also ask if the "Easterlin paradox" holds at the group level in the Great Britain, controlling for the endogenous and a variety of contextual social effects. Our answer is affirmative. We show that the employed workers care their own relative position on the income distribution rather than the absolute position of the group they are associated with.

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A GHQ Questionnaire

A series of questions are asked in the General Health Questionnaire (GHQ). These questions are:

Have you recently:

1. Been able to concentrate on whatever you are doing?
2. Lost much sleep over worry?
3. Felt that you are playing a useful part in things?
4. Felt capable of making decisions about things?
5. Felt constantly under strain?
6. Felt you couldn't overcome your difficulties?
7. Been able to enjoy your normal day to day activities?
8. Been able to face up to your problems?
9. Been feeling unhappy and depressed?
10. Been losing confidence in yourself?
11. Been thinking of yourself as a worthless person?
12. Been feeling reasonably happy all things considered?

Answers are coded on a four-point scale from "Disagree strongly" (coded 1) to "Agree strongly" (coded 4)—questions 1, 3, 4, 7, 8, and 12 are coded in reverse order—and added together to provide a total GHQ level of mental distress ranging in total from 12 to 48, which we call the "general happiness" score [see, e.g., Taylor (2006) for the construction principles]. Low scores correspond to low levels of stress/depression (i.e., high feelings of well-being). This approach is known as a Likert scale. Although our main focus is on the last question, which we call as the "overall happiness," for robustness purposes, we also perform our analysis using the general happiness score described above.

B Details of the Econometric Framework

The linear-in-means equation that we estimate is:

$$\omega_{i_g} = \beta_0 + \beta_1 \boldsymbol{X}_{i_g} + \beta_2 \boldsymbol{Y}_g + J m_g + \epsilon_{i_g}, \tag{B.1}$$

where the variables are as they are described in Section 4.2. Taking the conditional mathematical expectations in both sides of the Equation (B.1) yields

$$m_g = \beta_0 + \beta_1 \boldsymbol{X}_g + \beta_2 \boldsymbol{Y}_g + J m_g, \tag{B.2}$$

where $\boldsymbol{X}_g = \mathbb{E}[\boldsymbol{X}_{i_g}|g]$. The distinction between $\boldsymbol{X}_g$ and $\boldsymbol{Y}_g$ is key to understanding the identification problem. Any variable in $\boldsymbol{Y}_g$ has to describe something "meaningfully" related to that group; such as, the fraction of males, the mean education, the fraction of non-whites, etc. $\boldsymbol{X}_g$ is the group-level mean of individual-level observed characteristics and it may or may not coincide with $\boldsymbol{Y}_g$, i.e., not every variable in $\boldsymbol{X}_g$ has to correspond to an element in $\boldsymbol{Y}_g$.

In Equation (B.2), m_g appears on both sides. Solving for m_g yields the expression that

$$m_g = \frac{\beta_0}{1-J} + \frac{\beta_1}{1-J}\boldsymbol{X}_g + \frac{\beta_2}{1-J}\boldsymbol{Y}_g. \tag{B.3}$$

Manski (1993) defines the reflection problem as follows. Let $dim(\boldsymbol{a})$ denote the dimension of some generic vector $\boldsymbol{a}$. The *reflection problem* states that if $dim(\boldsymbol{X}_g) = dim(\boldsymbol{Y}_g)$, then linearity masks the econometric identification of the (endogenous) social interactions parameter J and the vector of contextual effects parameters β_2. To see this clearly, one can plug Equation (B.3) into Equation (B.1) to obtain the outcome equation

$$\omega_{i_g} = \frac{\beta_0}{1-J} + \beta_1 \boldsymbol{X}_{i_g} + \frac{J\beta_1}{1-J}\boldsymbol{X}_g + \frac{\beta_2}{1-J}\boldsymbol{Y}_g + \epsilon_{i_g}. \tag{B.4}$$

When the reflection problem is in effect, i.e., when $dim(\boldsymbol{X}_g) = dim(\boldsymbol{Y}_g)$, J and β_2 cannot be distinguished from each other econometrically, which implies that social interactions cannot be identified. For expositional purposes, we abuse the notation and set $\boldsymbol{X}_g = \boldsymbol{Y}_g$, which yields

the equation

$$\omega_{i_g} = \frac{\beta_0}{1-J} + \beta_1 \boldsymbol{X}_{i_g} + \frac{J\beta_1 + \beta_2}{1-J} \boldsymbol{Y}_g + \epsilon_{i_g}. \tag{B.5}$$

Obviously, it is impossible to separate J from β_2. One solution is to propose an additional X_g which is not in $\boldsymbol{Y}_g$; that is, we need to have $dim(\boldsymbol{X}_g) = dim(\boldsymbol{Y}_g) + 1$. If such a X_g exists, then all the parameters in our linear-in-means model are identified. In other words, one individual-level variable, the mean of which cannot be regarded as a group-level variable, is required for identification of social interactions. To demonstrate this, let $\tilde{X}_g$ be an element of the vector $\boldsymbol{X}_g$ and let $\tilde{\beta}_1$ be the coefficient associated with $\tilde{X}_g$. Let $\tilde{X}_g \notin \boldsymbol{Y}_g$ and $dim(\boldsymbol{X}_g) = dim(\boldsymbol{Y}_g)+1$. In other words, we let $\tilde{X}_g$ define that additional variable in $\boldsymbol{X}_g$, which does not correspond to a contextual variable. Then, Equation (B.4) can be rewritten as

$$\omega_{i_g} = \frac{\beta_0}{1-J} + \beta_1 \boldsymbol{X}_{i_g} + \frac{J\tilde{\beta}_1}{1-J} \tilde{X}_g + \frac{\beta_2}{1-J} \boldsymbol{Y}_g + \epsilon_{i_g}. \tag{B.6}$$

Clearly, $\tilde{\beta}_1$ is an element of the vector of paramaters β_1. From Equation (B.6), $\tilde{\beta}_1$ can be identified, which implies that J and β_2 can separately be identified within this framework. Again, the key point is the existence of a variable $\tilde{X}_g$, which does not correspond to a contextual variable $\boldsymbol{Y}_g$. Individual-level variables such as gender, education, age, marital status, and so on necessarily correspond to contextual effects when averaged out. One should find an individual-level variable $\tilde{X}_g$ such that it cannot be interpreted as a group-level characteristic. If such a variable exists, it serves as an instrument and secures identification of J and β_2 separately.

C Details of the Instrumental Variable

In this part, we explain the main intuition behind our IV strategy with an example. Suppose that there are many individuals in the population and each individual interacts with only a *group* of them. Individuals self-report the following happiness levels (everything is observed—the scale of the numbers is arbitrary, but the ordering of the days is consistent with the estimates reported in Table (2)):

$$\begin{aligned} M: &\quad (7+\epsilon_M) \\ T: &\quad (6+\epsilon_T) \\ W: &\quad (6+\epsilon_W) \\ T: &\quad (6+\epsilon_T) \\ F: &\quad (5+\epsilon_F) \\ St: &\quad (5+\epsilon_{St}) \\ S: &\quad (7+\epsilon_S). \end{aligned}$$

A lower score corresponds to a higher happiness level, just as in the BHPS dataset. Each individual's type is given by the vector $\boldsymbol{\epsilon} = \left(\epsilon_M, \epsilon_T, \epsilon_W, \epsilon_T, \epsilon_F, \epsilon_{St}, \epsilon_S\right)$. We assume that $\boldsymbol{\epsilon}$ is independent and identically distributed (iid) across individuals. Elements of $\boldsymbol{\epsilon}$ have all zero means, but different variances. Thus, the joint distribution of $\boldsymbol{\epsilon}$ has mean $\mathbf{0}$ and a covariance matrix $\boldsymbol{\Sigma}$. Individuals are identical apart from their $\boldsymbol{\epsilon}$'s. As a result, on average, we will have a 7, 6, 6, 6, 5, 5, 7 pattern from Monday to Sunday, just as the ordering of our estimates suggest. The overall mean is 6. However, this is the case at the population level. The group-level means would be different depending on the configuration of the $\boldsymbol{\epsilon}$'s.

To resolve the reflection problem, we need one variable that is correlated with the individual-level happiness score, but does not correspond to a contextual effect. The mean of this variable should affect my happiness level only through the group-level happiness. Let's say we put only "Saturday" as an instrument. The mean of this variable could in fact correspond to a contextual effect, because I would be picking those who are more likely to feel happier due

to a possible self-selection into a Saturday interview.

We first make the observation that groups with a higher fraction of individuals interviewed on, say, a Wednesday or Friday or Sunday have higher average happiness levels. To capture this effect, we construct a dummy variable $D = 1$ if the individual is interviewed on either of these days, and 0 otherwise. Clearly, the group-level mean of D is not a meaningful contextual variable. But the *incidental* correlation between ϵ_W, ϵ_F, and ϵ_S **at the group level** makes the group-level mean of D a strong determinant of social interactions. **So, the main identifying assumption is that groups with a larger fraction of individuals interviewed on Wednesdays, Fridays, or Sundays have higher happiness levels on average.** The empirical justification is presented in Table (7).

To sum up, we try to obtain a "synthetic" day-of-the-week variable that can potentially resolve the reflection problem.

Table 1: Summary Statistics

BHPS; Waves 2–18, 97,372 observations.

Variable	**Mean**	**Std.Dev**
Overall happiness	1.98	0.58
General happiness*	22.74	5.03
Male	0.51	0.50
Age	39.59	12.60
Married	0.55	0.49
Never married	0.33	0.47
Divorced	0.08	0.27
Separated	0.02	0.14
Widowed	0.02	0.12
Higher degree	0.03	0.17
First degree	0.13	0.34
A-level	0.13	0.35
O-level	0.20	0.40
Other higher qual.	0.28	0.44
Vocational qual.	0.11	0.31
No qual.	0.12	0.31
Temporary contract	0.03	0.14
Fixed term contract	0.02	0.11
Public sector worker	0.18	0.38
Small employer	0.61	0.46
Union member	0.21	0.44
Promotion opportunities	0.36	0.50
Prefer to work more hours	0.07	0.27
Prefer to work fewer hours	0.27	0.46
Health-very good	0.25	0.44
Health-satisfactory	0.16	0.36
Relative income	0.51	0.50
Wednesday-Friday-Sunday	0.36	0.48
London	0.07	0.26
Southeast	0.16	0.37
Southwest	0.08	0.26
East Anglia	0.03	0.17
East Midlands	0.07	0.25
West Midlands	0.07	0.25
Northwest	0.09	0.28
Yorkshire Humberside	0.08	0.26
Northeast	0.05	0.22
Wales	0.14	0.34
Scotland	0.17	0.38
Energy & Water Supplies	0.03	0.15
Extraction & Manufacture	0.05	0.22
Metal Goods & Engineering	0.07	0.25
Other Manufacturing	0.08	0.26
Construction	0.11	0.31
Distribution, Hotels & Catering	0.16	0.37
Transport & Communication	0.12	0.32
Banking & Finance	0.18	0.38
Other Services	0.22	0.41

* There are 79,289 observations for the general happiness score.

Table 2: Random-Effects Ordered Probit Estimation

	Overall Happiness		**General Happiness**	
Variable	**Coefficient**	**(St. Err.)**	**Coefficient**	**(St. Err.)**
Male	-0.042**	(0.006)	-0.321***	(0.016)
Age	0.015***	(0.001)	0.051***	(0.003)
Age-squared/100	-0.015***	(0.002)	-0.059***	(0.004)
Married	0.009	(0.009)	0.016**	(0.007)
Never married	0.022**	(0.011)	0.019***	(0.007)
Divorced	0.036***	(0.004)	0.023**	(0.001)
Widowed	0.027*	(0.014)	0.022***	(0.006)
Higher degree	-0.003	(0.017)	0.093**	(0.045)
First degree	0.012	(0.011)	0.067**	(0.025)
A-level	0.021**	(0.010)	0.060**	(0.027)
O-level	0.027***	(0.009)	0.043*	(0.025)
Other higher qual.	0.018*	(0.009)	0.029	(0.023)
Vocational qual.	0.015	(0.011)	0.021	(0.028)
Temporary contract	-0.007	(0.015)	0.065*	(0.034)
Fixed term contract	-0.066***	(0.020)	-0.162***	(0.037)
Public sector worker	0.007	(0.008)	-0.003	(0.016)
Small employer	-0.008	(0.005)	-0.014	(0.011)
Union member	0.022***	(0.006)	0.075***	(0.013)
Promotion opportunities	-0.047***	(0.004)	-0.154***	(0.010)
Prefer to work more hours	0.036***	(0.008)	0.087***	(0.015)
Prefer to work fewer hours	0.053***	(0.005)	0.188***	(0.009)
Health-very good	-0.096***	(0.005)	-0.313***	(0.011)
Health-satisfactory	0.068***	(0.006)	0.222***	(0.012)
Monday	0.0065	(0.0057)	0.0097	(0.0125)
Tuesday	0.0048	(0.0058)	0.0047	(0.0126)
Wednesday	0.0014	(0.0083)	-0.0127	(0.0126)
Friday	-0.0049	(0.0069)	-0.0238	(0.0149)
Saturday	-0.0042	(0.0058)	-0.0104	(0.0175)
Sunday	0.0118	(0.0099)	0.0184	(0.0204)
Industry Dummies	Yes		Yes	
Region Dummies	Yes		Yes	
Year Dummies	Yes		Yes	
Log-likelihood	-81,599.6		-219,321.3	
N	97,372		79,289	

Individual-level overall happiness score is the dependent variable.

*, **, *** indicate the 10 percent, 5 percent, and 1 percent significance levels, respectively.

Table 3: Linear-in-Means Estimation for Overall Happiness

Variable	w/o Earnings		w/ Earnings	
Individual-Level Characteristics	**Coef.**	**(SE)**	**Coef.**	**(SE)**
Male	-1.192***	(0.036)	-1.116***	(0.039)
Age	0.185***	(0.009)	0.196***	(0.009)
Age-squared/100	-0.220***	(0.010)	-0.233***	(0.011)
Married	-0.590***	(0.061)	-0.592***	(0.061)
Never married	-0.443***	(0.074)	-0.445***	(0.074)
Higher degree	0.307***	(0.113)	0.415***	(0.114)
First degree	0.189***	(0.073)	0.291***	(0.075)
A-level	0.139**	(0.069)	0.176**	(0.069)
O-level	0.005	(0.063)	0.036	(0.063)
Other higher qual.	0.067	(0.062)	0.126**	(0.063)
Vocational qual.	-0.106	(0.071)	-0.067	(0.071)
Temporary contract	0.182	(0.117)	0.142	(0.117)
Fixed term contract	-0.050	(0.156)	-0.077	(0.156)
Public sector worker	0.012	(0.054)	0.015	(0.054)
Small employer	-0.044	(0.038)	-0.056	(0.038)
Promotion opportunities	-0.593***	(0.037)	-0.578***	(0.037)
Union member	0.317***	(0.044)	0.346***	(0.044)
Health-very good	-1.666***	(0.037)	-1.657***	(0.037)
Health-satisfactory	1.416***	(0.052)	1.411***	(0.052)
Prefer to work more hours	0.643***	(0.069)	0.609***	(0.070)
Prefer to work fewer hours	0.823***	(0.038)	0.857***	(0.038)
Relative income	-	-	-0.254***	(0.043)
Friday-Wednesday-Sunday	-0.064*	(0.035)	-0.066*	(0.035)
Group-Level Characteristics				
Male (group mean)	-0.198	(0.156)	-0.137	(0.196)
Age (group mean)	-0.213***	(0.057)	-0.208***	(0.059)
Age-squared/100 (group mean)	0.269***	(0.067)	0.266***	(0.068)
Married (group mean)	-0.258	(0.380)	-0.239	(0.383)
Never married (group mean)	0.263	(0.454)	0.290	(0.455)
Higher degree (group mean)	0.260	(0.806)	0.321	(0.818)
First degree (group mean)	0.923**	(0.378)	1.018**	(0.411)
A-level (group mean)	0.849*	(0.506)	0.862*	(0.512)
O-level (group mean)	0.689*	(0.403)	0.722*	(0.410)
Other higher qual. (group mean)	1.209***	(0.358)	1.227***	(0.364)
Vocational qual. (group mean)	1.312***	(0.483)	1.320***	(0.483)
Temporary contract (group mean)	-0.269	(0.830)	-0.281	(0.837)
Fixed term contract (group mean)	-0.806	(1.074)	-0.432	(1.090)
Public sector worker (group mean)	0.604***	(0.195)	0.603***	(0.195)
Small employer (group mean)	-0.071	(0.219)	-0.072	(0.221)
Promotion opportunities (group mean)	1.053***	(0.228)	1.051***	(0.228)
Union member (group mean)	-0.528***	(0.201)	-0.547***	(0.202)
Prefer to work more hours (group mean)	0.275	(0.717)	0.251	(0.720)
Prefer to work fewer hours (group mean)	0.311	(0.315)	0.358	(0.321)
Health-very good (group mean)	-1.121***	(0.392)	-1.192***	(0.394)
Health-satisfactory (group mean)	0.310	(0.507)	0.206	(0.516)
Relative income (group mean)	-	-	-0.004	(0.218)
Friday-Wednesday-Sunday (group mean)	-0.410	(0.376)	-0.395	(0.377)
N	97,372		97,372	

Robust standard errors in parentheses.

*, **, *** indicate the 10 percent, 5 percent, and 1 percent significance levels, respectively.

Table 4: Linear-in-Means Estimation for General Happiness

Variable	w/o Earnings		w/ Earnings	
Individual-Level Characteristics	**Coef.**	**(SE)**	**Coef.**	**(SE)**
Male	-1.160***	(0.038)	-1.088***	(0.040)
Age	0.192***	(0.010)	0.202***	(0.010)
Age-squared/100	-0.228***	(0.012)	-0.240***	(0.012)
Married	-0.567***	(0.055)	-0.569***	(0.055)
Never married	-0.424***	(0.068)	-0.426***	(0.068)
Higher degree	0.375***	(0.112)	0.472***	(0.114)
First degree	0.245***	(0.074)	0.338***	(0.076)
A-level	0.167**	(0.072)	0.203***	(0.073)
O-level	0.0362	(0.065)	0.064	(0.066)
Other higher qual.	0.094	(0.064)	0.148**	(0.064)
Vocational qual.	-0.053	(0.073)	-0.016	(0.073)
Temporary contract	0.387***	(0.145)	0.340**	(0.145)
Fixed term contract	-0.208	(0.153)	-0.234	(0.154)
Public sector worker	-0.006	(0.053)	-0.003	(0.053)
Small employer	-0.063	(0.039)	-0.074*	(0.039)
Promotion opportunities	-0.597***	(0.037)	-0.584***	(0.037)
Union member	0.324***	(0.044)	0.349***	(0.044)
Health-very good	-1.650***	(0.041)	-1.642***	(0.041)
Health-satisfactory	1.462***	(0.049)	1.457***	(0.049)
Prefer to work more hours	0.693***	(0.068)	0.660***	(0.068)
Prefer to work fewer hours	0.834***	(0.038)	0.864***	(0.038)
Relative income	-	-	-0.230***	(0.043)
Friday-Wednesday-Sunday	-0.079**	(0.036)	-0.081*	(0.036)
Group-Level Characteristics				
Male (group mean)	-0.166	(0.162)	-0.178	(0.204)
Age (group mean)	-0.228***	(0.059)	-0.231***	(0.061)
Age-squared/100 (group mean)	0.289***	(0.069)	0.294***	(0.070)
Married (group mean)	-0.312	(0.393)	-0.318	(0.395)
Never married (group mean)	0.199	(0.470)	0.211	(0.471)
Higher degree (group mean)	0.387	(0.821)	0.362	(0.833)
First degree (group mean)	1.017***	(0.391)	1.021**	(0.423)
A-level (group mean)	0.759	(0.530)	0.737	(0.534)
O-level (group mean)	0.600	(0.430)	0.596	(0.435)
Other higher qual. (group mean)	1.202***	(0.377)	1.183***	(0.383)
Vocational qual. (group mean)	1.470***	(0.507)	1.465***	(0.508)
Temporary contract (group mean)	-0.526	(0.865)	-0.473	(0.875)
Fixed term contract (group mean)	-0.384	(1.125)	-0.140	(1.142)
Public sector worker (group mean)	0.532***	(0.197)	0.525***	(0.197)
Small employer (group mean)	-0.017	(0.227)	-0.004	(0.229)
Promotion opportunities (group mean)	0.993***	(0.239)	0.984***	(0.240)
Union member (group mean)	-0.442**	(0.207)	-0.461**	(0.207)
Prefer to work more hours (group mean)	0.273	(0.739)	0.288	(0.743)
Prefer to work fewer hours (group mean)	0.313	(0.331)	0.323	(0.336)
Health-very good (group mean)	-1.065**	(0.414)	-1.111***	(0.416)
Health-satisfactory (group mean)	0.293	(0.525)	0.253	(0.537)
Relative income (group mean)	-	-	0.001	(0.227)
Friday-Wednesday-Sunday (group mean)	-0.498	(0.398)	-0.491	(0.398)
N	79,289		79,289	

Robust standard errors in parentheses.

*, **, *** indicate the 10 percent, 5 percent, and 1 percent significance levels, respectively.

Table 5: Translated Coefficients for Overall Happiness.

Variable	w/o Earnings	w/ Earnings
Endogenous social effect	**Coef.**	**Coef.**
Group-level overall happiness	0.762	0.748
Contextual effects		
Male (group mean)	-0.001	0.002
Age (group mean)	-0.001***	-0.001***
Age-squared/100 (group mean)	0.001***	0.001***
Married (group mean)	0.006	-0.007
Never married (group mean)	0.008	0.009
Higher degree (group mean)	0.005	0.007
First degree (group mean)	0.037**	0.006**
A-level (group mean)	0.015*	0.016*
O-level (group mean)	0.015*	0.016*
Other higher qual. (group mean)	0.016***	0.016***
Vocational qual. (group mean)	0.022***	0.022***
Temporary contract (group mean)	-0.006	-0.007
Fixed term contract (group mean)	0.002	-0.008
Public sector worker (group mean)	0.008***	0.008***
Small employer (group mean)	-0.002	-0.002
Promotion opportunities (group mean)	0.009**	0.009**
Union member (group mean)	-0.009***	-0.009***
Prefer to work more hours (group mean)	-0.007	-0.008
Prefer to work fewer hours (group mean)	0.001	0.002
Health-very good (group mean)	-0.011**	-0.012***
Health-satisfactory (group mean)	0.042	0.002
Relative income (group mean)	-	-0.002

*, **, *** indicate 10 percent, 5 percent, and 1 percent significance levels, respectively. See Section 4 and Appendix B for the calculation procedures.

Table 6: Translated Coefficients for General Happiness.

Variable	w/o Earnings	w/ Earnings
Endogenous social effect	**Coef.**	**Coef.**
Group-level overall happiness	0.863	0.859
Contextual effects		
Male (group mean)	-0.022	-0.025
Age (group mean)	-0.031***	-0.032***
Age-squared/100 (group mean)	0.039***	0.039***
Married (group mean)	-0.043	0.040
Never married (group mean)	0.027	0.030
Higher degree (group mean)	0.052	0.051
First degree (group mean)	0.138***	0.143***
A-level (group mean)	0.103	0.103
O-level (group mean)	0.082	0.084
Other higher qual. (group mean)	0.164***	0.166***
Vocational qual. (group mean)	0.200***	0.205***
Temporary contract (group mean)	-0.071	-0.066
Fixed term contract (group mean)	-0.052	-0.019
Public sector worker (group mean)	0.072***	0.074***
Small employer (group mean)	-0.002	-0.001
Promotion opportunities (group mean)	0.136***	0.138***
Union member (group mean)	-0.060**	-0.065**
Prefer to work more hours (group mean)	0.037	0.040
Prefer to work fewer hours (group mean)	0.040	0.045
Health-very good (group mean)	-0.145**	-0.160***
Health-satisfactory (group mean)	0.042	0.035
Relative income (group mean)	-	-0.016

*, **, *** indicate 10 percent, 5 percent, and 1 percent significance levels, respectively. See Section 4 and Appendix B for the calculation procedures.

Table 7: p – values of the day dummies

Day Dummies	w/o Earnings		w/ Earnings	
	Individual Level	Group Level	Individual Level	Group Level
Friday-Tuesday-Sunday	0.589	0.053*	0.588	0.042*
Friday-Wednesday-Sunday	0.065*	0.587	0.060*	0.609
Friday-Thursday-Sunday	0.597	0.099*	0.559	0.089*
Friday-Tuesday-Monday	0.143	0.203	0.145	0.159
Friday-Wednesday-Monday	0.409	0.766	0.388	0.765
Friday-Thursday-Monday	0.660	0.499	0.703	0.456
Saturday-Tuesday-Sunday	0.253	0.614	0.222	0.634
Saturday-Wednesday-Sunday	0.188	0.231	0.203	0.166
Saturday-Thursday-Sunday	0.962	0.952	0.945	0.886
Saturday-Tuesday-Monday	0.044**	0.711	0.037**	0.709
Saturday-Wednesday-Monday	0.774	0.052*	0.800	0.036
Saturday-Thursday-Monday	0.320	0.457	0.314	0.426

*, **, *** indicate the 10 percent, 5 percent, and 1 percent significance levels, respectively.