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It's driving her mad: gender differences in the effects of commuting on psychological well-being

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Abstract:

In this paper, we seek to explore the effects of commuting time on the psychological well-being of men and women in the UK. We use annual data from the British Household Panel Survey in a fixed effects panel framework that includes variables known to determine well-being, as well as factors which may provide compensation for commuting such as income, job satisfaction and housing quality. Our results show that, even after all these variables are considered, commuting still has an important detrimental effect on the well-being of women, but not men, and this result is robust to numerous different specifications. We explore possible explanations for this gender difference and can find no evidence that it is due to women's shorter working hours or weaker occupational position. Rather women's greater sensitivity to commuting time seems to be a result of their larger responsibility for day-to-day household tasks, including childcare.

Introduction

Over the past decade or so, economists have begun to consider how data on happiness and psychological well-being can help to address important economic questions (see, for example, Blanchflower and Oswald 2004; Frey and Stutzer 2002; van Praag and Baarsma, 2005). These data are particularly useful because of their availability in large micro-level panel surveys, which means that longitudinal models can be estimated to control for individual heterogeneity. This is important when attempting to estimate causal relationships with self-reported variables like happiness, because unobservable characteristics, like personality and motivation, may be correlated both with reporting behaviour and the explanatory variables of interest, such as labour market status or marital status.

There is a growing literature on the determinants of happiness, some of which uses UK panel data (Booth and van Ours 2008; Dolan et al 2008; Oswald and Powdtahvee, 2008), and reasonably robust relationships have been established between happiness, labour market status and health. Despite the important role of labour market variables, virtually no consideration has been given to the role of commuting.[1] This is somewhat surprising because commuting is an important part of the day for those who work, and psychologists have long recognised the potentially detrimental effect of this particular activity (Koslowsky et al.). This should be seen alongside a more general concern with levels of stress and psychological problems amongst the working population, which seem to arise from the ever-increasing demands on our time and problems with maintain an appropriate work-life balance (Taylor, 2001).

Commuting is an important and ever-increasing part of how we use our time. In 1995-97, the average worker in Britain commuted for 48 minutes per day; in 2006 this had increased to 54 minutes, or 12% of a standard full-time working week (National Travel Surveys 1997 and 2006; www.statistics.gov.uk). This trend is not unique to the UK; in Spain commuting times have increased from 31 to 34 minutes over the same period, in Holland from 42 to 49 minutes, in Italy from 22 to 35 minutes and in the US from 44 to 51 minutes (although in France and Germany commuting times do not seem to have increased)[2].

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[1] A notable exception is Stutzer and Frey (2008) which is discussed further in the next section and, using time-based or 'experienced utility' measures, Kahneman et al (2004) find that commuting is associated with the lowest level of positive affect among a list of daily activities for women in US, such as housework, cooking, shopping and watching television.

[2] European data is from the European Survey on Working Conditions, conducted by the European Foundation for the Improvement of Living and Working Conditions in 2000. Data for the U.S. is from U.S. Census Bureau: 2002 American Community Survey http://www.census.gov/acs/www/index.html

There are a number of reasons for expecting commuting to adversely affect psychological well-being. It is a major cause of stress arising from its unpredictability and perceived loss of control (Evans et al. 2002; Gottholmseder et al. 2009; Koslowsky et al, 1995), and Gatersleben and Uzzell (2007) also cite boredom amongst commuters as an important negative aspect. In addition, Putnam (2000) cites commuting as a major cause of increased social isolation, which in turn leads to unhappiness. On the other hand, some commentators have pointed out the potential positive aspects of the daily commute, providing precious time alone to work, read or think, or simply to wind down from the working day (Lyons et al. 2007; Ory and Mokhtarian, 2005; Redmond and Mokhtarian, 2001). This is likely to depend on the time spent commuting, the mode of transport and the degree of control over the journey exercised by the individual.

In this paper, we explore the effects of commuting time on the psychological well-being of men and women in the UK by using annual data from the British Household Panel Survey (BHPS). We use a fixed effects framework that includes variables known to determine well-being as well as factors which may provide compensation for commuting such as income, job satisfaction and housing quality. Our results show that, even after all these variables are considered, commuting still has an important detrimental effect on the well-being of women, but not men, and this result is robust to numerous different specifications. We explore possible explanations for this gender difference and can find no evidence that it is due to women's shorter working hours or weaker occupational position. Rather women's greater sensitivity to commuting time seems to be a result of their larger responsibility for day-to-day household tasks, including childcare. Only those men with children appear to be adversely affected by commuting, and even then the effect is smaller than for women with or without children. Of course as well as the private psychological costs of commuting there are also social costs due to congestion and pollution but our paper does not consider these. Instead it points to a broader view of the costs of commuting that is normally considered in the economics literature.

In what follows, Section 1 considers the background literature on commuting and well-being. Section 2 sets out our econometric method. Section 3 describes the data and variables. Section 4 reports the results and sections 5 and 6 contain discussion and concluding comments.

1. Background

Commuting is generally taken to mean the regular journey to work, and while it has attracted some attention in economics, this has been dissipated across several specialisms, since Becker (1965) considered commuting in his model of optimal time allocation. In transport economics the focus has been on mode choice, with commuters choosing a mode to minimise the money and opportunity costs of travel (de Salvo and Huq, 1996). In urban economics the focus is on household location, with commuting behaviour emerging from models where households locate to maximise the utility obtained from housing and all other goods. Commuting is assumed to confer disutility; an assumption that is rarely if ever tested. Hamilton (1982) argued that actual commutes in the US were much longer than that predicted by the 'monocentric model' of urban location, and he terms this 'wasteful commuting'[3].

In labour economics commuting is considered to be a source of labour mobility since it allows workers to access geographical dispersed labour markets without the need for migration (Cameron and Muellbauer, 1998) and in this vein commuting has been incorporated into models of job search (Rouwendal, 2004; van den Berg and Gorter 1997; van Ommeren, 1998). Similarly, willingness to commute has been used a predictor of unemployment duration (Thomas 1998). Also studies have investigated whether compensating wages are paid for commuting, and here Leigh (1986) estimates a value of commuting time of around 37% of the hourly wage, which compares favourably to predictions from urban economics.

Our approach is different to those outlined above. We consider commuting from the perspective of the 'new economics of well-being'. Given the fact that commuting is such an important component of time-use, our focus is on whether this activity has a detrimental effect on psychological well-being, once we have controlled for those other factors known to explain variation in individual well-being. We know of only one study that has taken a similar approach. Stutzer and Frey (2008) investigate the effect of commuting on life satisfaction in Germany, and their results suggest that increased commuting time is associated with lower life satisfaction. They take a standard economic approach assuming that if commuting does confer disutility then rational individuals would only choose to spend their time commuting if they are compensated. Compensation can come from the labour market or the housing market, and while Stutzer and

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[3] The monocentric model (Alonso 1964, Mills 1972) assumes that households value access to the central business district (CBD), predicting that both residential density and rent gradients will be downwards sloping from the CBD and convex. Cropper and Gordon (1991) extend the household utility function to consider both housing and neighbourhood attributes, and to account for the commuting of a second worker in the household.

Frey (2008) do not consider the effects of these factors in their empirical work, in what follows we investigate how income, job satisfaction and housing quality (incorporating satisfaction with neighbourhood) affect well-being along-side commuting time.

Stutzer and Frey (2008) do not consider the possibility of different effects across genders; but given the differences in commuting patterns between the sexes (White, 1986) we are prompted to consider why commuting might affect men and women differently. The reasons can be summarised as relating either to labour market position or family circumstances, and we make no assumption here that these are independent factors (Camstra 1996; Turner and Niemeier, 1997). First, in relation to the labour market, women tend to work shorter hours and earn a lower hourly wage than men; hence the monetary cost of commuting is relatively more expensive for women, and their travel time has a higher relative weight. Also women are more likely to work in lower status service sector occupations, which are more geographically dispersed than other jobs thus increasing their chances of finding employment closer to home (Hanson and Johnston, 1985; MacDonald, 1999)[4].

Second, in relation to family circumstances women tend to provide the bulk of domestic work and childcare and to be secondary wage earners (Blau and Ferber, 1992). The former will mean they have less flexibility in their time use on a day-to-day basis (this may account for women's higher valuation of time relative to men (Madden and White, 1980)); and the second that the location of the home is more likely to be chosen to suit the labour market preferences of the primary wage earner husband (Hanson and Pratt, 1991; Kain 1962). This could mean that women commute further to find suitable employment, but combined with the other domestic factors, and the patterns of occupational segregation and geographical dispersion of these jobs, it seems more likely that women will find work in the local labour market (Schwanen and Djist, 2002; Turner and Niemeier, 1997).

It may also be that, regardless of the actual division of labour within the household, beliefs regarding gender roles may also mean that women may not tolerate longer commuting times if they place less weight on labour market aspirations and more on domestic responsibilities (Camstra, 1996). Of course, in relation to family circumstances and gender roles, we would expect these factors to be important largely for those individuals who are living as a couple, and

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[4] MacDonald (1999) points to the fact that women's jobs are often closely tied to consumers (for example retail, personal services, health and education), or in the case of clerical work, decentralised to suburban office locations; whereas men's jobs are more often concentrated in the CBD or industrial zones.

particularly for those with children. We might therefore expect single men and women, or couples without children, to be similar in their attitudes towards commuting time, and we investigate this in our empirical work, as well as testing some of the other explanations for gender differences outlined here. A standard finding is that women do have shorter commuting times than men (Madden, 1981) and this is borne out by our data (see Table 1 and discussion below). In addition, Latrielle et al (2006) find that unemployed and inactive men are prepared to travel around 35% further to work than women, and this is independent of the presence of dependent children and marital status.

Individuals may also commute for the good of the household i.e. they bear the cost to their own psychological well-being because the compensation of a higher income or better housing accrues to their partner and/or their children. We consider these household effects in our empirical work. It is also possible that people consider inter-temporal transfers in well-being, enduring long commutes now for housing and other benefits later on, but we do not consider this here.

2. Econometric method

Our aim is to estimate the effect of time spent commuting on psychological well-being, once we have controlled for other factors expected to determine well-being. Our method is based on fixed effects estimation with annual longitudinal data for a large number of individuals. The basic model can be denoted:

$$U_{it} = \alpha_i + \beta_1 y_{it} + \beta_2 D_{it} + \beta_3 H_{it} + \beta_4 \mathbf{X}_{it} + \varepsilon_{it} \qquad (1)$$

Where: U_{it} is a measure of the psychological well-being of individual i at time t, and can be thought of as a proxy for cardinal utility in a linear approximation to the utility function; y is income (own labour and other household); D is commuting time; H is housing quality; and X are a set of conditioning variables. The choice of explanatory variables is informed by the literature on the determinants of well being as well as the economics literature on commuting that suggests that compensation for this activity can be gained in the labour market or housing market. Further details of the variables are given in the next section.

The unobserved individual specific component (α_i) is assumed to be time invariant and correlated with the observed explanatory variables. We have annual longitudinal data on a large

set of individuals; hence we use a fixed effects model to control for unobserved time-invariant heterogeneity. We estimate all the models separately for men and women so we are able to investigate differences in the determinants of well-being between the sexes. Further, given that our initial results suggest important differences between the sexes we also specify a number of models to explore possible explanations for these differences.

We assume that commuting time (D) is exogenous in equation (1) because the fixed-effects specification controls for correlated unobservable effects on both commuting time and well-being (assuming these effects are constant though time), and there do not seem to be strong reasons for expecting simultaneity between the two variables. Further we estimate equation (1) assuming that all the explanatory variables are exogenous. However, we explore this assumption more fully below. In addition our model is specified to imply a contemporaneous linear association between commuting time and well-being. It is worth pointing out that the results are very similar if lagged commuting time is used; in addition we experimented with a quadratic function in commuting time but the squared term was never significant. It is also worth stressing that our key variable is commuting *time* and not *distance*, which is usually the focus of the transport and urban economics literatures. Time is more appropriate in our context of a utility function because it is more directly related to the opportunity cost of commuting, and in any case commuting times and distances are highly correlated (Small and Song, 1992).

We estimate a variety of models designed to explore the effect of commuting time on psychological well-being. We also undertake a number of robustness checks to satisfy ourselves of the reliability of our results. This includes excluding variables that may be endogenous, estimating the models on various sub-samples and dealing with possible measurement error in reported commuted times by using a dichotomous indicator for high/low commuting time. As explained above we assume that commuting time is exogenous. We do not have strong instruments for commuting time so it is not possible for us to compare the assumption of exogeneity with an instrumental variables approach. However, we have a stronger test because we are able to estimate the model for a subset of the sample who do not change job, home or mode of commuting throughout the time period. For these individuals any change in commuting time is truly exogenous, caused say by an increase in congestion, thus the estimated coefficient in a fixed effects model gives an estimate of the effect of an exogenous change in commuting time on well-being, controlling for a wide set of covariates and unobserved individual heterogeneity.

In an effort to investigate household effects, rather than simply the effects of own commuting on own well-being, we also estimate a number of models on a sub-sample of respondents who live as a couple. In models for the determinants of husband's (wife's)[5] well-being we include partner's commuting time and the sum of household commuting time. In addition we estimate models for men and women which include the interaction between own and partner's commuting time as well as own commute, in order to see whether this interaction attenuates the effect of own commuting time. We also estimate models for the determinants of total household well-being which include each partners commuting time[6].

3. Data and variables

Our data come from the first 14 waves of the British Household Panel Survey (BHPS), 1991 to 2004 (http://www.iser.essex.ac.uk/survey/bhps). The BHPS is a longitudinal survey of private households in Great Britain, and was designed as an annual survey of each adult member of a nationally representative sample. The first wave achieved a sample of approximately 5,500 households, covering around 10,300 adults from 250 areas of Great Britain. Additional samples of 1,500 households for both Scotland and Wales were added in 1999, and in 2001 a sample of 2,000 households in Northern Ireland were also added. The *BHPS* includes rich information on labour market status, socio-economic variables, well-being and health.

We use data on working adults aged 18 to 65, and we exclude the self-employed, since they are more likely to work at home and have different commuting patterns to employees[7]. We use an unbalanced panel and have 35157 observations on 7761 women, and 33720 observations on 7316 men.

A full list of variables and definitions is contained in Appendix 1. The dependent variable is derived from the General Health Questionnaire (GHQ). The GHQ contains twelve questions (see Appendix 2) that were developed as a screening device for identifying minor psychiatric disorders (Goldberg & Williams, 1988) but are also used to investigate psychological (or mental) health more generally (Argyle, 1989). Each question has a choice of four options in which the presence or intensity of the state over the last few weeks is related to its usual frequency or intensity, thereby creating a 36 point Likert scale (each question is scored from 0 to 3). For ease

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[5] The terms husband and wife are used here to mean partners who live as a couple whether or not they are legally married.

[6] While many households will also contain children our data do not include comparable information on children's well-being so we deal here only with adult partner members of the household.

[7] We exclude 5832 observations on the self-employed, and 109 observations for members of the armed forces.

of interpretation, we have reversed the coding so that a higher GHQ score means better psychological health. We treat the 36 point GHQ score as continuous, following evidence from Ferrer-i-Carbonell and Frijters (2004), which shows that once fixed effects are allowed for, assuming cardinality or ordinality in well-being scores makes little difference to the results. When calculating household GHQ we simply add the scores for the husband and wife.

The GHQ is increasingly used as a well-being measure in economic studies which control for unobserved individual heterogeneity and condition on a wide range of variables. For example Clark and Oswald (1994) find no relationship between GHQ and personal income; Brown et al. (2005) find that annual savings are positively related to the GHQ and the presence of credit card debt reduces the GHQ. A negative effect of unemployment on GHQ scores has been found by Shields and Wheatley-Price (2005) and Clark (2003), although this is dependent on the extent of local unemployment. A general finding from previous work is that women usually report lower levels of psychological well-being on the GHQ scale than men (Clark and Oswald, 1994), but the mean scores for our sample are not significantly different (see Table 1).

The key explanatory variable is commuting time derived from the question '*About how much time does it usually take you to get to work each day, door to door?*''. This is one-way commuting time in minutes and we treat it a continuous variable. In order to test the sensitiveness of our results to reporting error in commuting times we also define a high/low commuting time dummy variable which takes the value 1 if commuting time is greater than the overall mean (22 minutes) and zero if commuting time is less than the mean. Also, in common with ideas from the economics of well-being literature that it is divergence from social norms that might have the largest effect on well-being (see for example Clark 2003 on unemployment), in one model we define commuting time as the deviation from mean commuting time in each of the twelve regions in the UK. If commuting is assumed to confer disutility then we expect a negative relationship between commuting time and the GHQ score. As well as commuting time we also have information on the mode of commuting, and we distinguish between the car and other forms of transport, which includes walking and cycling as well as public transport.

We also include housing quality, job satisfaction and net household income as explanatory variables. These are all factors that may provide compensation for commuting in the utility function hence we expect a positive relationship between these variables and the GHQ score. Housing quality is created using principle components analysis on three variables: (i) house type

(flat, terrace, semi-detached or detached); (ii) the number of rooms in the house, divided by the number of people in the household; and (iii) whether or not the respondent likes their neighbourhood. Extreme values are removed (n=164), and the resultant variable is rescaled from zero to ten; zero being the worst housing quality and ten the highest.

Job satisfaction is derived from the question 'All things considered, how satisfied or dissatisfied are you with your present job overall'. This is measured on a seven-point scale where 1 is completely dissatisfied and 7 is completely satisfied. This variable may be endogenous in a model of psychological well-being, and while it is difficult to find instruments for it we estimate models both including and excluding job satisfaction to check the effect on other coefficient estimates. Net household income is a derived variable available from a supplementary BHPS data set[8]. Net income, rather than the gross income data included in the standard set of BHPS variables, seems a more appropriate determinant of well-being.

Other conditioning variables are age[9], marital status, highest educational attainment, number of children, working hours and health status. Health status is measured in two alternative ways. Firstly, we use the standard self-assessed health (SAH) measure derived from the question 'Please think back over the last 12 months about how your health has been. Compared to people of your own age, would you say that your health has on the whole been excellent/good/fair/poor/very poor?'[10] This is a broad health measure that may reflect psychological as well as physical health and hence may be endogenous in our model for GHQ. As an alternative we include a set of dichotomous variables on the presence of specific health problems (see Appendix 1). These are more objective measures which largely detect problems with physical health. We also include regional dummies and year dummies in our models.

4. Results

Table 1 reports descriptive statistics on all of the variables used in the modelling for men and women separately. For most variables, including the GHQ score, there is little difference between

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[8] The net income data is constructed by researchers at the Institute of Social and Economic Research See Data Archive SN 3909 -British Household Panel Survey Derived Current and Annual Net Household Income Variables, Waves 1-14, 1991-2005.

[9] Given the fixed-effects specification, we represent the well-known U-shaped relationship between age and well-being (see for example Blanchflower and Oswald, 2008) by including a squared term only, along with year dummies.

[10] A continuity problem arises with this 5-point SAH variable because in wave 9 (only) there was a change in the question and available response categories. To achieve consistency over all 14 waves we follow the method of Hernandez-Quevedo *et al.*, (2005) and recode SAH into the following 4-category scale: *very poor or poor; fair; good or very good; excellent.*

the means for men and women. However, women do appear to commute less with a mean one-way commuting time around 4 minutes lower than for men; and also women lower working hours, with an average working week of 29 hours compared to 38 for men. Table 2 reports associations between commuting time and the GHQ score in the raw data. There is a trend for lower GHQ scores the higher the commuting time but this slight, with approximately a 1 point reduction in GHQ scores for both men and women as commuting times increase from under 10 minutes to over 60 minutes. However, as economic theory suggests, commuting can bring benefits in terms of higher incomes and better housing that are likely to have a positive impact of the GHQ score. A simple multivariate OLS regression with commuting time as the dependent variable suggests a positive association with education, income, working hours, housing quality and health, and a negative relationship with job satisfaction and the GHQ score[11].

Figure 1 shows the distribution of commuting times and Figure 2 shows mean commuting time by wave. The vast majority of people commute for less than 30 minutes each way. There appears to be some measurement error in the data with people having a tendency to report rounded times at 30 minute intervals. While there is only a small increase in mean commuting time over the period this does mask important regional differences. In the South East mean (one-way) commuting time has increased from 27 minutes to 30 minutes and in Greater London the increase is from 33 to 37 minutes, from 1991 to 2004. Whereas in the rest of England commuting times have increased from just under 21 minutes to just over 22 minutes in the same period.

Insert Figures 1 and 2 here

Fixed effects models

Results for fixed effects models with psychological health (the GHQ score) as the dependent variable are reported in Table 3. Model (1) includes a standard set of conditioning variables identified from the economics of well-being literature, and also includes commuting time. Commuting time is shown to have a negative effect on the GHQ score, which though small (a 10 minute increase in commuting time reduces the GHQ score by 0.055) is significant at 1%. The other conditioning variables have the expected effects. Health status measured via SAH has the largest effect on the GHQ score; with a one- point health deterioration (on a 4-point scale) associated with a reduction of 1.4 points in the GHQ. The results including specific health problems instead of SAH health (not reported here) are very similar. Most health problems have

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[11] These results are not reported in detail here.

a significant negative impact on the GHQ score; the coefficients on problems with hearing, skin or allergies, diabetes and epilepsy are not significant at standard significance levels. For the remainder of the models reported here the differences to other coefficients (including that of commuting time) when we include specific health problems instead of SAH are negligible. Hence we are confident that SAH does not present any significant endogeneity problems.

Being part of couple (as opposed to being single), also has an important positive effect, as does net household income. The effect of age is picked up by the squared term and the year dummies so the positive coefficient on age suggests that the effect on GHQ is increasing over time. Education, number of children and working hours are not significant and this is largely true across all the models we estimate.

Model (2) includes two extra conditioning variables, housing quality and job satisfaction. Both of these variables have a significant positive effect on GHQ and the remaining coefficient estimates are not much changed from those reported for model 1, suggesting that the negative commuting effect is robust to the inclusion of job satisfaction and housing quality. The commuting effect is also robust to the exclusion of net household income. In addition the remaining coefficients are virtually identical if the commuting variable is excluded.

Models (3) and (4) are estimated separately for men and women and some important differences emerge. Commuting time is significant and negative for women with an effect that is around twice that in models (1) and (2). However, for men commuting time is not significant. In addition household income is not significant in the male GHQ model but it is significant and positive for women. The effects of health status, housing quality and job satisfaction are similar between the sexes, while living as a couple has a larger positive effect for men.

Models (5) and (6) estimate the same models but only for people who commute by car rather than walking, cycling or using any form of public transport. The results here are very similar to those for all modes of commuting in models (3) and (4). It is women whose GHQ seems to be affected most by commuting and the effect of commuting by car is larger than that for any form of commuting. Here, a 10 minute increase in commuting time reduces mean GHQ for women by 0.15 points. For women car users the number of children has a significant negative effect on GHQ, which is not apparent for men.

Models (7) to (12) estimate the models separately by gender and age group for all modes of commuting. Again commuting time has no effect on GHQ for men but it has a significant adverse effect for women aged 18 to 30 years and 31 to 50 years; the largest effect is for this latter age group. Other interesting findings by age are that: the health effect peaks in the mid-age range (31 to 50 years) for both sexes. The positive impact of living as a couple increases with age for men and women; household income and number of children only seem to be important for women in the mid-age range; working hours have a positive effect on GHQ only for women in the younger age range (18 to 30 years); job satisfaction is always important but the size of the effect is reduced for older workers of both sexes; housing quality only effects mid-age men but the contribution of this variable increases with age for women.

For all of the models reported in Table 3, the rho value suggests that just over half of the variance is due to within individual variation and the low R^2 values are typical of fixed-effects models with micro-level data, which utilise information only on this within individual variation.

Gender Differences

In Table 4 we explore some of these explanations for the gender difference in our results. In order to investigate whether the differences are a result of labour market position or working hours, we explore the effect of commuting across different occupational groups and also for those men and women who work full-time. To see whether the differences are a result of family circumstances we estimate the models separately for singles and couples, and also for those people who have no children and for those who state that they are the household head, and also for those who are the primary wage earner in the household. To explore the effect of attitudes regarding gender we distinguish between people according to their agreement with statements about traditional gender roles (see variable definition in Appendix 1). We also distinguish between people according to their level of satisfaction with the amount of leisure time they have (see variable definition in Appendix 1). The fixed effects models are estimated separately for men and women, and the conditioning variables (not reported here) are the same as those included in Table 3, model (2).

The basic finding, that women's GHQ scores are adversely affected by commuting but men's are not, still holds; despite the fact that in all cases men's mean commuting times are higher than women's. In all cases the size of the coefficient on commuting time is much larger for women than men. For men the effect of commuting time is not significant in any of the models, except

the one for men with children[12]. Whereas for women commuting has a significant effect on the GHQ score in all cases except for women in unskilled jobs and for women who state that they are head of the household or primary wage earners in the household.

Further light is shed on the gender differences by the mean commuting times. For singles, full-time workers and primary wage earners, male and female commuting times are very similar. For couples male commuting times are much higher than women's; and whereas single women commute more than women in couples, for men the reverse is true. In relation to domestic circumstances, for women the lowest mean commuting time is for those with children, whereas for men singles commute the least.

These results suggest that family responsibilities have a role in explaining why women appear to be adversely affected by time spent commuting but generally men are not. Commuting is not a significant determinant of well-being for women who are head of household and/or the primary wage earner in the household. This may be because they are more able to choose their residential and labour market location compared to women who are in households headed by someone else. It may also be that these women are more motivated by labour market aspirations and thus willing to tolerate longer commuting times. However, this latter explanation is undermined by the finding that women in professional/management occupations are still adversely affected by commuting.

The main result is robust to beliefs regarding gender roles; women suffer (and men do not) from commuting times whether or not they hold traditional views about household roles. Men do seem to be affected only if they have children and the effect is smaller than for women with or without children. For men with children a 10 minute increase in commuting time reduces the 36 point GHQ score by 0.062 on average, whereas for women the reduction is 0.153. The face validity of our results is supported by the fact that the relative size of the effects across all the sub-groups in Table 4 appears sensible. For example the largest significant effect is seen for women who are not satisfied with the amount of leisure time they have (-0.0206); which probably reflects a general dissatisfaction with the number of competing demands on their time. The smallest significant effect is for women who have no children (-0.0072).

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[12] These models look at all individuals with/without children, but restricting the estimates to couples produces very similar results. In addition distinguishing instead between those men and women who do/do not *are* for children produces very similar results to those reported in Table 4 for individuals who have/do not *have* children.

Robustness checks

In Table 5 we report a number of estimates designed to act as robustness checks on our results. As in Table 4 we only report the coefficients on commuting time from fixed effects models but the conditioning variables are the same as in Table 3, model (2). The overriding finding again is that the effect of commuting on GHQ scores is much larger for women than men. The first two models are an attempt to isolate exogenous commuting time changes by using only those observations where the individuals concerned (i) did not move house or move job and (ii) did not move house or job and did not change their mode of commuting. Again we see that commuting time has a significant adverse effect on the GHQ scores of women but not men; the effects are slightly larger than for the whole sample reported in Table 3, model (3). For the former group, women's mean commuting time is higher than men's, while for all other groups the reverse is true. The third model is estimated for those who commute by car and did not change this mode of commuting throughout the period; again the effect for women is significant and larger than that found in Table 3, model (5), which includes people who change to and from car as their mode of commute.

The fourth model is an attempt to test the sensitiveness of our results to reporting error by classifying commuting time as a high/low dummy as described in Section 4. The effect for men is approximately three times larger than that reported in Table 3, model (4), but neither are significant. For women the effect of the high commuting time dummy is very large and significant; commuting for over 22 minutes each way (compared to less than 22 minutes) is associated with a 0.36 point reduction in the GHQ score.

The next two models exclude (in turn) the two areas of the country with by far the highest average commuting times. In the South East mean one-way commuting time is 25 minutes and in Greater London this is 34 minutes, compared to around 20 minutes for other regions. The results presented here are virtually identical to those presented in Table 3, models (3) and (4) suggesting that these areas are not dominating the results[13]. The final model explores the effects of social norms by considering the effect of the divergence of an individuals commuting time from the mean for the area. Again the results are virtually the same as in Table 3 suggesting that it is absolute, rather than relative, commuting time that affects the GHQ score.

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[13] Benito and Oswald (2000), in a study of commuting as time use, suggested that most trends in commuting during the 1990s were driven by the South East and London, but this does not seem to be unduly affecting our results.

Household effects

Table 6 reports models which investigate whether partners commuting time has an effect on the psychological well-being of people living as a couple. Only the key results are reported; the conditioning variables are the same as those reported in Table 3, Models (2) to (4), and coefficient estimates on the other variables were changed very little by the inclusion of the new variables. In the first (second) column the first two coefficient estimates come from a model for wife's (husband's) GHQ which includes husband's (wife's) commuting time. In both cases the coefficient on own commuting time is changed little from the comparative model in Table (3), partner's commuting time is not significant in either model but own commuting time remains a significant determinant of wife's GHQ. Interactions between own and partners commuting time were not statistically significant when included in models with own commute time, and the inclusion of the interaction made little difference to the existing coefficient estimates. The last coefficient in the first (second) column is for wife's (husband's) GHQ with total household commuting time as a determinant (rather than individual commuting time). Household commuting time does have a significant detrimental effect on wife's GHQ, and the coefficient is smaller than for wife's own commuting time. The last column reports estimates on household GHQ; and here wife's commuting time does have a significant adverse effect on household well-being, which is smaller than the effect on wife's own GHQ.

5. Discussion

The overriding finding from our results is that while women spend a little less time commuting and significantly less time in work than men, their psychological well-being is adversely affected by commuting while men's is not. This effect is apparent even when potential compensation in the housing and labour markets is taken into account. Our results are robust across a number of specifications and the main result holds regardless of attitudes towards gender roles, but here we should recognise that these attitudes do not necessarily reflect how people live their lives. We find no evidence that individual well-being costs of commuting for wives is compensated for by improvements in their husbands' well-being. It is possible that compensation may accrue in the form of improvements in children's well-being but we do not have the data to test this.

We have explored some of the potential explanations for the gender difference and suggest that it is not a result of women's shorter working hours or weaker occupational position since the finding still holds for samples restricted to full-time workers and those in professional/managerial and skilled occupations. In relation to family circumstances, women are

adversely affected whether or not they are single or living as a couple and also even when they do not have children, although the size of the estimated effect is smaller in this latter case. We suggest that it is women's greater responsibility for day-to-day household tasks (including childcare) that makes them more sensitive to time spent commuting, and this seems to be supported by the fact that the largest adverse effect is found for women who are not satisfied with the amount of leisure time they have.

Other possibilities are that women are usually the secondary wage earner in a household and thus less likely to be able to align their housing and occupational choices. Some evidence for this is provided by the fact that women who report being head of household or are primary wage earners are not adversely affected by commuting. The fact that the burden of commuting is still felt by women in professional jobs is not inconsistent with this view, because many of these women will be in dual career households where their career (albeit a professional one) still takes second pace to their partners in issues of household bargaining (Fernandez et al. 2005; Green 1997).

Women do bear the primary responsibility for domestic work, even when they also work outside the home (Hochschild, 1989). Thus women make decisions about commuting under a different set of constraints to men: constraints which emerge from their lower wages, different employment opportunities, greater domestic responsibilities and weaker bargaining position within the household. Commuting is the link between home and work and is another competing demand on women's time. Under these circumstances it is perhaps not surprising that it imposes a psychological burden on women. In a recent paper using US data Stevenson and Wolfers (2007) discuss trends in female happiness. They show that women have many more opportunities now yet their happiness levels are declining relative to men's. Their explanation is that increased opportunity comes at the price of increased guilt arising from the feeling that you simply cannot do everything.

Of course, men also experience many competing demands on their time, and so it may simply be the case that their ability to cope with this is better than women's. It is possible also that men use commuting time positively in ways that women do not. Exploration of these potential explanations is beyond the limits of our data, and perhaps lies outside the remit of economic analysis. We may need to look to more detailed psychological explanations to fully understand why women appear to suffer psychologically form commuting whereas men do not but we hope to have inspired on-going research and debate into commuting and its well-being consequences.
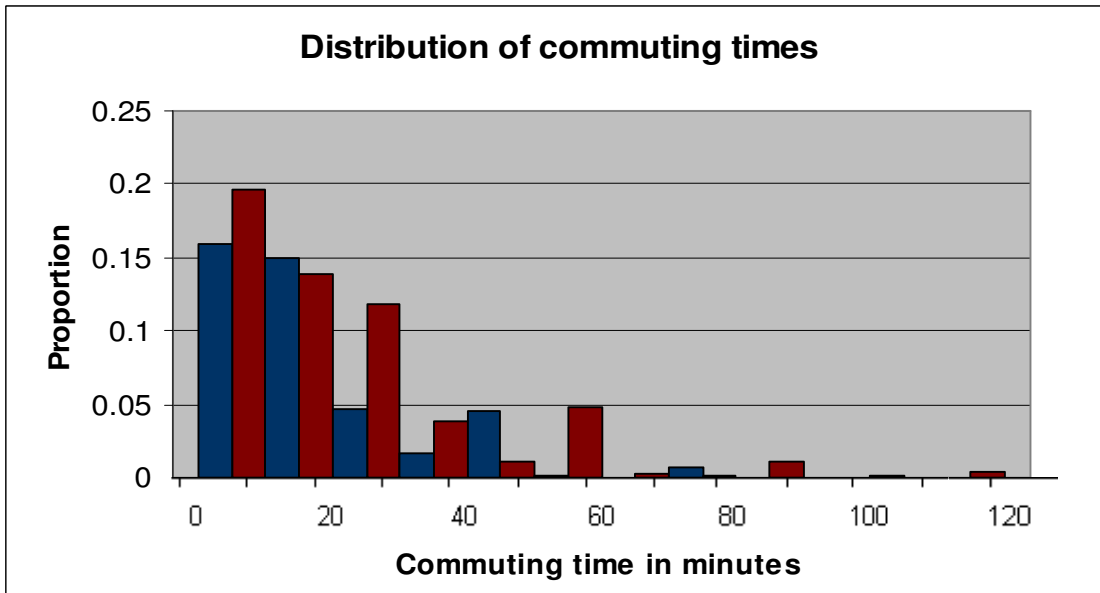
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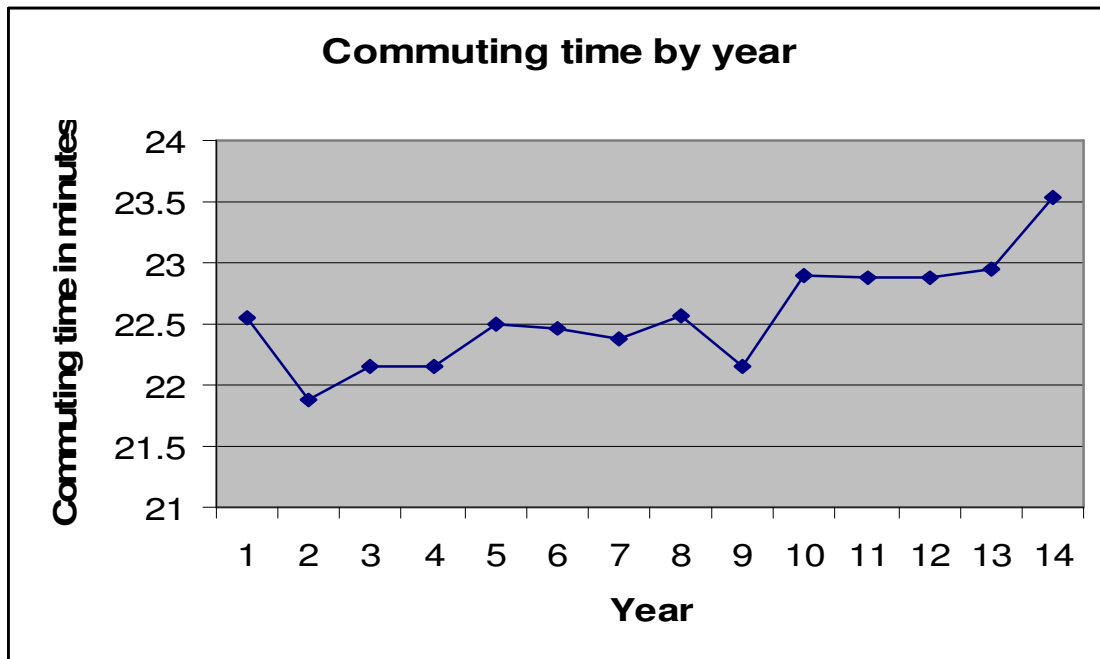
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Figure 1

Source: BHPS 1991 to 2004

Figure 2

Source: BHPS 1991 to 2004

Table 1: Descriptive Statistics by Sex

Variable	Women		Men	
	Mean	**sd**	**Mean**	**sd**
Commuting time	20.78	17.41	24.65	19.96
GHQ Score	24.17	5.69	25.50	5.10
Age	39.91	13.01	39.79	13.12
Self assessed health status	1.50	0.78	1.43	0.74
Married/couple	0.69	0.46	0.70	0.46
Net household income	5.52	0.64	5.59	0.63
Education	3.05	1.69	3.29	1.73
No. of children	0.75	1.05	0.66	1.01
Working hours	29.01	1.29	38.39	9.49
Job satisfaction	5.52	11.63	5.23	1.35
Housing quality	3.26	1.00	3.29	1.01
Arms	0.23	0.42	0.21	0.40
Sight	0.03	0.18	0.03	0.18
Hearing	0.04	0.19	0.06	0.24
Skin conditions or allergy	0.14	0.35	0.09	0.29
Chest/breathing	0.12	0.33	0.11	0.31
Heart/blood pressure	0.10	0.30	0.10	0.30
Stomach or digestion	0.07	0.26	0.06	0.24
Diabetes	0.02	0.13	0.02	0.15
Anxiety or depression	0.10	0.30	0.05	0.22
Alcohol or drugs	0.00	0.06	0.01	0.09
Epilepsy	0.01	0.09	0.01	0.09
Migraine	0.13	0.34	0.04	0.21
Other	0.05	0.22	0.03	0.16

Source: BHPS 1991-2004

Table 2: Mean GHQ score by commuting time

Commuting time (mins)	GHQ Score	
	Women	Men
0 - <10	24.8	26.2
10 - <20	24.6	25.9
20 - < 60	24.6	25.9
60+	23.8	25.1

Source: BHPS 1991-2004.

Table 3: Fixed effects estimates: dependent variable = GHQ

	(1) All	(2) All	(3) Women	(4) Men	(5) Women Car Only	(6) Men Car Only	(7) Women 18-30 yrs	(8) Women 31-50 yrs	(9) Women 50+ yrs	(10) Men 18-30 yrs	(11) Men 31-50 yrs	(12) Men 50+ yrs
age squared	0.0020**	0.0022**	0.0015**	0.0028**	0.0013*	0.0025**						
health status	-1.4333**	-1.3481**	-1.5040**	-1.1612**	-1.5776**	-1.2029**	-1.1312**	-1.6696**	-1.3422**	-0.9577**	-1.2666**	-1.0481**
married/couple	0.4353**	0.5058**	0.3787**	0.6372**	0.3418*	0.6997**	0.0694	0.4739*	1.6079**	0.3509*	1.1352**	1.2528**
net h'hold income	0.3445**	0.2335**	0.2994**	0.1535	0.2764*	0.2403*	0.2112	0.4058**	0.3206	0.2627	0.0965	0.3543
education	0.0073	0.0270	-0.0012	0.0373	0.0063	-0.1123	-0.1591	0.0928	-0.5374	0.0503	0.0560	0.0726
No. of children	-0.0302	-0.0601	-0.1058	-0.0206	-0.1916*	-0.0048	0.1257	-0.1639*	-0.0105	0.0445	-0.1008	-0.3890
working hours	-0.0043	0.0002	0.0045	-0.0058	0.0006	-0.0059	0.0239**	-0.0037	-0.0177	0.0010	-0.0050	-0.0171
job satisfaction		0.7605**	0.7120**	0.8091**	0.7854**	0.8342**	0.7356**	0.7303**	0.5549*	0.7631**	0.8821**	0.6450**
housing quality		0.1251**	0.1440**	0.1074**	0.1058*	0.0941*	0.1226	0.1732**	0.3187*	0.0067	0.1874**	0.0371
commuting time	-0.0055**	-0.0057**	-0.0106**	-0.0018	-0.0151**	-0.0021	-0.0078*	-0.0178**	-0.0062	-0.0023	-0.0013	0.0031
No. Obs	70987	69704	35494	34210	20215	23460	11145	18420	5619	10613	17624	5601
Rho	0.5807	0.5967	0.5324	0.6657	0.5233	0.6514	0.5173	0.4783	0.6307	0.5333	0.4771	0.6179
R^2	0.034	0.077	0.069	0.091	0.075	0.094	0.064	0.074	0.062	0.080	0.095	0.086

Notes:
(1) region and year dummies are included but not reported here.
(2) * denotes significant at 5%, ** at 1%.
(3) The 'health status' variable is decreasing in health.

Table 4: Exploring explanations for gender differences in the results.

Fixed effects estimates: dependent variable = GHQ

	coef. on commute time	n	mean commute time	coef. on commute time	n	mean commute time
		Women			Men	
Labour market position						
Professional/management	-0.0114**	12019	24.83	-0.0041	13163	30.21
Skilled	-0.0122**	16057	20.47	0.0026	14546	22.17
Unskilled	-0.0082	6930	14.83	-0.0055	5903	18.82
Full-time workers	-0.0126**	19735	23.96	-.0024	31350	24.95
Family circumstances						
Singles	-0.0110**	10619	22.73	-0.0029	9123	23.17
Couples	-0.0105**	24538	19.95	-0.0016	24597	25.23
No children	-0.0072*	20821	22.00	-0.0003	20179	24.90
Has children	-0.0153**	14626	19.08	-0.0062*	13962	24.42
Head of household	-0.0075	8845	21.35	-0.0025	26277	25.13
Primary wage earner	-0.0099	4756	24.71	-0.0028	16588	25.64
Gender Role Beliefs						
Agree: 'child suffers if mother works'	-0.0108**	27255	20.14	-0.0028	29206	25.29
Disagree: 'child suffers if mother works'	-0.0141**	8192	21.51	0.0015	4935	25.05
Agree: 'Husband should earn, wife stay at home'	-0.0099**	22008	18.66	-0.0047	23571	23.51
Disagree: 'Husband should earn, wife stay at home'	-0.0100*	13439	21.45	0.0049	10570	25.36
Time Satisfaction						
Satisfied with amount of leisure time	-0.0082**	29603	20.04	-0.0002	28554	23.40
Not satisfied with amount of leis. time	-0.0206**	5844	22.61	-0.0066	5587	27.79

Notes:
(1) * denotes significant at 5%, ** at 1%.
(2) Only the coefficient estimate for the commuting time variable is reported here. The set of conditioning variables included in the models are the same as those reported in Table 3, Model 2.

Table 5: Robustness checks

Fixed effects estimates: dependent variable = GHQ

	Coef.on commute time	n *Women*	Mean commute time	Coef.on commute time	n *Men*	Mean commute time
(1) No house or job move	-0.0142**	19061	23.92	-0.0032	18614	19.89
(2) No house/job move or mode change	-0.0127**	15242	19.59	-0.0004	14996	24.07
(3) By car (no mode change)	-0.0209**	24152	20.23	0.0010	23551	24.56
(4) Dummy for high commuting time	-0.3644**	35184	0.31	-0.0042	33838	0.40
(5) Excluding the South East	-0.0103**	26892	19.45	-0.0016	26037	22.56
(6) Excluding Greater London	-.01078**	35163	19.88	-0015	33709	23.66
(7) Divergence from mean commuting time for area	-0.0103*	35157	-1.88	-0.0019	33720	2.09

Notes:
(1) * denotes significant at 5%, ** at 1%.
(2) Only the coefficient estimate for the relevant commuting time variable is reported here. The set of conditioning variables included in the models are the same as those reported in Table 3, Model 2.

Table 6: Exploring household effects

Fixed effects estimates: couples only.

Explanatory Variable: Commute Time	Dependent variable		
	Wife GHQ	Husband GHQ	Household GHQ
Wife	-0.0125**[a]	0.0032[b]	-0.0083*
Husband	-0.0025[a]	0.0012[b]	-0.0035
Household	-0.0065**[c]	0.0021[c]	-0.0046[c]

Notes:
n = 17760, i = 4211 (couples)
[a] wife and husband commute time included in same model of wife's GHQ.
[b] wife and husband commute time included in same model of husband's GHQ.
[c] wife and husband individual commute times not included in model of household GHQ.
(1) ** denotes significance at 1%, * at 5%.
(2) The set of conditioning variables included in the models are the same as those reported in Table 3, Model 2, excluding the marital status dummy.

Appendix 1: Variable definitions

Variable	Definition
Commuting time	Commuting time one-way measured in minutes.
GHQ Score	General Health Questionnaire psychological health score. See Appendix 2.
Age	Age in Years
Health status	A four point indicator of self reported health status: 1 = excellent, 2 = good/very good 3 = fair, 4 poor/very poor.
Specific health problems	A set of 13 dummy variables = 1 if the respondent has a problem with: arms, legs or hands; sight; hearing; skin conditions or allergies; chest/breathing; heart/blood pressure; stomach or digestion; diabetes; anxiety or depression; alcohol or drugs; epilepsy; migraine; or other.
Married/couple	A dummy variable taking the value of one when the individual is either married or living as a couple and zero otherwise.
Net household income	Total weekly household income net of taxes and benefits.
Education	A seven point scale measuring highest level of education attainment
No. of children	Number of children under the age of 16.
Working hours	Normal working hours in a week.
Job satisfaction	Satisfaction with main job measured on a seven point scale from 1 = completely dissatisfied to 7 = completely satisfied.
Housing quality	A composite variable derived via factor analysis and based on three measures of housing quality, number of rooms per person, the type of accommodation and a binary variable indicating satisfaction with neighbourhood.
Gender attitudes	Level of agreement (5-point scale from 1 strongly agree to 5 strongly disagree) with statements: [A] 'A child is likely to suffer if his or her mothers works', [B] 'A husband's job is to earn money, a wife's job is to look after the home and family'. We have coded 1 and 2 as 'agree' and 4 and 5 as 'disagree'. Those who neither agree nor disagree are omitted.
Satisfaction with leisure time	Derived from responses to the question 'How dissatisfied or satisfied are you with the amount of leisure time you have?' Ranges from 1 completely dissatisfied to 7 completely satisfied. We have coded 1 to 3 as 'not satisfied' and 4 to 7 as 'satisfied'.
Wave	Dummy variables for each wave 1 to 16.
Region	Dummy variables for each of 12 regions of the UK: London; Rest of south east; South west; East Anglia; East Midlands; West Midlands; North West; Yorkshire and Humberside; North of England; Wales; Scotland and Northern Ireland.

Appendix 2: The General Health Questionnaire 12 (GHQ-12)

Have you recently:

1. been able to concentrate
2. lost much sleep over worry
3. felt that you were playing a useful part in things
4. felt capable of making decisions
5. Felt constantly under strain
6. felt you could not overcome difficulties
7. been able to enjoy normal activities
8. been able to face up to problems
9. Been feeling unhappy and depressed
10. been Losing confidence
11. been thinking of yourself as worthless
12. been feeling reasonably happy

Each question has a choice of four options (scored 0 to 3) in which the presence or intensity of the state over the last few weeks is related to its usual frequency or intensity, thereby creating a 36 point Likert scale. See: Goldberg, D. P. & Williams, P. (1988).