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INTRA-HOUSEHOLD COMMUTING CHOICES AND LOCAL LABOUR MARKETS

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Abstract

While the job search literature has increasingly recognised the importance of the spatial distribution of employment opportunities, local labour market conditions have been a notable omission from much of the empirical literature on commuting outcomes. This study of the commute times of dual earner couples in England and Wales finds that local labour market conditions are closely associated with commute times and their effects are not gender neutral. Male commute times are much more sensitive to local unemployment rates than women's; where women earn less than one–third of household income, their commute times do not seem to be sensitive to local unemployment. In addition, the more conducive the local labour market is to female employment, the less time women spend commuting. On average the 'female friendliness' of the local labour market has no effect on male commute times, but in households where women earn the majority of household income, men commute further if the local labour market is female friendly. We also show that it is important to account for the heterogeneity of household types; there are important differences in our results according to female income share, housing tenure, mover status and mode of travel.

Key words: commuting; local labour market; dual earner households

JEL codes: D19; J24: R40

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INTRODUCTION

This paper explores the commuting behaviour of dual earner households, and in particular considers how local labour market conditions, including gendered measures, impact on the commuting time of both spouses. Commuting is an important feature of the modern economy; in 1995/97, the average worker in Britain commuted for 48 minutes per day, and this had increased to 56 minutes by 2012 (Department for Transport, 2014). There is also evidence that commuting confers disutility, being detrimental to both mental and physical health (Martin et al., 2015: Roberts et al., 2011; Stutzer and Frey, 2008); and in Kahneman et al.'s (2004) seminal work on experienced utility, commuting was associated with the lowest level of positive affects among a broad list of daily activities for working women in the US.

Commuting is of interest to economists because it is the conduit between two markets: labour and housing. However, labour and urban economists have approached the subject quite differently. In labour economics the focus has been on commuting and wage bargaining, assuming that the housing market is in equilibrium. Individuals choose their home location based on factors such as price, location and amenities, and longer commutes are assumed to be compensated by higher wages, or other improved terms and conditions of work (Manning, 2003; Leigh, 1986; Mulalic et al., 2014). In contrast urban economics assumes that the labour market is in equilibrium. Individuals choose their place of work based on factors such as pay and prospects, and then try to minimise their commute subject to the constraints of housing price and quality (Glaeser et al., 2008; Simpson and van der Veen, 1992). The job search literature has been extended to consider both job and residential search, forming a link between these two areas of research (Rouwendal, 2004; van Ommeren 1998). Spatial factors are important in labour market analysis because the spatial distribution of workers (and jobs) introduces frictions and therefore has implications for unemployment (Patacchini and Zenou, 2006). Despite the clear theoretical links between job search

and commuting there are virtually no empirical studies of commuting that take account of local labour market conditions.

One thing that labour and urban economics have in common is that their emphasis has tended to be on individual decision making. Household location theory and commuting models usually assume only a single wage earner (Sultana, 2006). Similarly labour economics and search theory largely focus on individual labour market outcomes. Much less attention has been paid to the commuting behaviour of couples, despite the fact that 67% of working age adults in the UK live in a household as part of couple.[1] Couples make joint decisions as a result of a bargaining process and while they necessarily must reach the same decision on the choice of home location, spouses can make separate (but dependent) employment location decisions, thus the location of their home dictates each spouses commute time given their employment choices. This premise forms the basis of our theoretical framework presented in the next section.

In this paper we advance the literature on commuting decisions in four main directions. Firstly, we extend the job location model of Beesley and Dalvi (1974) to form hypotheses around the commuting behaviour of different types of dual earner households. Secondly, we consider the interdependent commuting decisions of dual earner couples, in a random effects seemingly unrelated regression (SUR) framework, which allows for correlation between the unobservable components of couple commute times. Thirdly, we explore how local labour market conditions, including gender specific conditions, affect commuting outcomes. Finally, we use the most recent data available from a large longitudinal household survey for the UK, which allow us to explore differences across a number of different types of dual earner households, distinguished by: female income share; mover status, commuting mode and housing tenure. Our results reveal that poorer local labour market conditions are associated with longer commuting times for both men and

[1] Percentage calculated from UK Household Longitudinal Study wave 4, 2012-14 (University of Essex, 2014).

women, and that where local labour markets are more conducive to female employment, women commute for less time. We also show that it is important account for heterogeneity of the household types because there are important differences in our results according to female income share, housing tenure, mover status and mode of travel.

THEORETICAL FRAMEWORK AND EXISTING LITERATURE

Most studies of urban household location derive from theoretical models based on a monocentric city and a single wage earner (Muth 1969; Mills, 1967; Alonso, 1964). Extensions have included both multiple employment centres (see for example Rouwendal, 1998) and, to a lesser extent, dual earner households (van Ommeren, 1998). We focus here on the latter since this is the subject of our empirical work, but it is worth noting that our empirical model makes no assumptions about the monocentric nature of employment concentrations. The theoretical foundations for our work extend the job location model of Beesley and Dalvi (1974) who explore spatial equilibrium and the journey to work for individual decision makers.[2] The journey to work is a result of decisions on both job location and home location. While in some circumstances these might be viewed as simultaneous decisions, and this has been the focus of some of the recent search literature (see for example Deding et al., 2009; van Ommeren, 2000), in reality most decisions will proceed from one fixed point; so at any point in time either the job is fixed and the relevant decision is where to live, or the home location is fixed and the decision is where to work. We argue here that the latter is a reasonable assumption for many households, because job moves are generally easier than home moves. This is especially true for home owners and those households with children, where other factors such as housing market rigidities and concerns over school access constrain location choices. It is also a valid assumption in the context of dual earner households where any

[2] While Beesley and Dalvi (1974) do not consider dual earner households they do acknowledge that the decision making framework of men and women in relation to job location may differ.

compromise over the employment choices of both workers also constrain relocation (Clark et al., 2003; van Ommeren et al., 1998; Kim, 1995).

The following assumptions underlie the model of Beesley and Dalvi (1974): households attempt to maximise their utility function;[3] the location of job sites is pre-determined;[4] the characteristics of the transport system are fixed and transport quality is uniform by location;[5] transport costs depend both on the value of time and the money cost. When making job search decisions an individual's goal is to maximise net income (W), the income that remains after paying transport costs and (fixed) rent.[6] $Yi(j)$ is the income that can be earned from a job near (distant) to the home location, and Xij is the cost of travel between sites i and j. Then $Z(t) = Yj - Yi \geq 0$, because X is always positive by assumption. Z is an increasing function of the distance between i and j measured in time (t) units, and the second-order derivative is < 0, implying there is an upper limit on the amount of income the individual can earn by taking up a distant job. The model also assumes that transport cost $X(t)$ is a function of the time input, with a positive second-order derivative. With Ri as (fixed) rent at site i, the individual's net income (W) is, $W = Yi + Z(tij) - Ri - Xtij$. Differentiating this with respect to t gives, $Z'(tij) = X'tij$, which states that the individual will commute up to the point where the marginal increase in income is equal to the marginal increase in transport costs.

Two factors contribute to the complexity of the decision. Firstly, in a standard time allocation framework the distance an individual is willing to travel to access a 'better' job is dependent on

[3] We implicitly assume a single household utility function maximised by either an altruistic household head (Becker, 1981) or via consensus (Samuelson, 1956). Extensions in the literature consider cooperative (Manser and Brown, 1980; McElroy and Horney, 1981) and non-cooperative household bargaining models (Lundberg and Pollak, 1993; Hoddinott and Haddad, 1995). While these differ as to how utility is maximised they share the common implication that the relative contribution of each spouse to total household income is important. We return to this in our empirical work where we explore the 'income pooling' hypothesis.

[4] This means that firms have already found the spatial equilibrium for their productive activities, so that there is no two-way interaction between the location of job sites and home sites.

[5] In our empirical work we can explore this assumption because we know whether or not our households have access to a car and which mode of transport they use to commute to work.

[6] Rent is fixed in this job location model because residence is fixed.

their value of leisure time; the higher this value the less willingness to travel. The different market earning potential of each spouse, as well as their differential responsibilities for domestic labour, will affect their value of leisure time (Becker, 1965; 1985). Secondly, there is a limit to the search for a better job from a given home location, because at some threshold the household will relocate, which will cause a reduction in journey time. Theory and evidence suggest that dual earner households, as well as those households with children, and homeowners, may have a higher move threshold (and thus a lower propensity to move) than single, or childless households, or renters (Deding et al., 2009; Clark et al., 2003).

Beesley and Dalvi (1974) suggest a simplified typology of individuals dependent on value of time and utility of income; this typology is shown in Figure 1. Type B (C) individuals who have low (high) value of time and high (low) utility of income will commute longer (shorter) distances. So for example, women who are subject to high domestic demands and have a low need for income are Type C, whereas women with no children and whose husband is out of work are Type B. Types A and D individuals are subject to conflicting effects of the value of time and utility of income, and thus their commuting decisions will be affected to a greater extent by a range of other factors reflecting individual characteristics, household responsibilities, labour market position and local labour market conditions. We explore all of these factors in our empirical work, allowing also for correlation between the commuting times of male and female spouses.

A general finding from the commuting literature is that on average women tend to commute less than men (see for example Roberts et al., 2011; Gordon et al., 1989; White, 1986) and a number of explanations have been suggested for this. Women tend to work shorter hours and earn a lower hourly wage than men, thus commuting is relatively more expensive for them. Women tend to provide the majority of domestic work and childcare and are typically the secondary wage earner

within households. This means that they have less flexibility in their time use on a day-to-day basis and that the location of the home is more likely to be chosen to suit the labour market preferences of the primary wage earner (Green, 1997; Hanson and Pratt, 1995; Singell and Liilydahl, 1986; Mincer, 1978). However, Tkocz and Kristensen (1994) find evidence from a study of household commuting patterns in 16 Danish urban areas that households are more likely to choose their location to suit the wife's job rather than the husbands; despite the fact that the husband is usually the main breadwinner. A number of studies have also found that women have a higher value of time than men, despite their lower wages, and that this may be due to their larger domestic responsibilities, and in particular their role in childcare (Brownstone and Small, 2005; Sermons and Koppelman, 2001; Rouwendal, 1999; Turner and Niemeier, 1997). Finally a number of authors have argued that women are more likely to work in lower status service sector occupations, and these are less geographically concentrated than traditional male jobs thus increasing women's chances of finding employment closer to home (Benson, 2014; MacDonald, 1999; Gordon et al., 1989; Hanson and Johnston, 1985). Furthermore, Hansen and Pratt (1985) find that employers localised recruitment strategies reinforce the patterns of shorter female commutes.

A number of empirical studies have considered the commuting behaviour of dual earner households. Nearly all of these use US data; very few account for the interdependence between male and female outcomes in their estimation or use longitudinal analysis. In an early empirical study Madden (1980) uses data from the 1976 wave of the Panel Study of Income Dynamics and finds that two earner households tend to live further from their work locations than single people. Freedman and Kern (1997) assume that two earner households maximise a joint utility function, which allows for the intermittent labour market participation of women. They use 1980 US census data from five cities and find that women's earnings opportunities affect both their own and their husband's choice of workplace, as well as household location. The influence is stronger the greater

the differences in wife's earnings potential and commuting time among alternative options. Plaut (2006) looks at the commuting choices of dual earner couples in the 2001 American Housing Survey, and finds that spouses commuting distances are complements rather than substitutes, in that they tend to increase or decrease together (Suprenant-Legault et al. (2013) find a similar result). Mok's (2007) study of 1996 Canadian Census data shows that the location choices of two-earner households are more sensitive to the wife's earnings than the husbands, but only in households where children are not present.

Using data for Denmark Deding et al. (2009) treat commuting as an input in a job mobility model and find that, in two earner households, a worker's job mobility depends positively on their own commuting distance and negatively on their spouses, as well as negatively on the distance between the two workers' workplaces.[7] Their theoretical model, based on that of van Ommeren et al. (1998), predicts that two earner households do not minimise the current commuting distances of both spouses. This excess or 'wasteful' commuting prediction (Hamilton and Roell, 1982) was also explored by Kim (1995) in his study of two earner households in Los Angeles; he shows that two earner households do aim to minimise joint commuting distances but they cannot do so because they face more constraints than single earner households. Similarly, Suprenant-Legault et al. (2013) find that, once socio-demographic factors are controlled for, two worker households commute less (on average) than single worker households.

One set of factors that has been neglected in all of these studies is the role of local labour market conditions in determining commuting outcomes. Local labour market opportunities are important because they affect search costs (van Ommeren et al. 1998). Patacchini and Zenou (2006) show, using data for English sub-regions, that local labour market tightness increases job search. Given the spatial aspects of job search, conditions in the local labour market will feed through to commute

[7] Workplace location information is not available in the data we use.

times; poorer local job prospects will force workers to travel further to seek a job, or to obtain better wages or terms and conditions. In addition the unequal distribution of male and female employment across the occupational and industrial structure, and in particularly the segregation of women into a narrower range of employment than men (Pan, 2015; Sparreboom, 2014) means that it is necessary to account for the gendered nature of local labour markets in order to properly take account of the local conditions faced by both spouses.

DATA AND METHODOLOGY

We use Understanding Society – the UK Household Longitudinal Study (UKHLS); a 21st Century study designed to capture UK life and how it is changing over time (University of Essex, 2014). The survey builds upon its predecessor the British Household Panel Survey which took place from 1991 to 2008. Participants live in Scotland, Wales, Northern Ireland and England and the survey contains information on social and economic circumstances, attitudes, behaviours and health. The UKHLS is large scale (over 40,000 households) and representative of the population. Moreover, it is panel data hence the same individuals can be tracked over time. In the first wave over 50,000 individuals were interviewed between 2009 and 2011, correspondingly in the latest wave (wave 4) over 47,000 individuals were interviewed between 2012 and 2014. Using all available waves of the UKHLS there are 23,110 couples defined as either legally married or as a partner/cohabiting.[8] In 34% of these couples both spouses work; in 40% only one member of the couple works (of which in 53% (47%) it is the male (female)); and in the remaining 26% neither spouse works.

The former group, of dual earner couples (n = 7,877), are of interest in this study; in our analysis we also control for selection into employment (see below). Our focus is upon working age individuals who commute to work and are in paid employment. Each wave of the UKHLS asks the following

[8] Note we drop same sex couples which account for less than 1% of the sample.

question: *About how much time does it usually take for you to get to work each day, door to door?*[9] Our sample consists of working age employees residing in England or Wales[10] who report a time travelling to work of 1 minute or more.[11] After also conditioning on missing values for key explanatory variables we create an unbalanced panel of 11,776 individuals comprising 5,888 couples; 3,574 couples are observed in all four waves and the average length of time a couple is in the panel is two periods. We have detailed information on the Local Authority District (LAD) in which the couple resides,[12] which allows us to merge in proxies for local labour market conditions (see below for details). Furthermore, we also have information on the local neighbourhood (such as crime rate and access to amenities) at Lower Layer Super Output Area (LSOA) level. There are 32,844 LSOAs in England and 1,909 in Wales, with an average population size of 1,500 residents (650 households). Once we match the LSOA information to our sample of commuting couples, they reside in 3,297 LSOAs.

A random effects seemingly unrelated regression model based upon unbalanced panel data, see Biorn (2004),[13] is estimated at the couple level, i.e. an equation is estimated for males (M) and females (F), simultaneously as follows:

$$\begin{aligned}\log(CT)_{it}^{M} &= \boldsymbol{X}_{it}^{M\prime}\boldsymbol{\gamma}^{M} + \boldsymbol{A}_{jt}{}'\boldsymbol{\psi}^{M} + \pi^{M}\log(U)_{kt} + \phi^{M}\{\log(U)_{kt} \times S_{it}\} + \alpha_{i}^{M} + \lambda_{t}^{M} + \varepsilon_{it}^{M} \\ \log(CT)_{it}^{F} &= \boldsymbol{X}_{it}^{F\prime}\boldsymbol{\gamma}^{F} + \boldsymbol{A}_{jt}{}'\boldsymbol{\psi}^{F} + \pi^{F}\log(U)_{kt} + \phi^{F}\{\log(U)_{kt} \times S_{it}\} + \alpha_{i}^{F} + \lambda_{t}^{F} + \varepsilon_{it}^{F}\end{aligned} \quad (1)$$

[9] Our outcome variable is commuting time rather than distance. Time is an appropriate measure here because it is directly related to the opportunity cost of commuting. In addition Small and Song (1992) show that commuting times and distances are highly correlated, and Plaut's (2006) results for the main associates of couples commuting outcomes are virtually identical for both time and distance.

[10] We are limited to England and Wales due to some of the Local Authority level labour market data we use.

[11] For those that commute in excess of 120 minutes we recode the travel time to a maximum of 2 hours. This is applicable for around 0.3% of the sample. The results which follow are robust to excluding these observations.

[12] In the UKHLS there are 355 LADs.

[13] The methodology developed by Biorn (2004) essentially integrates the system Maximum Likelihood (ML) approach to balanced data and the single equation unbalanced panel data approach where attrition is random. The estimator is based upon a multistep (stepwise) algorithm using Generalized Least Squares (GLS) and ML procedures. In our scenario attrition is likely to be due to couple dissolution.

Let i denote the individual $(= 1, \dots, 5888)$, j the LSOA $(= 1, \dots, 3297)$, k the LAD $(= 1, \dots, 355)$ and t the time period $(= 1, \dots, 4)$. The dependent variable commuting time is given in minutes spent travelling to work by the individual per day (CT_{it}). Following Plaut (2006) we model CT as a natural logarithm which, given the functional form, allows the effect of labour market impacts to be interpreted directly as an elasticity. CT is conditioned upon a set of covariates, $\boldsymbol{X}_{it}$, a vector of area controls defined at the LSOA level, $\boldsymbol{A}_{jt}$, e.g. the crime rate, and measures of local labour market conditions defined at the LAD level, e.g. the unemployment rate (U_{kt}). The model also incorporates gender specific individual random effects, α_i, and time fixed effects, λ_t. The errors from the male and female equations (ε_{it}^{M} and ε_{it}^{F}) are allowed to be correlated, where the sign of the intra-correlation in the unobservable effects gives an insight into whether commuting is complementarity or substitutable within the couple. The key parameters of interest, π^{M} and π^{F}, indicate the extent to which local labour market conditions influence commuting time. We also estimate specifications where local labour market conditions are interacted with binary indicators, S_{it}, defining a number of states (e.g. whether both members of the couple commute to work by car, or whether the couple are owner–occupiers), to explore whether there are heterogeneous effects of labour market conditions upon commuting time.

The vector $\boldsymbol{X}_{it}$ contains the following individual demographic controls: whether aged 16-24, 25-34, 35-44, 45-54 or 55 to 65 (the omitted category); whether there are dependent children in the household aged 0-2, 3-4, 5-11 or 12-15 (with no children as the omitted category); highest educational attainment distinguishing between GCSE, A level, teaching, nursing or equivalent level qualification, or a university degree (with no education as the omitted category); and ethnicity specifically whether white British, black or Asian (where other ethnic groups comprise the reference category). Previous work has shown that education is positively related to commute times; it is a good proxy for potential earning power and hence the value of time. The presence of children

is a suitable proxy for domestic responsibilities which may constrain commutes, particularly for women, and will also affect the value of time. Given that we focus upon individuals who commute, i.e. report a time travelling to work of 1 minute or more, and who are employees it is potentially important to account for selection into employment, an issue that has been ignored in much of the previous literature on commuting behaviour. A greater willingness to commute should increase the probability of gaining a job and willingness to commute has been shown to be a predictor of unemployment duration (Thomas 1998). Further the effects may differ between spouses; van den Berg and Gorter (1997) found differences between men and women in their stated willingness to accept jobs that are distant from home. To control for sample selection we include gender specific inverse mills ratios in the analysis.[14]

We also control for a number of individual level labour market characteristics. Firstly, own labour income (the natural logarithm of the hourly wage rate), which we expect to be positively associated with commute times, with previous work finding that male commute times are more sensitive to labour income than women's. One modelling concern might be the possibility endogeneity of this income variable, due to potential feedback effects from commuting time to income and unobserved factors affecting both variables. Our set of control variables is rich, and individual random effects are included, so the problem of unobserved heterogeneity is reduced as far as possible. Further, our theoretical framework proceeds from the basis of fixed residential location, which therefore precludes any feedback from commute time to income, since commute time is an outcome and not an input (Manning, 2003). In our empirical work we explored the robustness of our results to excluding labour income, and there are no substantive changes to that reported below. The second set of labour market characteristics are occupational controls; specifically whether professional,

[14] The selection equation is estimated as a probit model with a binary indicator equal to unity if the individual is an employee and commutes to work. This is conditioned upon highest educational attainment, ethnicity and identifying variables which draw upon the existing literature, e.g. Gronau (1979) and Brown et al. (2010), namely: the number of children under 16 that the individual is responsible for; whether the individual is in poor health; and the number of hours per week spent caring for others.

managerial and technical, skilled non-manual, skilled manual, partly skilled (with unskilled as the reference category), as well as the number of hours worked per week. Also included in vector $\boldsymbol{X}_{it}$ are household and housing situation controls, in particular: the natural logarithm of total household income excluding the labour income of the individual; housing tenure i.e. whether the home is owned outright, owned via a mortgage with no negative equity,[15] or if owned on a mortgage with negative equity (other housing tenure states make up the omitted category); the number of years resident at the current address; the number of rooms in the house per head; and whether the individual likes the area they currently live in.

The area controls ($\boldsymbol{A}_{jt}$) defined at the LSOA level include; whether the couple lives in an urban area; the crime rate; the accessibility of 'amenities' including food stores, secondary schools, hospitals and employment centres with at least 500 jobs. The proxies for local labour market conditions (U_{kt}), defined at the LAD level, are the unemployment rate, the unemployment to vacancy rate (a measure of labour market tightness); the growth in female employment over the past year relative to the growth in total employment; and the female real wage rate relative to the total real wage rate.[16] We hypothesise that individuals will commute for longer if jobs are more scarce in their local area. The latter two measures are an attempt to account for the gendered nature of local labour markets; better female employment opportunities in the local area will lower search costs for women, but may increase them for men. Green et al. (1986) use 1981 census data for the UK to show that standard (gender neutral) 'travel to work areas' understate the length and diversity of male commuting patterns and overstate women's; however this issue has been largely ignored in the existing commuting literature. We hypothesise that the more female friendly a local labour market is, the less women will need to commute to find employment; these measures will either have no

[15] This is defined as the difference between the current estimated value of the house provided by the head of household and the remaining amount of mortgage debt. If this figure is negative a binary indicator is given a value of unity.
[16] All local labour market data are obtained from https://www.nomisweb.co.uk which is a service provided by the Office for National Statistics (ONS) containing official labour market statistics.

significant relation to male commute times, or they may be positively associated. Regional controls (with London as the base group); and year indicators (with 2009 as the reference) are also included in all models. Full variable definitions for all variables are given in the Appendix.

Figure 2 shows the density of commuting time for males and females where clearly for less than 30 minutes travel distance female commuting time is more volatile than that of males, but males tend to commute for longer. Figure 3 shows a scatter plot of time spent travelling to work for both spouses where there is an apparent positive and statistically significant correlation between couples commuting time which would suggest that a joint modelling process is applicable. Table 1 provides summary statistics on the variables used in the empirical analysis. One-way commuting time is between 1 and 120 minutes (2 hours) where the distribution are as follows for males (females): at the 25th percentile 15 (10) minutes; at the median 25 (20) minutes; at the 75th percentile 40 (30) minutes; and at the 99th percentile 120 (90) minutes. The log mean travelling time to work is 3.09 (or 22 minutes) for males and 2.94 (19 minutes) for females. Hence for a five day week males (females) commute for 3 hours 40 minutes (3 hours 10 minutes) hours compared to working 38 (30) hours. The majority of couples are aged 25-44 and 23% have a dependent child living in the household aged 5-11. The sample of individuals is highly educated with over 40% of males and females having at least undergraduate degree level education[17]. Men earn an average of £15.83 per hour and women £12.76. 13% of couples own their home outright, 62% via a mortgage and have an estimated house value greater than the outstanding mortgage, and 4% of couples own their via a mortgage but are in negative equity.

RESULTS

Results from the random effects SUR estimation of model (1) are shown in Table 2. Looking first at the lower part of the table, which contains the area level controls and local labour market conditions

[17] This proportion is very similar to that reported in a recent Office for National Statistics report (ONS, 2013).

– apart from the local unemployment rate, other area level controls seem to have no relationship with women's commute times. For men, those living in areas with a higher crime rate commute for longer; also if they live in neighbourhood with better access to employment centres (where there are more job locations per capita) they commute less. For both men and women worse local labour market conditions, proxied by the unemployment rate in their LAD, are associated with longer commute times, and this effect is almost twice as large for men than women. A 1% increase in the local unemployment rate is associated with a 0.16% increase in commuting time for men and a 0.10% increase for women. Evaluated at the mean this suggests that if the local unemployment rate increases by 1% men will travel 35 minutes longer per week, and women 19 minutes. These effects equate to around 20 hours per year for men and 15 for women.[18] This finding is supportive of the view that women's employment opportunities are less geographically concentrated than men's (see for example MacDonald, 1999).

Moving to the top part of the table to consider individual demographic characteristics, for both men and women commuting time is higher for all age groups than for those aged 55 and over, peaking at age 25-34 and with a steeper gradient for women than men. Having school age children has no effect on men's commuting times but it is associated with shorter commuting time for women; which is consistent with the model predictions because women with high childcare responsibilities will have a higher value of leisure time. For example, for women with children aged 5-11 the coefficient estimate (-0.1339) implies that they commute for 0.87 minutes less each way per day, so around 9 minutes less per week, compared to women who do not have primary school age children. For both men and women higher levels of education are associated with longer commuting times, and the gradient is steeper for men. There are no effects of ethnicity for men, but black women seem to commute further than other ethnic groups.

[18] These calculations assume 46 working weeks per year.

Looking now at labour market characteristics of individuals. Firstly, the effect of labour income is very similar for men and women and it is inelastic; for both spouses a 10% increase in labour income is associated with a 2.8% increase in commuting distance. This equal sensitivity of commuting distance to income for men and women is in direct opposition to the argument that men commute further than women because their incomes increase more as a result of commuting further.[19] Further this can be seen as support for the income pooling hypothesis for commuting decisions. Income pooling is implied by the assumption of households having a single utility function; meaning an extra pound of income from either spouse will be spent in the same way so the marginal impact on commuting distances should also be equal (see Mok, 2007). We return to this issue in our sensitivity analysis below, where we consider different earnings shares within the household. Occupational status has no effect on commuting distance for men. For women, those in professional and skilled non-manual jobs commute for longer than those in other occupations. For both sexes the more hours that are worked the longer commute times; for men (women) an extra hour per week of work is associated with 10 (11) minutes more commuting per week. The Inverse Mills ratio from the employment selection equation is positive and significant for both men and women, suggesting a positive correlation between the unobservable effects associated with selection into the labour market and the commuting time model; this correlation is stronger for men. Thus our analysis sample has higher commuting times on average than we would expect for the entire population of working age, if they were in the labour market.

For the set of variables representing household and housing situation other household income (excluding own income) has a similar positive effect for both men and women. Compared to renting, homeowners commute further and the effects are largest for those with negative equity; this reflects rigidities in the housing market. However length of time in the current home is associated

[19] If we omit area level characteristics, including the local labour market conditions, from this model the coefficient on male labour income is 0.31 compared to 0.29 for women, suggesting that the neglect of these factors in previous work may have accounted for the findings on the different commuting elasticities between the sexes.

with a small decrement in commuting time for women, but this is not significant for men. For both men and women the number of cars in the household is associated with shorter commuting times. For men, those who like their neighbourhood commute for less time, but this is not significant for women. Finally the rho (ρ) statistic suggests a positive and significant correlation between the errors from the two equations in model (1); that is between the unobservable factors associated with spouses' commute times. This positive correlation suggests that spouse commutes are complements rather than substitutes, which is in line with the US findings of Plaut (2006). The implication here is that journeys are jointly chosen to be longer (shorter) for both spouses. Further support for this complementarity is provided by the fact that the significant associations with commuting time shown in Table 2 all act in the same direction for both men and women.

In Table 3 we explore whether our results on the importance of local labour market conditions are robust to different measures. Whereas Table 2 presented results using the local unemployment rate, three alternative measures are used in Table 3; the other control variables included are identical to those reported in Table 2 and the results for those controls (not reported here) are ostensibly the same. Using the unemployment to vacancy ratio as the measure of local labour market conditions (as used for example by van Ommeren, 2000) results are very similar to those for the unemployment rate; as hypothesised both men and women commute for longer if local labour market conditions are worse, and in contrast to the unemployment rate, the effects of this ratio are very similar for both sexes. The next two measures are an attempt to account for the gendered nature of labour markets, and they proxy the 'female friendliness' of the local labour market via measures of the relative growth (over the past 12 months) in female employment and the relative female wage rate. Neither of these variables is significant for men, but, as hypothesised, for women they are associated with shorter commute times. In a further robustness check (not reported here) we include four different pairs of local labour market measures; each of unemployment rate and

unemployment/vacancy ratio paired with each gendered measure. The variables remain individually significant when included in pairs. These results further confirm the importance of local labour conditions in commuting time outcomes.

To further explore the role of labour market conditions we report the results of a number of specifications where local labour market conditions are interacted with binary indicators, S_{it}, defining a number of analysis sub-groups. In Tables 4 and 5 we only report the coefficients on the local labour measure and the interaction, i.e. the π's and ϕ's; the other controls are as reported in Table 2. The first columns of Table 4 show the results with an interaction for mode of commute, where the sub-group of interest is where both spouses commute by car. In general we expect car commuters to be more flexible than those who use public transport or other active modes to travel to work. Here a higher local unemployment rate is still associated with longer commute times for both spouses; the effect (as for the full sample) is greater for men than women, and in fact for women the positive coefficient on the interaction term means this increased travel time is ameliorated to some extent by car travel. So for those who commute by car, men are much more sensitive to the local unemployment rate than women; at mean commute times a 1% increase in the local unemployment rate is associated with a 36 minute increase in weekly commute times for men (more or less the same as the average for all male commuters), and a 9 minute increase for women (compared to a 19 minute average effect for all female commuters). In the case of the unemployment to vacancy ratio, the results suggest that car travel reduces the commuting time increase for both sexes. For the relative growth in female employment the results for car commuters are virtually identical to those for the full sample. There is evidence that male car commuters travel for longer the higher the relative female wage rate in their local labour market, while for women the net effects of the wage rate and commuting by car cancel out.

The second set of columns in Table 4 reports interactions where the sub-group of interest have moved home within the last 12 months. We hypothesise that those who have moved recently are likely to be closer to a utility maximising equilibrium in both job and residence location choices. As before higher local unemployment rates and unemployment to vacancy ratios are associated with longer commute times for both sexes, but for men there is evidence in both cases that these effects are reduced for recent movers. This may support the view that home moves are chosen to suit the male earner, over the female. Further evidence for this is suggested by the fact that the negative association between commuting distance and the growth in the local female employment rate that is present for full sample, is no longer present for females who have recently moved (the positive coefficient on the interaction term outweighs the negative effect). For the female relative wage there are no significant differences for recent movers.

Two further sub-groups are considered in Table 5. Firstly, we consider homeowners as opposed to people who rent their home. We hypothesise that due to rigidities in the housing market homeowners are more constrained than renters and will have a higher relocation threshold in relation to commute time. This seems to be the case in relation to the local unemployment rate, the increase in commuting time that growth in the local unemployment rate is associated with, is larger for homeowners than for the full sample (positive interaction effects). However, there are no significant differences when local labour market conditions are proxied by the unemployment to vacancy ratio. For the gendered measures of local labour market conditions, these results suggest that all the advantages for female commuting time are experienced by homeowners. Females in owner occupied homes commute for a shorter time if the local labour market is more female friendly. Finally we explore further the income pooling hypothesis by differentiating households according to the share of female earned income. In the base group women earn less than 33% of household income, in sub-group one (S1) they earn between 33% and 66%, and in sub-group two

(S2) they earn more than 66%. Local unemployment rates (and the unemployment to vacancy ratio) increase male commute times when men earn either the majority or minority of household income but not in those households where income shares are more equal. In contrast for women the effects of local unemployment are felt only where they earn at least 33% of household income. Higher growth in relative female employment locally is associated with increased commute times for men who earn the minority of household income, and with decreased commute times for women whose share is at least 33%. Similarly growth in the relative female wage rate in the local labour markets is only associated with reduced female commute times in this latter group. These results together provide some evidence that household income share does matter in commute decisions, and the higher a spouses' income share the more the commute journeys will be chosen to suit them. This is in line with the results of Singell and Lillydahl (1986) who used 1980 US Census data and found that choice of residence favours the male earner, but that this advantage is reduced as the ratio of female to male earnings narrows.

CONCLUSIONS

While the job search literature has increasingly recognised the importance of the spatial distribution of employment opportunities, local labour market conditions have been a notable omission from much of the empirical literature on commuting outcomes. This study of the commute times of dual earner couples in England and Wales has shown that local labour market conditions are closely associated with commute times and their effects are not gender neutral. Male commute times are much more sensitive to local unemployment rates than women's; men commute for 35 minutes more per week on average for every 1% increase in the local unemployment rate, whereas for women this is 19 minutes. Further, where women earn less than one–third of household income, their commute times do not seem to be sensitive to local unemployment. In addition, the more conducive the local labour market is to female employment, the less time women spend commuting.

On average the 'female friendliness' of the local labour market has no effect on male commute times, but in households where women earn the majority of household income, men commute further if the local labour market is female friendly. Other results confirm the findings from a number of other studies; women commute for less time if they have school age children and for more time if they work in professional and skilled jobs. These findings, combined with the fact that each additional pound of labour income has similar associations with both male and female commute times, add support to the view that female commuting outcomes are the result of a complex set of factors combining labour market status, domestic responsibilities, household income share and the spatial distribution of female jobs.

Overall our results show that dual earner households face a complex set of constraints on commuting times, and that the commute times of spouses are complements. The growth in female labour market participation means an increase in this household type, with the probability of increased average commuting times and the consequent implications for increases in pollution, noise, congestion, health and wellbeing effects. There are also implications for housing policy since housing market rigidities seem to worsen the situation; homeowners, and particularly those with negative equity, commute for longer than people who rent their home.

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FIGURE 1: Commuting Distance, Valuation of Time and Income

		Value of time	
		High	Low
Utility of income	High	A	B long distances
	Low	C short distances	D

Source: Adapted from Beesley and Dalvi (1974)

FIGURE 2: Density Plots of Commuting Time by Gender

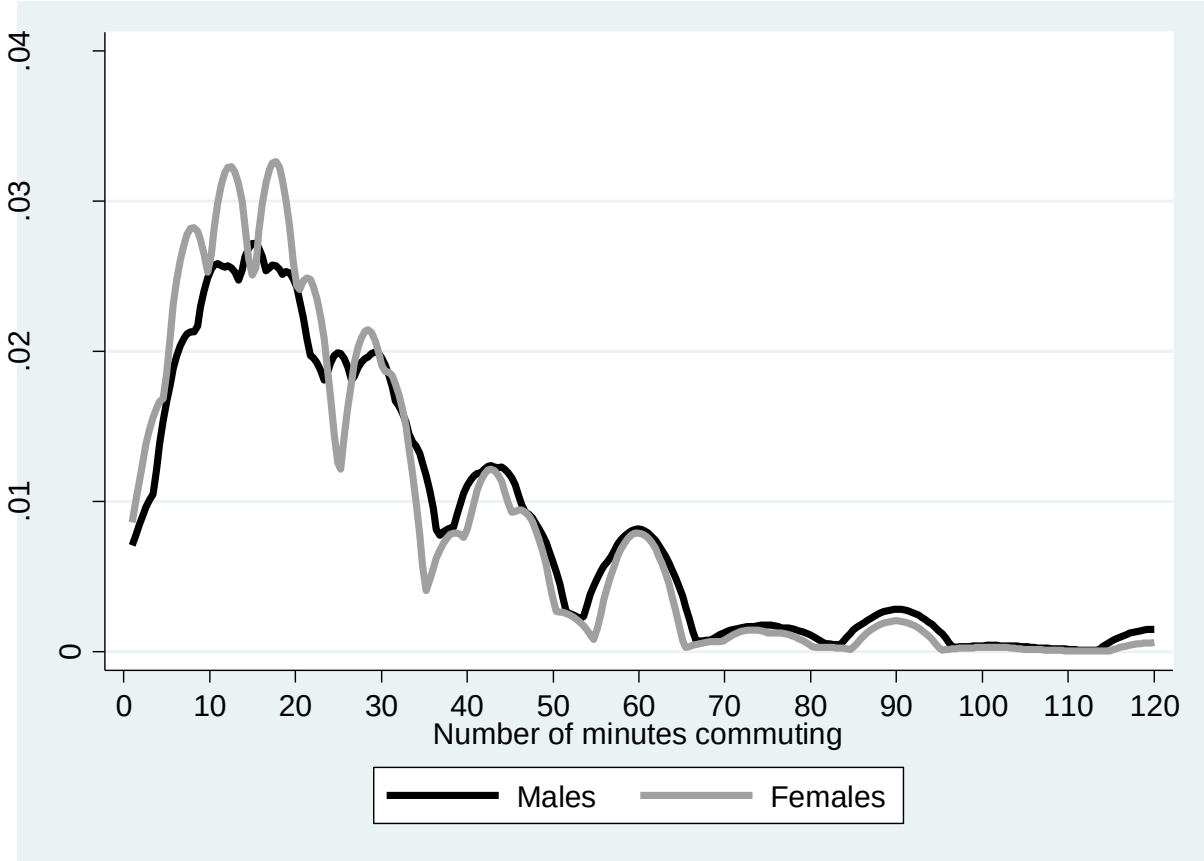

FIGURE 3: Scatter Plot of Commuting Time by Gender

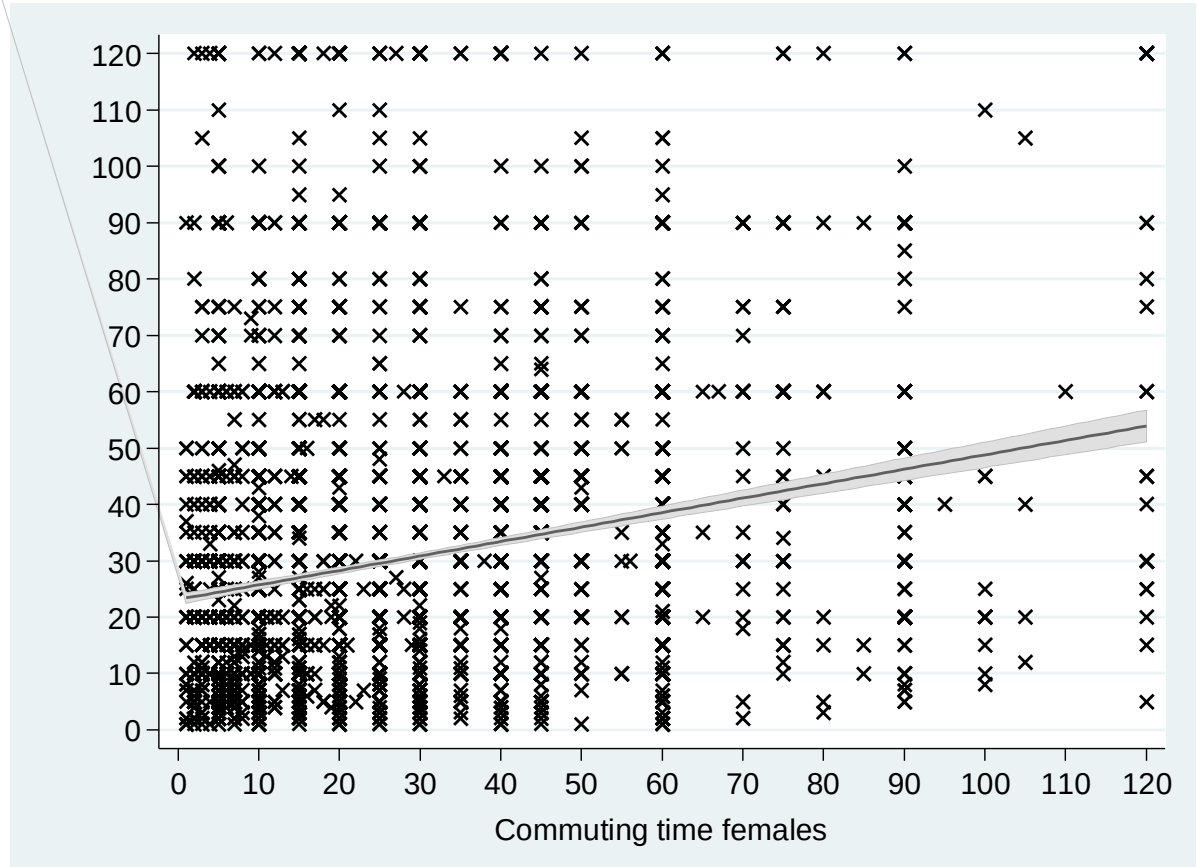

TABLE 1: Summary Statistics

	MALE		FEMALE	
	MEAN	*STD*	MEAN	*STD*
Log commuting time	3.0929	*0.827*	2.9473	*0.814*
Individual demographics				
Aged 16-24	0.0292	*0.168*	0.0545	*0.227*
Aged 25-34	0.2651	*0.441*	0.3251	*0.468*
Aged 35-44	0.3324	*0.467*	0.2869	*0.452*
Aged 45-54	0.2252	*0.418*	0.2155	*0.411*
Children 0-2 years old [#]	0.1253	*0.331*	0.1253	*0.331*
Children 3-4 years old [#]	0.0915	*0.288*	0.0915	*0.288*
Children 5-11 years old [#]	0.2333	*0.417*	0.2233	*0.417*
Children 12-15 years old [#]	0.1228	*0.328*	0.1228	*0.328*
GCSE	0.1856	*0.389*	0.1938	*0.395*
A level	0.1994	*0.399*	0.1765	*0.381*
Other qualification	0.0640	*0.245*	0.0498	*0.217*
Degree	0.4321	*0.495*	0.4778	*0.499*
White	0.7123	*0.458*	0.7028	*0.419*
Black	0.0463	*0.210*	0.0552	*0.228*
Asian	0.1157	*0.258*	0.1073	*0.269*
Individual labour market characteristics				
Log labour income per hour	2.6141	*0.538*	2.4072	*0.520*
Professional	0.0737	*0.261*	0.0581	*0.234*
Managerial & technical	0.4127	*0.492*	0.3949	*0.489*
Skilled non-manual	0.1369	*0.344*	0.3127	*0.464*
Skilled manual	0.2152	*0.411*	0.0498	*0.217*
Partly skilled	0.0988	*0.298*	0.1489	*0.356*
Number of hours worked	38.4229	*7.290*	30.3144	*9.912*
Household income and housing situation				
Log household income (all others)	7.3478	*0.627*	7.7509	*0.546*
Own home outright [#]	0.1248	*0.331*	0.1248	*0.331*
Mortgage no negative equity [#]	0.6167	*0.486*	0.6167	*0.486*
Mortgage and negative equity [#]	0.0389	*0.193*	0.0389	*0.193*
Years in current home [#]	5.0729	*7.227*	5.0729	*7.227*
Number of cars in household [#]	1.5414	*0.749*	1.5414	*0.749*
Number of rooms in home per head [#]	2.3310	*0.773*	2.3310	*0.773*
Likes neighbourhood	0.3882	*0.487*	0.3957	*0.489*
Area level controls & local labour market conditions				
Urban area [$]	0.8441	*0.363*	0.8441	*0.363*
Log crime rate [$]	1.8829	*0.769*	1.8829	*0.769*
Log number of food stores/population [$]	-0.3946	*0.498*	-0.3946	*0.498*
Log number of employment centres/population [$]	-0.1678	*0.630*	-0.1678	*0.630*
Log number of secondary schools/population [$]	0.5193	*0.856*	0.5193	*0.856*
Log number of hospitals/population [$]	-0.9669	*3.601*	-0.9669	*3.601*
Log unemployment rate [%]	2.1433	*0.378*	2.1433	*0.378*
Log unemployment/vacancy rate [%@]	1.4275	*0.509*	1.4275	*0.509*
Log female relative growth in employment [%]	-0.1966	*1.442*	-0.1966	*1.442*
Log female relative wage [%]	-0.2417	*0.080*	-0.2417	*0.080*
Number of couples	5,888		5,888	
Number of observations	11,776			

Notes: (i) [#] denotes household (couple) specific variable; (ii) [$] denotes a LSOA specific variable; (iii) [%] denotes a LAD specific variable; (iv) [@] number of observations 4,874 (9,748) couples (individuals).

TABLE 2: Panel Seemingly Unrelated Regression Models of Couples Commuting Time

	LOG COMMUTING TIME			
	MALE		FEMALE	
Individual demographics	Coef.	t-stat	Coef.	t-stat
Aged 16-24	0.1199	*(1.12)*	0.3378	*(5.84)*
Aged 25-34	0.1298	*(2.05)*	0.3696	*(7.54)*
Aged 35-44	0.1074	*(2.79)*	0.2279	*(4.28)*
Aged 45-54	0.0630	*(1.22)*	0.1870	*(3.97)*
Children 0-2 years old	-0.0024	*(0.06)*	-0.0055	*(0.17)*
Children 3-4 years old	-0.0367	*(0.91)*	0.0142	*(0.45)*
Children 5-11 years old	0.0365	*(1.05)*	-0.1339	*(4.36)*
Children 12-15 years old	-0.0469	*(1.06)*	-0.0732	*(2.11)*
GCSE	0.1204	*(2.44)*	0.1482	*(3.80)*
A level	0.2089	*(4.19)*	0.0816	*(2.01)*
Other qualification	0.1804	*(2.60)*	0.0473	*(0.91)*
Degree	0.2336	*(4.74)*	0.2077	*(5.37)*
White	0.0110	*(0.22)*	-0.0299	*(0.84)*
Black	0.0555	*(0.47)*	0.2548	*(2.66)*
Asian	-0.0306	*(0.35)*	-0.1007	*(1.33)*
Individual labour market characteristics				
Log labour income per hour	0.2892	*(10.50)*	0.2847	*(14.00)*
Professional	0.0335	*(0.41)*	0.2001	*(2.89)*
Managerial & technical	0.0259	*(0.39)*	0.0452	*(1.80)*
Skilled non-manual	0.0640	*(0.89)*	0.1984	*(3.56)*
Skilled manual	-0.1139	*(1.70)*	0.0091	*(0.14)*
Partly skilled	-0.0419	*(0.54)*	-0.0578	*(1.00)*
Number of hours worked	0.0116	*(6.84)*	0.1031	*(8.77)*
Inverse mills ratio	0.2206	*(2.15)*	0.1074	*(2.59)*
Household income and housing situation				
Log household income (all others)	0.1108	*(6.09)*	0.1359	*(8.38)*
Own home outright	0.1416	*(2.52)*	0.2072	*(4.84)*
Mortgage no negative equity	0.0966	*(2.24)*	0.1176	*(3.76)*
Mortgage and negative equity	0.2282	*(2.99)*	0.2034	*(3.59)*
Years in current home	-0.0028	*(1.08)*	-0.0060	*(2.72)*
Number of cars in household	-0.0326	*(2.59)*	-0.0312	*(2.03)*
Number of rooms in home per head	0.0036	*(0.17)*	-0.0048	*(0.30)*
Likes neighbourhood	-0.0579	*(2.05)*	0.0305	*(1.44)*
Area level controls & local labour market conditions				
Urban area	0.0832	*(1.23)*	-0.0578	*(1.12)*
Log crime rate	0.0383	*(2.97)*	0.0074	*(0.50)*
Log number of food stores/population	0.0777	*(1.30)*	-0.0406	*(0.90)*
Log number of employment centres/population	-0.1348	*(3.16)*	0.0024	*(0.08)*
Log number of secondary schools/population	-0.0126	*(0.45)*	-0.0273	*(1.30)*
Log number of hospitals/population	-0.0038	*(0.56)*	0.0022	*(0.46)*
Log unemployment rate	0.1594	*(4.35)*	0.0987	*(3.60)*
ρ; p-value	0.1876; p=[0.000]			
Number of observations (N)	11,776 [m=5,888 : f=5,888]			

Notes: (i) other controls include binary indicators for region of residence and year of interview; (ii) ρ is the correlation between the error terms from the male and female commuting time equations.

TABLE 3: Panel Seemingly Unrelated Regression Models of Couples Commuting Time – Alternative Local labour Market Indicators

	N	ρ; p-value	LOG COMMUTING TIME MALE		LOG COMMUTING TIME FEMALE	
			Coef.	t-stat	Coef.	t-stat
Log unemployment/vacancy rate	9, 748	0.1728; *p=[0.000]*	0.0946	*(2.91)*	0.1026	*(3.86)*
Log female relative growth in employment	11,776	0.1895; *p=[0.000]*	-0.0060	*(0.72)*	-0.0176	*(3.92)*
Log female relative wage	11,776	0.1895; *p=[0.000]*	-0.2270	*(1.14)*	-0.2531	*(2.71)*

Notes: (i) model specification and other controls as in Table 2; (ii) ρ is the correlation between the error terms from the male and female commuting time equations.

TABLE 4: Panel Seemingly Unrelated Regression Models of Couples Commuting Time – Mode of Transport and Home Movers

	(1) MODE OF TRANSPORT				(2) MOVED HOME			
	MALE		FEMALE		MALE		FEMALE	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
PANEL A: UNEMPLOYMENT RATE								
Log unemployment rate	0.1654	*(4.47)*	0.1249	*(4.51)*	0.1646	*(4.43)*	0.0966	*(3.47)*
Log unemployment rate × S	-0.0212	(1.43)	-0.0765	*(6.86)*	-0.0446	*(1.96)*	0.0136	*(0.79)*
PANEL B: UNEMPLOYMENT TO VACANCY RATIO								
Log unemployment/vacancy rate	0.1246	*(3.55)*	0.1337	*(4.67)*	0.1000	*(3.06)*	0.1027	*(3.84)*
Log unemployment/vacancy rate × S	-0.0652	*(2.53)*	-0.0656	*(3.14)*	-0.0470	*(2.26)*	-0.0009	*(0.03)*
PANEL C: GROWTH IN FEMALE EMPLOYMENT RELATIVE TO TOTAL								
Log female relative growth in employment	0.0074	*(0.65)*	-0.0171	*(2.25)*	-0.0101	*(1.17)*	-0.0238	*(3.78)*
Log female relative growth in employment × S	-0.0293	*(1.73)*	-0.0013	*(0.11)*	0.0371	*(1.16)*	0.0584	*(2.52)*
PANEL D: FEMALE RELATIVE WAGE								
Log female relative wage	-0.3610	*(0.71)*	-0.4875	*(3.12)*	-0.2754	*(1.38)*	-0.2432	*(2.77)*
Log female relative wage × S	0.2685	*(2.26)*	0.4614	*(5.19)*	0.3539	*(1.64)*	-0.0946	*(0.64)*

Notes: (i) control variables as in Table 2; (ii) in column 1 S is a binary indicator equal to unity if both the male and female use a car to commute to work (zero otherwise); (iii) and in column 2 S is a binary indicator equal to unity if the couple moved home, i.e. address, within the last 12 months.

TABLE 5: Panel Seemingly Unrelated Regression Models of Couples Commuting Time – Housing Tenure and Female Share of Household Income

	(1) HOMEOWNER				(2) FEMALE SHARE			
	MALE		FEMALE		MALE		FEMALE	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
PANEL A: UNEMPLOYMENT RATE								
Log unemployment rate	0.1358	*(3.55)*	0.0671	*(2.37)*	0.1471	*(3.76)*	0.0528	*(1.74)*
Log unemployment rate × S1	0.0341	*(1.96)*	0.0459	*(3.47)*	0.0126	*(0.71)*	0.0462	*(3.45)*
Log unemployment rate × S2	–		–		0.1139	*(3.35)*	0.0610	*(2.36)*
PANEL B: UNEMPLOYMENT TO VACANCY RATIO								
Log unemployment/vacancy rate	0.0824	*(2.08)*	0.0991	*(3.12)*	0.0947	*(2.27)*	0.0358	*(1.01)*
Log unemployment/vacancy rate × S1	0.0166	*(0.55)*	0.0034	*(0.14)*	0.0010	*(0.20)*	0.0679	*(2.61)*
Log unemployment/vacancy rate × S2	–		–		0.1015	*(1.85)*	0.1081	*(2.22)*
PANEL C: GROWTH IN FEMALE EMPLOYMENT RELATIVE TO TOTAL								
Log female relative growth in employment	0.0215	*(1.10)*	0.0039	*(0.27)*	-0.0168	*(1.03)*	0.0364	*(3.04)*
Log female relative growth in employment × S1	-0.0341	*(1.57)*	-0.026	*(2.67)*	0.0068	*(0.35)*	-0.0686	*(4.84)*
Log female relative growth in employment × S2	–		–		0.1164	*(2.86)*	-0.0687	*(2.34)*
PANEL D: FEMALE RELATIVE WAGE								
Log female relative wage	-0.0448	*(0.19)*	0.1192	*(0.70)*	-0.4038	*(1.66)*	-0.0158	*(1.09)*
Log female relative wage × S1	-0.2394	*(1.54)*	-0.4832	*(4.29)*	0.1359	*(0.91)*	-0.3209	*(2.89)*
Log female relative wage × S2	–		–		-0.5854	*(1.92)*	-0.4867	*(2.18)*

Notes: (i) control variables as in Table 2; (ii) in column 1 S1 is a binary indicator equal to unity if the household owns their home (zero otherwise) and S2=0; (iii) in column 2 S1 is equal to unity if the contribution of the females income to total household income is between 33% and 66% (zero otherwise); (iv) in column 2 S2 is equal to unity if the contribution of the females income to total household income is above 66% (zero otherwise).

Appendix: Variable Definitions

VARIABLE NAME	DEFINITION
Commuting time	Natural logarithm of commuting time
Individual demographics	
Age	4 dummy variables =1 if aged between 16-24/25-34/35-44/45-54, otherwise =0
Children	4 dummy variables =1 if household has children aged 0-2/3-4/5-11/12-15, otherwise =0
Education	4 dummy variables =1 if highest educational attainment is GCSE/A level/teaching or nursing qualification/undergraduate or postgraduate degree, otherwise =0
Ethnicity	3 dummy variables =1 if ethnic group is white/black/Asian, otherwise =0
Labour market characteristics	
Occupation	3 dummy variables =1 if employed in professional/managerial & technical/skilled non-manual/skilled manual/partly skilled occupation, otherwise =0
Number of hours worked	Number of hours normally worked per week
Income and housing situation	
Labour income per hour	Natural logarithm of total real gross weekly labour income ÷ number of hours worked per week
Household income (all others)	Natural logarithm of real gross household monthly income minus total individual monthly labour income
Housing tenure	3 dummy variables =1 if own home outright/mortgage no negative equity/mortgage and negative equity, otherwise =0
Years in current home	Number of years in current home = year of interview minus year last moved (constant within couple)
Number of cars in household	Number of cars in household (constant within couple)
Number of rooms in home per head	Number of bedrooms plus number of other rooms ÷ household size (constant within couple)
Likes neighbourhood	Dummy variable =1 if either strongly agrees or agrees that plans to stay in neighbourhood
Lives in an urban area	Dummy variable =1 if lives in urban area (constant within couple)
Area level controls (constant within couple)	
crime rate	Natural log of total crime rate in LSOA (number of crimes ÷ population)
Accessibility of:	Accessibility of various 'amenities' in LSOA, measured as natural logarithm of the number of those amenities accessible by cycle ÷ potential user population. Source: Department for Transport Accessibility Statistics https://www.gov.uk/government/statistical-data-sets/acs05-travel-time-destination-and-origin-indicators-to-key-sites-and-services-by-lower-super-output-area-lsoa
food stores	
employment centres	
secondary schools	
Hospitals	
Local labour market controls	All variables from NOMIS https://www.nomisweb.co.uk/
unemployment rate	Natural log of the unemployment rate in LAD
unemployment/vacancy rate	Natural log of the LAD number of unemployment ÷ LAD number of vacancies
female relative growth in employment	Natural log of LAD female employment growth ÷ LAD total employment growth (over past 12 months)
female relative wage	Natural log of LAD female real wage ÷ LAD total real wage

Notes: (i) all data are from the UKHLS except for the area and local labour market controls, where the sources are stated above; (ii) LAD = local authority district, LSOA = lower layer super output area.