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Intra-household commuting choices and local labour markets

By Jennifer Roberts[a] and Karl Taylor[b]

[a]University of Sheffield
[b]Department of Economics, University of Sheffield, 9 Mappin Street, Sheffield, S1 4DT, and IZA; e-mail: k.b.taylor@sheffield.ac.uk

Abstract

Commuting is the conduit between two markets: labour and housing. While the job search literature recognizes the importance of the spatial distribution of employment, local labour market conditions have been a notable omission from the commuting literature. In the first study of its kind, we introduce local labour market conditions into a model of spouses' commuting behaviour in the UK. We find male commute times are more sensitive to local unemployment rates than women's, although both effects are inelastic, and are of a similar magnitude to that of labour income. The more conducive the local labour market is to female employment opportunities, the less time women spend commuting. Local unemployment rates have heterogeneous effects on commuting, e.g. arising from mode of transport, job change, and homeownership. Furthermore, housing market rigidities lead to longer commuting times and thus increase the social costs that a more flexible housing market could alleviate.

JEL classifications: D19, J24, R40.

1. 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); this hides important differences across socio-economic and demographic groups, with commuting times longest among the most affluent workers and among men (Dorling, 2013). There is also evidence that commuting confers disutility, being detrimental to both mental and physical health (Stutzer and Frey, 2008; Roberts *et al.*, 2011; Martin *et al.*, 2015); and in Kahneman *et al.*'s (2004) seminal work on experienced utility, commuting was associated with the lowest level of positive affect among a broad list of daily activities for working women in the USA.

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 (Leigh, 1986; Manning, 2003; 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 minimize their commute subject to the constraints of housing price and quality (Simpson and van der Veen, 1992; Glaeser *et al.*, 2008). 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 *et al.*, 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. Indeed, in an early paper on UK regional labour markets, Blackaby and Manning (1992) implicitly assume that regional commuting patterns are not directly linked to local labour markets.

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 a 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 spouse's 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. First, 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. Second, 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. Third, 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 allows us to explore differences across a number of different types of dual-earner households, distinguished by female income share, mover status, job changers, commuting mode, and housing tenure. Our results reveal that poorer local labour market conditions are associated with longer commuting times for both men and women (more so for men), and that where local labour markets are more conducive to female employment, women commute for less time. We also show that it is important to account for

1 Percentage calculated from UK Household Longitudinal Study wave 4, 2012–14 (University of Essex, 2014). This figure falls to 45% for dual-earner couples.

heterogeneity of the household types because there are important differences in our results according to female income share, housing tenure, mover status, and changes in employment and mode of travel.

2. 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 (Alonso, 1964; Mills, 1967; Muth, 1969). Extensions have included both multiple employment centres (see for example Rouwendal, 1998) and, to a lesser extent, dual-earner households (van Ommeren *et al.*, 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 van Ommeren, 2000; Deding *et al.*, 2009), 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 homeowners 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 compromise over the employment choices of both workers also constrains relocation (Kim, 1995; van Ommeren *et al.*, 1998; Clark *et al.*, 2003).

The following assumptions underlie the model of Beesley and Dalvi (1974): households attempt to maximize their utility function;[3] the location of job sites is predetermined;[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 maximize 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

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.

3 We implicitly assume a single household utility function maximized by either an altruistic household head (Becker, 1981) or via consensus (Samuelson, 1956). Extensions in the literature consider co-operative (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 maximized, 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.

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. First, in a standard time allocation framework, the distance an individual is willing to travel to access a 'better' job is dependent on 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). Second, 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. This idea of a commuting threshold is incorporated into the job search model of van den Berg and Gorter (1997), and a number of empirical studies have estimated the threshold for different cities and different time periods. In addition, Clark and Huang (2004) point out that households of different types will have differing sensitivity to the separation between income and work; and in relation to dual-earner households, both theory and evidence suggest that they, 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 (Clark *et al.*, 2003; Deding *et al.*, 2009; Rabe, 2011).

Beesley and Dalvi (1974) suggest a simplified typology of individuals dependent on value of time and utility of income; this typology is shown in Fig. 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. Type 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 White, 1986; Gordon *et al.*, 1989; Roberts *et al.*, 2011), 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 (Mincer, 1978; Singell and Lillydahl, 1986; Hanson and Pratt, 1995; Green, 1997). 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 husband's, despite the fact that the husband is

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

Fig. 1. Commuting distance, valuation of time, and income
Source: Adapted from Beesley and Dalvi (1974).

usually the main breadwinner. Also, Taylor (2007) and Rabe and Taylor (2012) have demonstrated, with British data, that a higher proportion of women than men are 'tied migrants', moving for their husband's job rather than their own. 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 (Turner and Niemeier, 1997; Rouwendal, 1999; Sermons and Koppelman, 2001; Brownstone and Small, 2005). 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 (Hanson and Johnston, 1985; Gordon *et al.*, 1989; MacDonald, 1999; Benson, 2014). Furthermore, Hansen and Pratt (1995) find that employers' localized recruitment strategies reinforce the patterns of shorter female commutes. Also Latreille *et al.* (2006) find that unemployed and inactive men in Wales are prepared to travel around 35% farther to work than women, and this is independent of the presence of dependent children and marital status.

These various hypotheses are not mutually exclusive. As Blumen (1994) points out, labour market–based explanations, like the segregation of women into certain types of industries and occupations, complement more domestic explanations, like women's greater responsibility for household tasks, because this means for example that women can work closer to home or work part-time hours. A relevant question that has been posed is whether or not women pay a penalty for commuting, in that they commute farther for lower wages than men; this would occur if women suffer from greater spatial mismatch than men. Madden (1981), for example, is an early study which showed that women's lower earnings levels make longer work trips less worthwhile. However, using more recent evidence from minority women in Los Angeles, Clark and Wang (2005) do not find strong evidence for an absolute commuting penalty. However, they do find that the gains to commuting for this group are contingent on human capital, with the greatest gains accruing to skilled workers.

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 farther from their work locations than single people. Freedman and Kern (1997) assume that two-earner

households maximize 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 (Surprenant-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 husband's, 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 minimize the current commuting distances of both spouses. This excess or 'wasteful' commuting prediction (Hamilton and Röell, 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 minimize joint commuting distances, but they cannot do so because they face more constraints than single-earner households. Similarly, Surprenant-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 times; poorer local job prospects will force workers to travel farther 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 particular the segregation of women into a narrower range of employment than men (Sparreboom, 2014; Pan, 2015), 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.

3. Data and methodology

We use Understanding Society—the UK Household Longitudinal Study (UKHLS); a twenty-first-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

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

same individuals can be tracked over time. In the first wave over 50,000 individuals were interviewed between 2009 and 2011; correspondingly, in wave 4 over 47,000 individuals were interviewed between 2012 and 2014. Our analysis uses the first four waves of UKHLS; in these data there are 23,110 couples of working age (aged 16–65) 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 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 11,816 individuals comprising 5,908 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 the 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 Biørn, 2004)[13] is estimated at the couple level, i.e. an equation is estimated for

8 Note that we drop same-sex couples, which account for less than 1% of the sample.

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 Biørn (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. We can get some idea of how prevalent this is from the UKHLS technical reports (https://www.understandingsociety.ac.uk/documentation/mainstage/technical-reports, last accessed 17/05/2016). Note that household splits are likely to overestimate attrition due to couple dissolution because new households may form for other reasons. The following figures exclude those households which were ineligible for interview (e.g. through death or leaving the UK). Between waves 1

males (M) and females (F), simultaneously, as follows:

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

Let i denote the couple ($= 1, \ldots, 5908$), j the LSOA ($= 1, \ldots, 3297$), k the LAD ($= 1, \ldots, 355$), and t the time period ($= 1, \ldots, 4$). 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 couple random effects, α_i, and gender-specific 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 55–65 (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

and 2 there were 27,193 eligible households for interview in the general population sample and 1,528 household splits. Between waves 2 and 3 there were 24,661 eligible households for interview in the general population sample and 1,395 household splits. Finally, between waves 3 and 4 there were 21,497 eligible households for interview in the general population sample and 1,251 household splits. This implies a household split rate of just under 6% between each wave which could be due to couple dissolution.

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. First, 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 possible 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).[15] 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, 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,[16] or 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 a set of neighbourhood characteristics, explicitly whether the individual feels they can get advice from people locally, whether the individual talks regularly to their neighbours, whether the individual feels they belong to the neighbourhood, and whether the individual plans to stay in the neighbourhood.

The area controls ($\boldsymbol{A}_{jt}$) defined at the LSOA level include whether the couple lives in an urban area; the crime rate; and 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 and the female real wage rate relative to the total real wage rate.[17] We hypothesize that individuals will commute for longer if jobs are more scarce in their local area. The latter measure

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 (1974) 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.

15 It should be noted that endogeneity may also be of concern if commuting time restricts hours worked or forms a component of the decision-making process for individuals when seeking work, e.g. higher wages to compensate for longer commuting times.

16 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.

17 All local labour market data are obtained from https://www.nomisweb.co.uk, (last accessed 17/05/2016) which is a service provided by the Office for National Statistics (ONS) containing official labour market statistics.

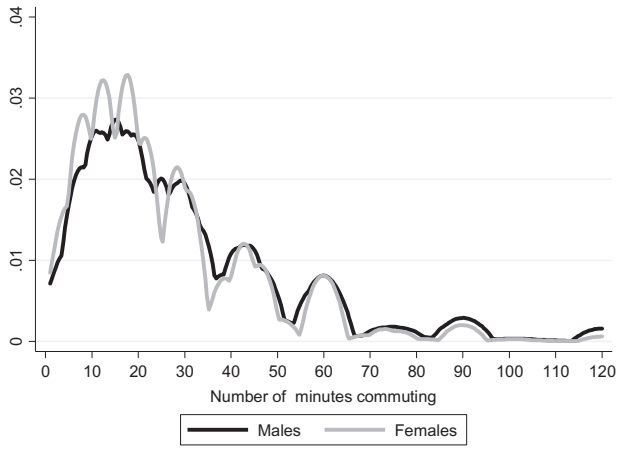

Fig. 2. Density plots of commuting time by gender

is an attempt to account for the gendered nature of local labour markets. 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 hypothesize 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 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 scatterplot 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 distributions 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 2.95 (19 minutes) for females. Hence, for a five-day week males (females) commute for 3 hours 40 minutes (3 hours 10 minutes) compared to working 38 (30) hours. The majority of couples are aged 25–44 and 22% 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.[18] Men earn an average of £13.69 per hour and women £11.15; 13% of couples own their home outright, 62% own their home via a mortgage and have an estimated house value greater than the

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

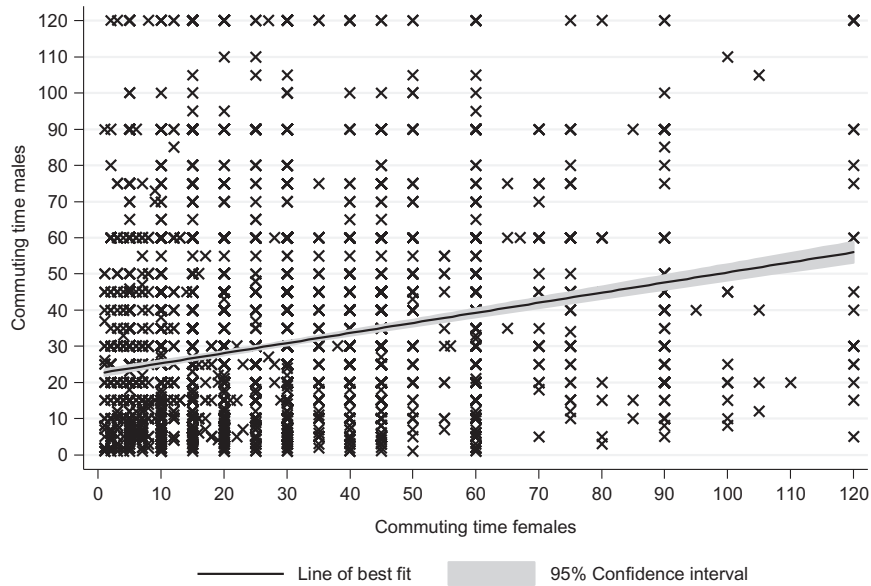

Fig. 3. Scatterplot of commuting time by gender

outstanding mortgage, and 4% of couples own their home via a mortgage but are in negative equity. In relation to the neighbourhood variables, a similar proportion of men and women (just under half) say they plan to stay in their neighbourhood, but more women than men respond positively to the variables that proxy the extent to which they are integrated into their local neighbourhood.

4. 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, both men and women who live in neighbourhoods with better access to employment centres (where there are more job locations per capita) commute less. In addition, males living in areas with a higher crime rate commute for longer. 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 larger for men than women. A 1% increase in the local unemployment rate is associated with a 0.19% increase in commuting time for men and a 0.12% increase for women.[19] The average change in the local unemployment rate across LADs over the time period was 10%, hence based upon the above estimated elasticities and the mean change in the LAD unemployment rate over the sample period this implies that men will travel 4 minutes longer per week, and

19 For males the elasticity is similar in magnitude to that stemming from labour income, which is discussed below.

Table 1. Summary statistics

	Male		Female	
	Mean	STD	Mean	STD
Log commuting time	3.0892	*0.827*	2.9525	*0.812*
Individual demographics				
Aged 16–24	0.0311	*0.174*	0.0557	*0.229*
Aged 25–34	0.2617	*0.440*	0.3252	*0.468*
Aged 35–44	0.3241	*0.468*	0.2874	*0.453*
Aged 45–54	0.2241	*0.417*	0.2136	*0.410*
Children 0–2 years old [#]	0.1266	*0.332*	0.1266	*0.333*
Children 3–4 years old [#]	0.0895	*0.286*	0.0895	*0.286*
Children 5–11 years old [#]	0.2205	*0.415*	0.2205	*0.415*
Children 12–15 years old [#]	0.1195	*0.324*	0.1195	*0.324*
GCSE	0.1840	*0.387*	0.1916	*0.394*
A level	0.1979	*0.398*	0.1732	*0.378*
Other qualification	0.0618	*0.241*	0.0487	*0.215*
Degree	0.4345	*0.496*	0.4836	*0.499*
White	0.7195	*0.462*	0.7020	*0.419*
Black	0.0462	*0.226*	0.0542	*0.228*
Asian	0.1101	*0.271*	0.1038	*0.269*
Individual labour market characteristics				
Log labour income per hour	2.6169	*0.549*	2.4121	*0.528*
Professional	0.0741	*0.262*	0.0604	*0.238*
Managerial & technical	0.4169	*0.493*	0.3937	*0.489*
Skilled non-manual	0.1349	*0.341*	0.3155	*0.465*
Skilled manual	0.2165	*0.412*	0.0479	*0.214*
Partly skilled	0.0977	*0.297*	0.1476	*0.355*
Number of hours worked	38.4937	*7.368*	30.3466	*9.939*
Household income and housing situation				
Log household income (all others)	7.3527	*0.628*	7.7552	*0.546*
Own home outright [#]	0.1263	*0.332*	0.1263	*0.332*
Mortgage no negative equity [#]	0.6158	*0.486*	0.6158	*0.486*
Mortgage and negative equity [#]	0.0388	*0.193*	0.0388	*0.193*
Years in current home [#]	5.1628	*7.274*	5.1628	*7.274*
Number of cars in household [#]	1.5454	*0.750*	1.5454	*0.750*
Number of rooms in home per head [#]	2.3397	*0.774*	2.3397	*0.774*
Advice available locally	0.2811	*0.450*	0.3465	*0.476*
Talk regularly to neighbours	0.3252	*0.468*	0.3402	*0.474*
Belongs to neighbourhood	0.4003	*0.490*	0.3937	*0.486*
Plans to stay in neighbourhood	0.4557	*0.498*	0.4699	*0.499*
Area level controls & local labour market conditions				
Urban area [$]	0.8449	*0.362*	0.8449	*0.362*
Log crime rate [$]	1.8844	*0.768*	1.8844	*0.768*
Log number of food stores/population [$]	–0.3933	*0.499*	–0.3933	*0.499*
Log number of employment centres/population [$]	–0.1659	*0.626*	–0.1659	*0.626*
Log number of secondary schools/population [$]	0.5239	*0.859*	0.5239	*0.859*

(continued)

Table 1. Continued

	Male		Female	
	Mean	STD	Mean	STD
Log number of hospitals/population $	–0.9481	*3.623*	–0.9481	*3.623*
Log unemployment rate %	2.1444	*0.378*	2.1444	*0.378*
Log female relative wage %	–0.2422	*0.086*	–0.2422	*0.086*
Number of couples	5,908		5,908	
Number of observations	11,816			

Notes: (i) # denotes household (couple) specific variable; (ii) $ denotes a LSOA specific variable; (iii) % denotes a LAD specific variable.

women 2 minutes.[20] These effects equate to around 3 hours 17 minutes per year for men and 1 hour 45 minutes for women.[21] This finding is supportive of the view that women's employment opportunities are less geographically concentrated than men's (see for example MacDonald, 1999).[22,23]

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-aged 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 (–0.172) implies that they commute for approximately 3 minutes less each way per day, compared to women who do not have primary school–aged children. For both men and women higher levels of education are associated with longer commuting times, and the gradient is steeper for men. In terms of ethnicity both black men and women are found to commute farther than other ethnic groups.

Looking now at labour market characteristics of individuals, first, 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 2.6% increase in commuting time. This equal sensitivity of commuting time to income for men and women is in direct opposition to the argument that men commute farther than women because their incomes increase more as a

20 For example, considering a 10% increase in unemployment the effect on male commuting time is calculated as follows: $0.0019 \times 220 \times 10 = 4.2$ minutes, where 220 minutes is the mean commute time for males.

21 These calculations assume 46 working weeks per year.

22 There is considerable variation across LADs in terms of the percentage change in the unemployment rate. For example, the Forest of Dean, Crawley, and Guildford experienced a doubling of the unemployment rate, which would suggest that male (female) commuting time in these LADs increased by 42 (23) minutes per week.

23 We have also experimented with using the unemployment-to-vacancy ratio as the measure of local labour market conditions (as used for example by van Ommeren, 2000), and results are very similar to those for the unemployment rate; as hypothesized, 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.

Table 2. Panel seemingly unrelated regression models of couples' commuting time – unemployment

	Log commuting time			
	Male		Female	
	Coef.	*t*-stat	Coef.	*t*-stat
Individual demographics				
Aged 16–24	0.0355	*(0.46)*	0.2391	*(4.65)*
Aged 25–34	0.0730	*(2.22)*	0.3467	*(7.87)*
Aged 35–44	0.0658	*(2.49)*	0.2349	*(5.12)*
Aged 45–54	0.0397	*(0.92)*	0.2379	*(5.73)*
Children 0–2 years old	0.0419	*(1.26)*	–0.0122	*(0.25)*
Children 3–4 years old	–0.0803	*(1.10)*	0.0172	*(0.56)*
Children 5–11 years old	–0.0326	*(1.01)*	–0.1720	*(5.67)*
Children 12–15 years old	–0.0257	*(0.67)*	–0.1580	*(5.49)*
GCSE	0.1684	*(3.86)*	0.0357	*(1.94)*
A level	0.2452	*(5.98)*	0.0716	*(1.93)*
Other qualification	0.2498	*(3.98)*	0.1288	*(2.66)*
Degree	0.2736	*(5.21)*	0.1722	*(4.41)*
White	–0.0841	*(0.18)*	–0.0533	*(1.47)*
Black	0.1644	*(1.92)*	0.1556	*(2.13)*
Asian	–0.0208	*(0.28)*	–0.1016	*(1.70)*
Individual labour market characteristics				
Log labour income per hour	0.2599	*(10.78)*	0.2576	*(14.18)*
Professional	0.0635	*(0.09)*	0.2830	*(4.82)*
Managerial & technical	–0.0425	*(0.74)*	0.1723	*(3.59)*
Skilled non-manual	0.0245	*(0.40)*	0.2912	*(6.11)*
Skilled manual	–0.1973	*(3.50)*	0.0872	*(1.49)*
Partly skilled	–0.1351	*(2.20)*	0.0342	*(0.69)*
Number of hours worked	0.0131	*(8.50)*	0.0100	*(9.74)*
Inverse Mills ratio	0.1952	*(2.26)*	0.0485	*(2.55)*
Household income and housing situation				
Log household income (all others)	0.1279	*(8.61)*	0.1737	*(12.90)*
Own home outright	0.0864	*(2.82)*	0.0348	*(0.94)*
Mortgage no negative equity	0.0864	*(2.40)*	0.0590	*(0.23)*
Mortgage and negative equity	0.1531	*(2.44)*	0.1494	*(3.03)*
Years in current home	–0.0037	*(1.95)*	–0.0035	*(2.16)*
Number of cars in household	–0.0277	*(1.64)*	–0.0783	*(5.75)*
Number of rooms in home per head	0.0317	*(1.71)*	0.0416	*(2.88)*
Advice available locally	–0.0880	*(3.03)*	–0.0557	*(2.52)*
Talk regularly to neighbours	0.0260	*(0.89)*	0.0181	*(0.72)*
Belongs to neighbourhood	–0.0823	*(2.72)*	0.0034	*(0.03)*
Plans to stay in neighbourhood	0.0055	*(0.21)*	–0.0549	*(2.49)*
Area level controls & local labour market conditions				
Urban area	0.0652	*(1.30)*	0.0262	*(1.87)*
Log crime rate	0.0363	*(2.33)*	0.0074	*(0.60)*
Log number of food stores/population	–0.0284	*(0.57)*	–0.0070	*(0.17)*

(continued)

Table 2. Continued

	Log commuting time			
	Male		Female	
	Coef.	*t*-stat	Coef.	*t*-stat
Area level controls & local labour market conditions				
Log number of employment centres/population	–0.1358	*(3.77)*	–0.0787	*(2.79)*
Log number of secondary schools/population	0.0328	*(1.43)*	–0.0057	*(0.31)*
Log number of hospitals/population	–0.0119	*(1.91)*	0.0086	*(1.77)*
Log unemployment rate	0.1879	*(5.67)*	0.1213	*(4.72)*
ρ; p-value	0.2198; $p = [0.000]$			
Number of observations (N)	11,816 [m = 5,908: f = 5,908]			

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.

result of commuting further.[24] One explanation may be that we have a relatively highly educated sample, and the commuting penalty for women has been shown to be ameliorated for those with high levels of human capital (Clark and Wang, 2005). 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. Men in skilled manual and partly skilled occupations are found to commute for less time than those in other occupations, whilst for women, those in professional, managerial, 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 3 (2) 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 positive effect for both men and women. Compared to renting, homeowners commute farther and the effects are largest for those with negative equity, where both men and women in such households commute approximately 30 minutes more per week; this reflects rigidities in the housing market. However, length of time in the current home is associated with a small decrement in commuting time for both men and women. For women the number of cars in the household is associated with shorter

24 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.

commuting times. There is some evidence that those who like their neighbourhood and feel more integrated into it commute for less time; for both sexes, those who feel that advice is available locally commute for less, and males (females) who feel that they belong to the neighbourhood (plan to stay in the neighbourhood) commute for less time. 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 generally 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 a different measure. Whereas Table 2 presented results using the local unemployment rate, in Table 3 we attempt to account for the gendered nature of labour markets, and proxy the 'female friendliness' of the local labour market by considering the relative female wage rate. 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. The relative female wage rate has no effect on the commute times of men, but, as hypothesized, for women it is inversely associated with commute times.[25] A 10% increase in the local female relative wage rate is associated with a 3.2% decrease in commuting time for women, again an inelastic association consistent with that found from unemployment. Evaluated at the mean, this equates to women travelling 6 minutes less per week.[26]

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 to 6 we only report the coefficients on the local labour market measure and the interaction term, i.e. the π's and ϕ's from eq. (1); the other controls are as reported in Table 2. The first column of Table 4 shows 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 negative 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 0.43-minute increase in weekly commute times for men (more or less the same as the average for all male commuters), and a 0.17-minute increase for women (compared to a 0.23-minute average effect for all female commuters). 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

25 We have also experimented with an alternative proxy for the 'female friendliness' of the local labour market via the relative growth (over the past 12 months) in female employment. This variable is insignificant for men, but, as hypothesized (and consistent with the relative wage variable), for women it is negatively associated with commute times.

26 Calculated as follows: $0.0032 \times 190 \times 10 = 6$ minutes.

Table 3. Panel seemingly unrelated regression models of couples' commuting time – relative wage

	Log commuting time			
	Male		Female	
Area level controls & local labour market conditions				
Urban area	0.1010	*(1.98)*	0.0399	*(1.99)*
Log crime rate	0.0404	*(2.59)*	0.0109	*(0.88)*
Log number of food stores/population	0.0297	*(0.60)*	–0.0045	*(0.01)*
Log number of employment centres/population	–0.1479	*(4.08)*	–0.0816	*(2.89)*
Log number of secondary schools/population	0.0395	*(1.71)*	–0.0040	*(0.22)*
Log number of hospitals/population	–0.0113	*(1.81)*	0.0090	*(1.84)*
Log female relative wage	–0.0525	*(0.41)*	–0.3207	*(5.17)*
ρ; p-value	0.2238; $p = [0.000]$			
Number of observations (N)	11,816 [m = 5,908 : f = 5,908]			

Notes: (i) control variables 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	0.1968	*(5.90)*	0.1350	*(5.21)*	0.1940	*(5.70)*	0.1118	*(4.30)*
Log unemployment rate × S	–0.0324	*(1.53)*	–0.0458	*(4.51)*	–0.0178	*(2.88)*	0.0742	*(4.70)*
Panel B: Female relative wage								
Log female relative wage	–0.2659	*(1.97)*	–0.2360	*(5.97)*	–0.0718	*(0.55)*	–0.2736	*(4.70)*
Log female relative wage × S	0.3537	*(4.17)*	0.2451	*(2.83)*	0.1771	*(0.98)*	–0.2859	*(1.42)*

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.

the wage rate and commuting by car cancel out, suggesting that if a woman can commute by car her commute time is less affected by the gendered nature of the local labour market.

The second set of columns in Table 4 reports interactions where the sub-group of interest is whether the couple have moved home within the past 12 months. We hypothesize 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 are associated with longer commute times for both sexes, but for both men and women there is evidence that these effects are confounded for recent movers. In particular, for recent movers the sensitivity of commute time to local labour market conditions is

Table 5. Panel seemingly unrelated regression models of couples commuting time – change of job; change of job and moved house

	(1) Change of job (employer)				(2) Moved home and change of job			
	Male		Female		Male		Female	
	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat	Coef.	*t*-stat
Panel A: Unemployment rate								
Log unemployment rate	0.1859	*(5.59)*	0.1253	*(4.84)*	0.1884	*(5.64)*	0.1194	*(4.62)*
Log unemployment rate × S	0.0157	*(2.02)*	–0.0235	*(2.05)*	–0.0082	*(2.21)*	0.0442	*(1.47)*
Panel B: Female relative wage								
Log female relative wage	–0.0399	*(0.31)*	–0.4575	*(5.49)*	–0.0570	*(0.44)*	–0.4157	*(5.12)*
Log female relative wage × S	–0.1126	*(0.82)*	0.2021	*(2.84)*	0.2285	*(0.59)*	–0.2633	*(0.88)*
Panel C: Lagged unemployment rate								
Log unemployment rate$_{[t-1]}$	0.2044	*(4.12)*	0.1947	*(5.07)*	0.2097	*(4.23)*	0.1984	*(5.11)*
Log unemployment rate$_{[t-1]}$ × S	0.0532	*(2.55)*	0.0411	*(2.51)*	–0.0574	*(1.97)*	0.1654	*(3.49)*

Notes: (i) control variables as in Table 2; (ii) in column 1, S is a binary indicator equal to unity if either the male or the female changed job last year, i.e. moved to a different firm (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 past 12 months and one of them also changed job last year.

reduced (increased) for males (females). This may support the view that home moves are chosen to suit the male earner over the female. For the female relative wage there are no significant differences for recent movers.

In Table 5 we consider whether an individual changed job in the past 12 months, i.e. specifically moved to a different firm and employer; these results are shown in the first column. We do not jointly model decisions about home and job location, rather it is assumed that the home location is inflexible and consequently the decision lies in the job location, which is consistent with Rabe (2011), who found that dual-earner couples are less likely to migrate. However, we are able to examine those couples who moved home and where either the male and/or female experienced a change of employer, which constituents around 2.5% of our sample of couples. The results are shown in the second column of Table 5. The role of the local labour market is potentially important in this context, where it is conceivable that the decision about employment and home location is a joint one.

The first column of Table 5 reveals differential effects of job change by gender. In particular, males who moved firm during the past 12 months are more sensitive to local unemployment rates whilst the opposite is true for females. When we consider those who moved job and residence, the unemployment elasticity for males is reduced, which is driven by the home mover effect (as found in Table 4). In terms of the relative wage, there is no effect on male commuting time but the negative effect of a female friendly labour market for women is reduced for job changers. In the final part of Table 5, Panel C, we account for labour market conditions at the time the job search was likely to have taken place by replacing the contemporaneous local unemployment rate with the unemployment rate in the previous year. Clearly, for both males and females the elasticity of commuting time to lagged unemployment is higher and is extenuated even further for those individuals who

Table 6. 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	0.1762	*(5.04)*	0.1319	*(4.99)*	0.2151	*(6.01)*	0.0927	*(3.18)*
Log unemployment rate × S1	0.0190	*(2.28)*	0.0229	*(2.42)*	0.0272	*(1.68)*	0.0294	*(2.38)*
Log unemployment rate × S2	–		–		0.0786	*(2.58)*	0.0430	*(2.87)*
Panel B: Female relative wage								
Log female relative wage	0.0422	*(0.27)*	–0.4942	*(4.82)*	–0.2060	*(1.65)*	–0.1493	*(1.89)*
Log female relative wage × S1	–0.0211	*(0.16)*	–0.0895	*(1.90)*	0.2065	*(1.26)*	–0.2035	*(2.96)*
Log female relative wage × S2	–		–		–0.4016	*(1.88)*	–0.6917	*(3.96)*

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).

changed employment during the past 12 months (this is particularly noticeable for females). For couples who moved residence and where a member of the couple also experienced a change of employer, i.e. moved to a different firm, the effects are much higher for females and the sensitivity of male commuting time to local labour market conditions in the previous year is moderated. This adds further support to the notion that simultaneous home moves and job changes are chosen to suit the male earner.

Two further sub-groups are considered in Table 6. First, we consider homeowners as opposed to people who rent their home. We hypothesize 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. For the gendered measure of local labour market conditions, these results suggest that additional 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 increase both male and female commute times across each subgroup; however, the effects are at their largest when men earn either the majority or minority of household income—rather than in those households where income shares are more equal. The relative female wage rate in the local labour markets is only associated with reduced female commute times. These results together provide some evidence that household income share does matter in commute decisions, and the higher a spouse's 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.

5. Conclusions

While the job search literature has increasingly recognized 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 0.42 minutes more per week on average for every 1% increase in the local unemployment rate, whereas for women this is 0.23 minutes. Further, the sensitivity of women's commute times to local unemployment increases the greater their share of household income. In addition, the more conducive the local labour market is to female employment, the less time women spend commuting, whereas on average the 'female friendliness' of the local labour market has no effect on male commute times. Other results confirm the findings from a number of other studies; women commute for less time if they have school-aged 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 well-being effects. There are also implications for housing and labour market 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. This finding supplements that of Andrews *et al.* (2011), who have revealed a high degree of residential inertia in Britain, especially among homeowners, and this clearly reduces labour market flexibility, despite the apparent willingness to accept longer commute times.

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Appendix

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

(continued)

Appendix. Continued

Variable name	Definition
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)
Advice available locally	Dummy variable = 1 if either strongly agrees or agrees that advice is obtainable locally
Talk regularly to neighbours	Dummy variable = 1 if either strongly agrees or agrees that talks regularly to neighbours
Belongs to neighbourhood	Dummy variable = 1 if either strongly agrees or agrees that belongs to neighbourhood
Plans to stay in 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: food stores employment centres secondary schools hospitals	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
Local labour market controls	All variables from NOMIS https://www.nomisweb.co.uk/
unemployment rate	Natural log of the unemployment rate in LAD
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.