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Willingness to accept longer commutes for better salaries: understanding the differences within and between couples

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ABSTRACT:

This paper reports on an analysis aiming to understand differences across individual people in their willingness to accept increased commuting time in return for higher salary, using Hierarchical Bayes (HB) analysis of a dataset collected in Sweden. In addition to differences across key socio-demographic groups, we also study the differences between valuations obtained in choices where respondents are faced only with their own commute journeys and those where they make decisions jointly for themselves and their partner. The analysis has revealed a very rich set of findings. We observe major differences between men and women in their preferences. We also note how these preferences change when respondents are faced with choices that affect both themselves and their partner. Finally, there are major differences between respondents' own preferences and those assigned to them by their partner in the joint choices. An extensive regression analysis has highlighted a diverse set of drivers for these differences, be they socio-demographics, attitudes, or current commute circumstances. The sheer richness of our results is a reflection of the benefits of a HB approach in the present context.

KEYWORDS: group choice, joint choice, hierarchical bayes, regression, preference heterogeneity, commute, willingness to accept

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1. *Transportation*, 39(1), 19–31.

1. Introduction

Commuting forms a key component of travel behaviour. According to recently published results from the Sydney Household Travel Survey (*1*), 23.3% of all trips made by individuals in Sydney were for commuting or work related purposes, representing almost a quarter of the 16.5 million trips made on weekdays in 2011/12. Additionally, in comparing the average length of trips made by the various categorisations of trip types, commuters travel significantly further distances than any other trip. In the UK, a recent report by the Office for National Statistics examined the relationship between commuting to work and personal well-being (*2*). They found that, ceteris paribus, commuters have lower life satisfaction, a lower sense that their daily activities are worthwhile, lower levels of happiness and higher anxiety on average than non-commuters. The worst effects of commuting on personal well-being were associated with journey times lasting between 61 and 90 minutes. These findings provide ongoing support for previous work that discovered longer commutes are positively correlated with high blood pressure, higher back pains and job satisfaction (*3*) as well as chronic stress and fatigue symptoms which can induce cardiovascular abnormalities and dysfunctions related to the inset of heart disease (*4*).

As both the developed and developing world experience increased urbanisation it is conceivable higher city based populations will contribute significantly to congestion on the roads and crowding on public transportation, and potentially bring into sharper focus the commute decisions of individuals and the recompense required in order to engage in varying types of commuting behaviour. While there is some evidence that telecommuting can decrease the distances travelled (*5*), the reductions are only small (0.7%). Indeed, the well-known phenomenon of Marchetti's Constant, seems to indicate that there is an innate human preference for some degree of travel for commuting each day, which is approximately one hour. A study by IBM (*6*) provides support for this, with the average one-way commute across the range of international cities being 32 minutes (with Moscow at 42 minutes and New Delhi at 41 minutes having the longest commute). In Australia, the average commute times are remarkably similar despite the differing populations and densities of capital cities; the average time ranged from a low of 27 minutes in Perth to a high of 35 minutes in Sydney.

Whilst the average commute time might be remarkably constant over time and geographic location, there is a distribution of individuals around that mean who are more or less willing to commute. Not only does this willingness vary across the population, but individuals themselves may also change over time. It has been found that 20% of workers change job or residence each year (*7*). When workers change jobs and/or home or both it is found that just as many increase their commute time as decrease it (*8*). In a small sample study of workers in Bristol in the UK, it was found that half of those surveyed would be prepared to commute further for a job they wanted, but only a small percentage would be prepared to move house to do so (*9*). Adding further complexity to this situation is the growth in dual-income households, for example the between 1996 and 2006, the number of dual-income families in America increased 31% (*10*). Such households have complex trades to make with respect to the balancing of household activities (both social and domestic) as well as the preferences of multiple income earning individuals with respect to where to live and thus how far to travel for work. In responding to a change in employment location for one of the household members, many households choose to avoid moving, to avoid impacting children and the career of the partner whose job has not changed, typically resulting in longer commutes for the partner changing job (*11*). There is some evidence that the affected partner views this sacrifice as a gift to their partner (*12*).

Given the volume of trips made for commuting purposes, understanding the valuations attached to such trips is important for a range of policy and economic reasons. Lyons and Chatterjee (*13*) clearly state that “The commute in connecting the domestic and employment spheres of people’s lives is thus

a significant feature of life course decisions; notably residential and job location choices", concluding that such decisions significantly impact housing and employment markets. In attempting to understand such choices, the residential and job location choice literature is dominated by models considering a single decision-maker in each household (see (*14*) for a board overview of the extant literature), however a small but growing field of research is attempting to understand the behaviour of households. For example, it was found that with respect to residential location, preferences between family members differ substantially and group members are largely unaware of the direction and extent of these differences (*15*). The household attitude to inequalities in utilities among the household members when choosing a residential location has also been explored (*16*).

The literature has also examined the role of households in travel activity patterns (which incorporate commuting trips). For example, choices of household activity, assignment of activities and cars to household members, tour generation and assignment affect by individual and household characteristics (*17*). It was found that individual activity pattern influenced greatly by patterns of others in the household (*18*) and that different activities are more likely to be completed jointly on different days or by different household members (*19*). With respect to who influences the decisions made by households, husbands exert more influence over the allocation of household activities (*20*). It should also be noted that the importance of choices which are a function of interacting decision makers as also been explored in the context of other transport environments such as holiday choice (*21*,*22*) and automobile choice (*23*).

These aforementioned studies examine either the outcomes of household decisions or the way that individuals within the household interact in order to arrive at a consensus choice. While this is crucial to our understanding of transport related behaviour, of equal importance is understanding why individuals might hold the specific preferences they exhibit and how these preferences might change in response to the presence of other people. This is particularly true in the context of choices affecting the commute of individuals within a household, given the social and health implications of these trips and the important economic function they serve. A better understanding of commuting preferences will also allow transport planners to better manage these trips. Thus, the objective of this paper is to provide an example of how researchers and practitioners might seek to understand how preferences are formed, and how that formation might change when the individual is asked to consider their partner in addition to themselves when making a decision. Specifically, we explore the willingness of couples to accept longer commuting times for an increased salary. To do this we employ a Hierarchical Bayes model to estimate individual level sensitivities from stated choice (SC) data collected in Sweden, thus allowing for inferences about a specific respondent's preferences.

The paper is structured as follows. In the next section, we present the data used for our analysis. This is followed in Section 3 by a brief overview of the modelling methodology. Section 4 describes the results of the empirical modelling. Finally, Section 5 provides discussion and concluding remarks.

2. Survey data

The case study used in this paper is an examination of salary and travel time trade-offs in the Stockholm region of Sweden. The sample consisted of dyadic households, wherein each member of the household was required to make decisions independently of the other member.

Within the experiment, two different scenarios were administered. The first required respondents to consider the hypothetical scenario that their workplace would be moved to a location that would imply a longer commuting time and that this disutility would be compensated by a higher monthly net wage. All other characteristics, including commuting cost, commuting mode, other work characteristics, and housing characteristics, were assumed to remain unchanged. Two levels of each attribute were used in all possible combinations and always pivoted around the respondents' present situation. These levels were an additional 10 minutes or an additional 25 minutes per one-way commuting trip and 500 SEK and 1,000 SEK in net wage per month (at the time of the survey 11 SEK was equal to approximately 1 EUR).

In the second stated choice experiment, the respondents were given choice scenarios where four attributes in each alternative were also varied around the current reference situation, under the assumption that the workplace of themselves *and* their partners was relocated. Thus, the attribute varied in this experiment were the respondents own commuting time and wage, as per the previous experiment, but also the travel time and salary of their partner was also increased.

A total of 1,179 household couples were included in the sample (creating a pool of 2,358 total respondents). Each respondent was given four scenarios to complete in the first game where only their own commute and salary was varied, and an additional four or five tasks in the second game, depending on the design which was used, where both their own and their partners attributes were changed. It should be noted that men and women within the same household received different versions of the survey. This provided a total of 20.041 choice observations. While the dataset contained 1,179 households, the total number of usable responses varied slightly around this number based on the completeness of the survey data collected.

A range of contextual information was also captured in addition to the travel times and salaries of each member of the dyad. This included age, driver's license, distance driven by the individual in a year, which partner drives most often when car-sharing, level of education, employment status, number of hours worked per week, flexibility of the work schedule, and attitudes about whether respondents agreed if the car was used by the person who needed it most, that car user decisions are made equally, that housework is divided equally and that women are safer drivers. These variables were used to explain variations in the willingness of respondents to spend more time commuting in order to earn a higher salary.

For background information on the data, see (*24*) while a recent application using the data is described in (*25*).

3. Methodology

To gain a deeper understanding of preferences at the individual levels, we used Hierarchical Bayes (HB) estimation of Mixed Logit models. For a detailed discussion of Bayesian techniques for Mixed Logit, see (*26*). As with a standard Mixed Logit model, a sample level assumption is made about the distribution of sensitivities across respondents, but priors are additionally provided for estimation. HB estimation produces conditional (posterior) distributions of sensitivities at the individual respondent level. These are analogous to conditional distributions obtained from Mixed Logit using classical estimation (cf. *27*).

In the present analysis, we are interested in understanding the differences across individuals in their willingness-to-accept (WTA) increases in commuting time in return for increases in salary. This WTA is clearly given by the ratio of two marginal sensitivities, say:

$$WTA = -\beta_T/\beta_S \qquad [1]$$

obtained from a model with a utility function for alternative *i*, respondent *n* and choice task *t* given by:

$$U_{int} = \beta_T TT_{int} + \beta_S S_{int}, \qquad [2]$$

where TT_{int} and S_{int} give the travel time and salary for alternative *i* as shown to respondent *n* in choice task *t*.

With β_T and β_S both following random distributions across respondents in [2], the WTA in [1] is given by a ratio of two random coefficients. HB models produce such distributions at the individual level, which include as the mean the most likely value for the coefficient for a given respondent. Simply using these most likely values in Equation [1] would however equate to a ratio of means approach, rather than a mean of ratios. To avoid this issue, we instead parameterise our model directly in WTA space, rewriting [2] as:

$$U_{int} = \beta_T TT_{int} - \beta_T \beta_{WTA} S_{int}, \qquad [3]$$

where it can easily be seen that [2] and [3] are equivalent when β_{WTA}=WTA as in Equation [1]. This in turn means that the posterior means at the individual level from the distribution of β_{WTA} can be used as the most likely value of the WTA for a given respondent. We experimented with various different distributional assumptions for β_T and β_{WTA} but settled on Normal distributions as giving the best performance in the end. No problems with sign violations for the posterior means of either β_T or β_{WTA} were observed, and the issue of division by a normally distributed random coefficients (cf. *25*) does not arise as the division in [1] is not required when working directly in WTA space.

4. Results

4.1 Exploring the Willingness to Accept Values

The HB estimation procedure resulted in individual level mean willingness-to-accept values (WTAs) for both men (MO) and women (FO) in the individual choice games, but also the individual WTAs when asked to consider changes to their partners commute and salary as well as their own (FOG: female WTAs in the group choice and MOG: female WTAs in the group choice). On average, females were willing to travel an additional 11.8 minutes for an increase in salary by 1,000SEK, a significantly higher WTA than males who were prepared to travel 10.6 minutes longer ($t = 5.936$). As can be seen in Figure 1, females exhibit a much larger variation in WTAs. Both distributions appear to be bimodal though a greater proportion of woman are prepared to accept much longer trips for salary increases than males, the long right tail for females indicating that a sizeable proportion have quite high WTAs.

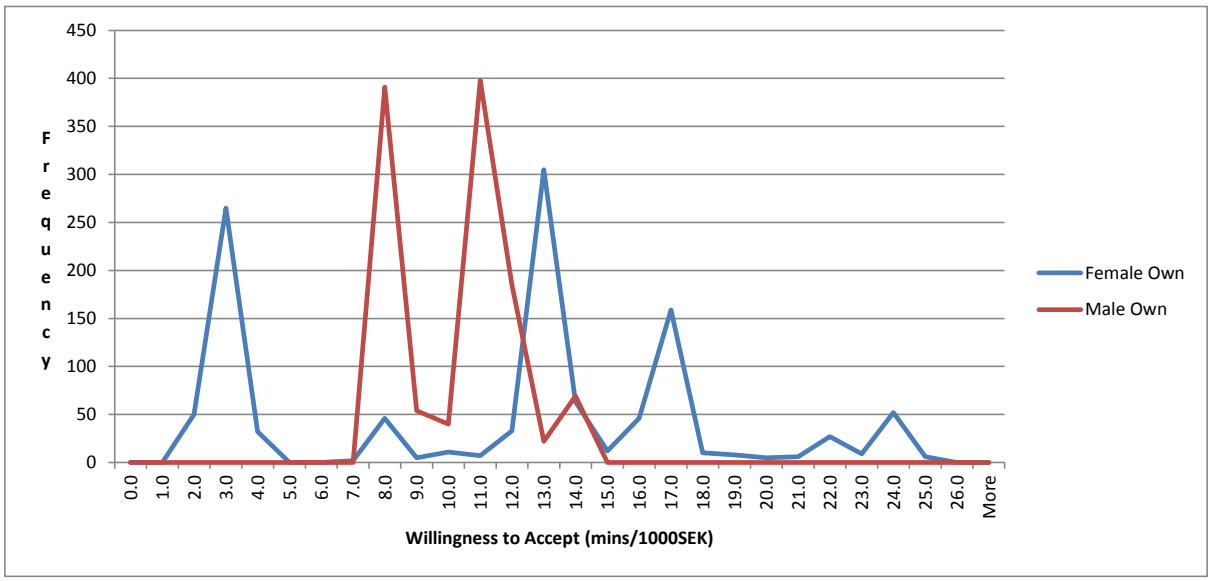

Figure 1: Distribution of Female and Male Own WTAs

When comparing the distributions of WTAs in the joint task (where the respondent had to consider the changes to their partner as well as their own situation, the WTAs were much smaller. On average women would travel 7.7 minutes, compared to 6.3 minutes for men, with this difference being significant ($t = 35.063$). Interestingly, both males and females decrease their WTA by the same amount (approximately 4 minutes with the difference between how much males and females reduce their WTA being insignificant), such that the differences between the individual WTAs of between males and females (1.174 minutes) and individual WTAs in the joint task (1.413) remain the no different ($t = 1.127$). That is to say, men and women have different individual preferences, but both genders revise their WTAs downwards in choices where their partner is affected by a similar amount, such that the relative difference is maintained.

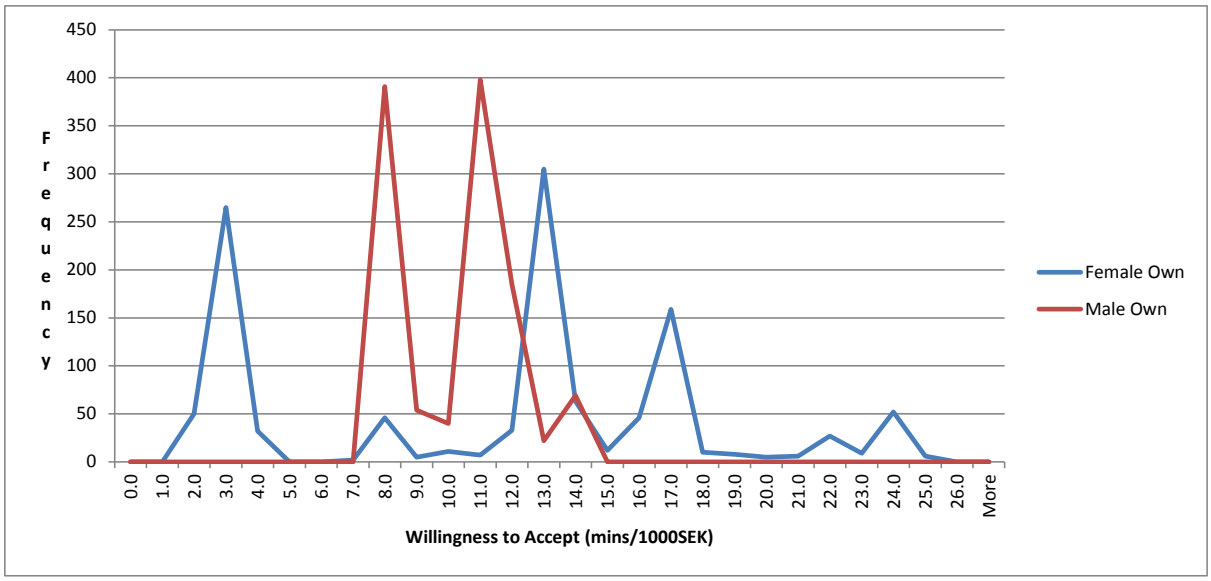

Figure 2: Distribution of Female and Male Own WTAs in the Joint Task

Another interesting finding highlighted in Figure 3 is that while men, on average, reduce their WTA by 4 minutes, every male revises their WTA downward when moving from strictly choices about their own commute to choices where the commute of the partner is also affected. This is in contrast to females. While the majority of women also revise their WTA down when asked to make choices where their partner is affect, 30% of the sample *increased* their WTA. In other words, they made choices that indicated they themselves would be prepared to travel further for an increased salary. Again, the distribution for differences between the two games for females is distinctly bimodal indicating two very different types of behaviours, with females in general exhibiting a wider range of different behaviours than males when it comes to adjusting their own WTA. Correlation analysis reveals a significant and positive relationship ($r = 0.523$) between the WTAs of males in the individual game and the joint game, indicating that men who have a higher WTA as individuals, also have a higher personal WTA when also considering changes to their partners commute. This is also true for females though the relationship, whilst still significant, is weaker ($r = 0.252$).

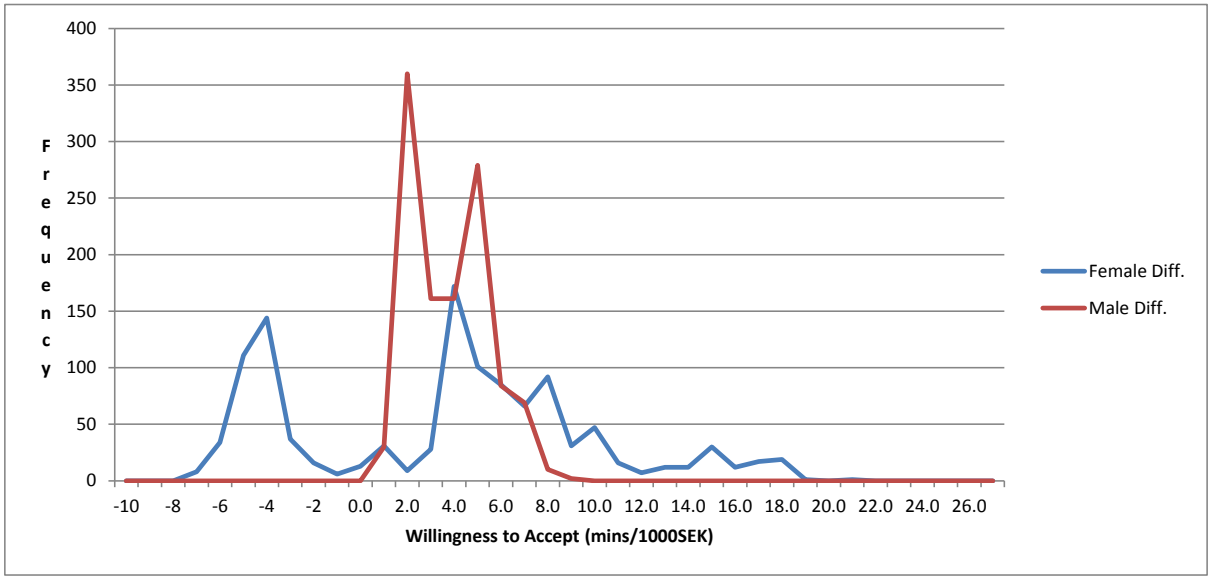

Figure 3: Distribution of Differences in WTAs (Own compared to Own in Joint)

In the stated preference tasks where respondents make a choice in the context of changes to their own commute and salary as well as their partner's, it is implied that they assign their partner a WTA value. Here, two interpretations arise. If they make a choice where their partner will have to travel further for an increased salary, they are either assuming a willingness on behalf of that person to engage in that behaviour, or they show their own valuation for their partner's travel time and salary. In practice, a mixture of the two may arise. Independently of the interpretation, there are thusly four total comparisons of interest; the WTA that females assign to their partner (FP) and their partner's actual WTA as an individual decision and a decision in the joint task (MO and MOG). The same is also true for males; the WTA assigned to their partner (MP) and their partner's actual WTAs (FO and FOG).

In all instances, the WTA each gender assigns to their partner is lower than either the WTA expressed by their partner in individual decisions or expressed by their partner in choices made in the joint task. Indeed, every respondent in the sample makes choices that imply a lower WTA for their partner than for what their partner actually exhibits. With the own WTA being lower in the joint tasks than single tasks, the WTAs assigned by a person to their partner are closer to the WTAs that the partner expressed in the joint task himself or herself. On average, males understate the WTA of their partners by 6.6 minutes compared to 3.3 minutes for females. This results indicate that while both men and women assign significantly lower WTAs to their partner then the actual values ($t = 193.673$ and 137.023 respectively), females give WTAs closer to those revealed by the respondents themselves ($t = 79.990$). There is a very significant and very strong positive correlation between the WTAs males expresses in the joint task and the WTA they assign to their partner ($r = 0.955$), indicating that the higher a male's WTA, the higher the WTA they assign to their partner. On the other hand, almost the exact opposite is true for females. The higher a female's own WTA in the joint task, the lower the WTA they assign to their partner ($r = -0.951$).

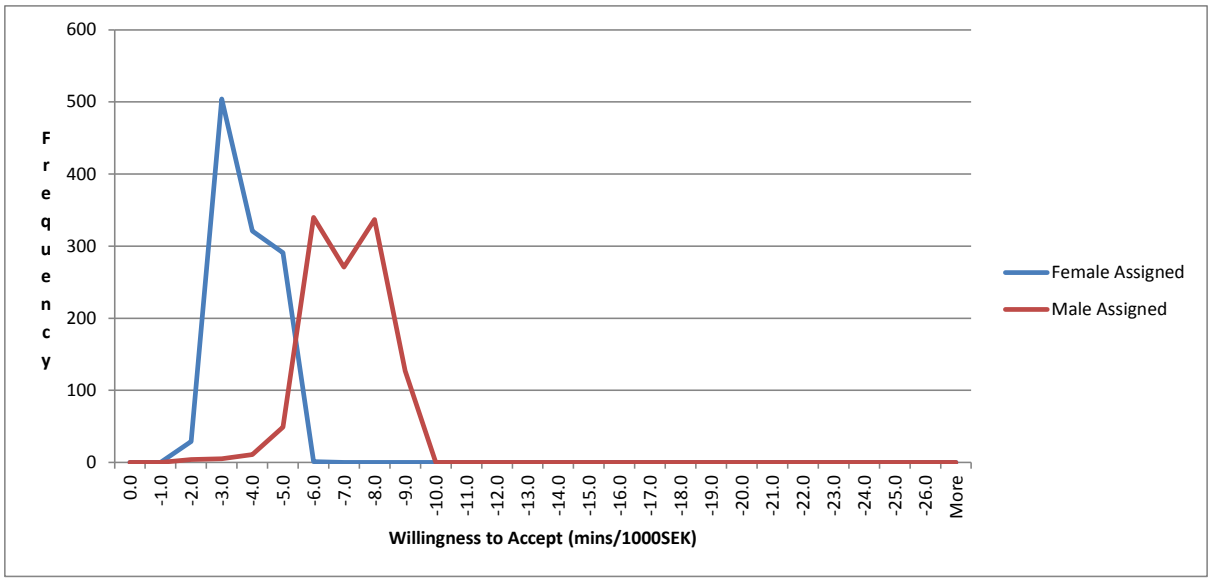

Figure 3: Distribution of Differences in Assigned WTA

(Assigned compared to Actual in Joint)

4.2 Explaining the Willingness to Accept Values

Six regression models were constructed to explain the WTA values observed in the data. The socio-demographic and attitudinal covariates introduced in Section 3 were regressed on the WTAs estimated for females and males from the choice tasks involving changes to only their own commute and salary; the female and male own WTAs estimated from the joint task and the WTA's that females and males assign to their partners.

Table 1: Regression Models: Female and Male Own WTA

Model	*Variable*	*Beta*	*Std. Error*	*t*
Female Own $R^2 = 0.213$ S.E Est = 5.810 F = 11.114	(Constant)	10.638	1.783	5.965
	Car Share (m) – Often Me	-2.693	0.765	-3.520
	Salary (f)	-0.00009	0.000	-4.824
	Kilometres Driven / Yr (f)	.000	0.000	-4.395
	Salary (m)	--0.00005	0.000	-4.152
	Hours Worked / Wk (f)	.123	0.033	3.743
	Car Share (f) – Often Partner	1.664	0.659	2.524
	Travel Time (m)	-.038	0.010	-3.638
	Work Flex. (f) – Other	6.046	1.731	3.493
	Kilometres Driven / Yr (m)	0.00006	0.000	3.295
	Distance (f) – Never	1.440	0.482	2.989
	Education (f) – Primary School	-3.038	0.937	-3.242
	Days / Yr Commute Made (f)	.226	0.077	2.940
	Car Share (m) – Always Me	-1.803	0.771	-2.338
	Housework Equally Divided (f)	-.442	0.185	-2.396
	Car Share (f) – Always Me	3.933	1.628	2.416
	Car Share (f) – Often Me	2.388	1.051	2.273
	Car Decisions Equal (f)	.447	0.228	1.960
	Work Flex. (f) – Fixed	.891	0.451	1.974
	Work Flex. (f) – Shift	1.303	0.677	1.926
	Women Safer Drivers (f)	.316	0.172	1.836
Male Own $R^2 = 0.212$ S.E Est = 1.636 F = 12.799	(Constant)	12.206	0.686	17.784
	Salary (m)	-0.00003	0.000	-8.267
	Hours Worked / Wk (f)	.033	0.009	3.516
	Car Share (f) – Often Partner	.401	0.126	3.176
	Age (f)	-.028	0.015	-1.855
	Years held License (m)	.022	0.010	2.202
	Work Flex. (m) – Shift	.712	0.243	2.926
	Years held License (f)	.022	0.011	2.026
	Car Share (f) – Often Me	.722	0.282	2.556
	Housework Equally Divided (f)	-.123	0.049	-2.515
	Car Share (m) – Always Partner	1.618	0.661	2.446
	Salary (f)	-0.00001	0.000	-2.020
	Hours Worked / Wk (m)	-.022	0.009	-2.348
	Days / Wk Commute Made (f)	.299	0.129	2.313
	Work Flex. (m) – Fixed	.278	0.135	2.061
	Work Flex. (f) – Shift	.394	0.183	2.157
	Women Safer Drivers (m)	-.105	0.048	-2.173
	Days / Mth Commute Made (m)	-.113	0.056	-2.011

Table 1 provides the results from the regression on the respondents' own WTA, where the coefficients have been ordered based on relative impact on the dependent variable (largest to smallest). With respect to the WTAs of females, the biggest relative impacts have a negative effect; women whose partner states that he is the person who drives *most often* when car-sharing, women on higher salaries (overall, not necessarily relative to their partner), women who drive more kilometres per annum and women whose partners have higher salaries, have lower WTAs. That is to say, they would be less willing to commute further distances for an increase in salary. Women who work more hours per week

have a higher willingness to travel further for pay increases. Females whose partner earns a higher income are less willing to commute for increases in salary, however the more their partner drives, the greater their own WTA. A number of attitudinal variables are also significant; women who agree that housework is divided equally have a lower WTAs and women who agree that car user decisions are made equally and that women are safer drivers have a higher WTA.

Regarding the WTAs of males, like females, men with higher salaries have a lower willingness to accept increased commute times for salary increases. The more hours their partner works, the longer a man has held his driver's license and if his partner states that the male drives *most often* when car-sharing, the higher the willingness of males to commute further. Males with older partners, however, have lower WTAs as do men whose partners earn more. Again attitudes play a role in determining willingness to commute; males have a lower WTA if their partner feels that housework is divided equally and if they themselves agree with the statement that women are safer drivers.

Turning to the drivers of willingness to accept presented in Table 2, the first thing to note is the reduced number of variables that explain the values exhibited. In particular, we note that very little is explained about the drivers of the WTA of females in the joint task. At this point, it is worth repeating the finding that the WTAs in the joint task are significantly correlated with the WTAs in the individual commuting decision, but the correlation is much weaker for females than it is for males. With respect to the WTA of females, women who earn more have a lower willingness to commute in the joint task, women also have a lower willingness if their partner states that it is the woman who *always* drives when car-sharing or if they (the male) drive *most often* (compared to the base of an equal split). Women who have a license have a higher WTA in the joint task than those who do not, as do women who have shift/schedule work relative to other types of employment. The willingness to accept longer commutes for higher pay is lower for males who have a higher salary and whose partner has a higher salary. Conversely, men whose partner works more hours per week, or whose partner works part-time will accept longer commutes. Interestingly, men whose partner agrees with the statement that the car is used by the one most in need of it have higher WTAs.

Table 2: Regression Models: Female and Male Own WTA in Joint Task

Model	*Variable*	*Beta*	*Std. Error*	*t*
Female Own (Joint Task) $R^2 = 0.026$ S.E Est = 1.127 F = 6.269	(Constant)	7.851	.123	64.012
	Salary (f)	-0.00001	.000	-4.146
	Car Share (m) – Always Partner	-.421	.190	-2.214
	Have License (f)	.246	.120	2.048
	Car Share (m) – Often Me	-.144	.073	-1.972
	Work Flex. (f) – Shift	.202	.098	2.058
Male Own (Joint Task) $R^2 = 0.143$ S.E Est = 0.698 F = 12.718	(Constant)	5.698	.218	26.135
	Salary (m)	-0.00009	.000	-6.656
	Hours Worked / Wk (f)	.019	.005	3.908
	Salary (f)	-0.00009	.000	-3.974
	Employ Status – Part-time	.173	.077	2.248
	Education (m) – Primary School	-.253	.090	-2.823
	Car Use by Need (f)	.061	.022	2.854
	Education (f) – Other	.367	.136	2.702
	Employ Status – Other	1.029	.409	2.517
	Education (m) – Other	.673	.287	2.342
	Work Flex. (f) – Fixed	.096	.052	1.841
	Years held License (m)	.005	.003	1.799

Finally, Table 3 provides the results for the WTAs that the respondents assign to their partners in the joint task. Again, compared to their own personal WTAs, the number of factors that explain these assigned WTAs is greatly reduced and the ability of the data to explain the WTAs that females assign

to their partners is limited. In this instance though, the assigned WTAs are *very strongly* correlated (indeed almost perfectly correlated) with the willingness of the individual themselves to commute further distances for increased pay. In the case of females, the higher their own willingness to commute the lower the WTA they assign to their partner. The opposite is true for males, with men who have a low (high) willingness to accept longer commutes assigning similarly low (high) willingness to their partner. Females who earn more assign a higher WTA to their partner, as do women whose partner states that the female *always* drives when car-sharing. Women who have held a license for a longer time assign a lower WTA. Men with a higher salary and males whose partners have high salaries assign lower WTAs to their partners. Conversely, older males, males whose partner works more hours per week and whose partner has an education level other than primary school, high school or university assign lower WTAs to their partner. The attitudes of their partner also impacts on the willingness to commute values that men assign to their partner. Males whose partner agrees more with the statements that car user decisions are made equally and that the car is used by the one who needs it most, assign a higher WTA to their partner.

Table 3: Regression Models: Female and Male WTA Assigned to Partner

Model	*Variable*	*Beta*	*Std. Error*	*t*
Female Assign to Partner $R^2 = 0.021$ S.E Est = 0.253 F = 4.981	(Constant)	3.003	.027	113.273
	Salary (f)	0.00002	.000	3.545
	Car Share (m) – Always Partner	.117	.043	2.753
	Years held License (f)	-.057	.027	-2.115
	Car Share (m) – Often Me	.032	.016	1.938
	Education (f) – Other	.078	.043	1.822
Male Assign to Partner $R^2 = 0.140$ S.E Est = 0.299 F = 13.638	(Constant)	.840	.100	8.400
	Salary (m)	-0.00004	.000	-6.777
	Salary (f)	-0.00004	.000	-4.633
	Age (m)	.004	.001	3.300
	Hours Worked / Wk (f)	.005	.002	2.990
	Education (f) – Other	.169	.054	3.115
	Education (m) – Primary	-.102	.039	-2.638
	Car Share (f) – Always Partner	-.081	.034	-2.407
	Car Share (m) – Often Partner	-.108	.051	-2.134
	Car Decisions Equal (f)	.020	.011	1.882
	Car Use by Need (f)	.016	.010	1.699

4.3 Explaining the Differences in Willingness to Accept Values

An additional benefit of having individual specific mean WTA measures is that it enables an exploration of the differences that exist in these values. In this data, we observed significant revision of a respondent's willingness to pay in the joint task compared to what they stated in the individual task where they were considering choices where only their own commutes and salaries were varied. Table 4 provides the results of regression analysis that was conducted to uncover the drivers of these preference revisions. The dependent variable in the models presented is the difference between the WTAs in the joint task minus the WTAs in the individual task.

In the case of males, all these values were negative, indicating that WTAs in the joint task were lower than in the individual task, in other words the WTAs for men were lowered when the partner was affected by the choice. Positive coefficients in the regression model indicate smaller differences between the WTAs whereas negative coefficients indicate that the downwards revision was larger. Males on higher salaries revise their preferences less than males on lower incomes. Men who state that their partner *always* drives when they car-share and men who have a license reduce their WTA by

a larger amount. Attitudes are important in explaining how much males revise their willingness to commute; men whose partner agrees that housework is divided equally reduce their WTA less, whereas men who themselves agree with this statement revise their WTA more. Men who agree that women are safer drives revise their WTA less than those who don't. With respect to the differences exhibited in the female willingness to accept longer commutes for increases in salary, recall that it was observed that while most women similarly lower their WTA in the joint task, a sizeable minority increased their WTA. That is to say, unlike men, some females were willing to commute for longer in order to secure an increased salary in the scenarios where the commutes and salaries of their partners were affected by their choices.

Table 4: Differences in Preferences: Own in Joint Task minus Own

Model	*Variable*	*Beta*	*Std. Error*	*t*
Male (Own-Joint vs. Own) $R^2 = 0.177$ S.E Est = 1.443 F = 12.680	(Constant)	-2.464	.829	-2.974
	Salary (m)	0.00002	.000	7.422
	Car Share (m) – Always Partner	-1.648	.547	-3.011
	Years held License (m)	-1.517	.638	-2.377
	Housework Divided Equally (f)	.164	.049	3.387
	Work Flex. (f) – Shift	-.507	.153	-3.305
	Employ Status (f) Part-time	.348	.128	2.725
	Days / Mth Commute Made (m)	.140	.047	2.967
	Work Flex. (m) - Shift	-.536	.197	-2.720
	Car Share (f) – Often Me	-.650	.249	-2.609
	Work Flex. (m) – Fixed	-.281	.113	-2.482
	Housework Divided Equally (m)	-.103	.048	-2.146
	Hours Worked / Wk (f)	-.219	.101	-2.171
	Car Share (f) – Often Partner	-.237	.106	-2.230
	Women Safer Drivers (m)	.081	.040	2.012
	Year License Held (f)	-.012	.006	-1.886
Female WTA Down (Own-Joint vs. Own) $R^2 = 0.387$ S.E Est = 0.788 F = 24.968	(Constant)	4.036	.342	11.809
	Salary (f)	-0.00003	.000	-10.438
	Car Decisions Equal (m)	.208	.065	3.220
	Car Share (f) – Often Me	-.689	.285	-2.418
	Distance (f) – Always	-1.200	.573	-2.095
	Car Decisions Equal (f)	-.100	.057	-1.748
	Women Safer Drivers (m)	.071	.042	1.702
Female WTA Up (Own-Joint vs. Own) $R^2 = 0.140$ S.E Est = 3.790 F = 7.477	(Constant)	-5.710	1.554	-3.675
	Salary (f)	0.00007	.000	4.564
	Housework Divided Equally (m)	-.570	.151	-3.778
	Housework Divided Equally (f)	.489	.154	3.169
	Age (f)	-.078	.022	-3.595
	Work Flex. (m) – Other	-4.211	1.309	-3.217
	Car Share (m) – Always Partner	-2.559	.850	-3.010
	Education (f) – Other	-2.347	.808	-2.904
	Hours Worked / Wk (f)	-.056	.024	-2.375
	Car Decisions Equal (m)	.372	.160	2.322
	Travel Time (f)	.016	.007	2.219
	Work Flex. (m) – Fixed	-.682	.322	-2.115
	Distance (f) – Always	4.158	1.952	2.130
	Days / Wk Commute Made (f)	.647	.327	1.979
	Travel Time (m)	.016	.008	1.907

Though there are only a handful of significant variables, a relatively high amount of the downwards revision of the WTAs expressed by females can be explained. Among the females who lower their WTA in the joint task, women with higher salaries reduce their WTA by larger amounts (in contrast to men where the opposite is true). Similarly, women who state that they drive *most often* when car-sharing and women tho agree with the statement that car use decisions are made equally reduce their WTA more. Women whose partners agree that car user decisions are made equally and that women are safer drivers reduce their WTA less than others.

Interestingly, among women who increase their willingness to commute, those on higher salaries increase their WTA more than those on lower salaries. Women who agree that housework is equally divided also increase their WTA more, whereas those whose partners agree with this statement increase their WTA less. Older women increase their WTA less as compared to younger women, women whose partner states that the female *always* drives when car sharing and females who work more hours per week increase their willingness to commute less than others. A result worth highlighting is that among women who increase their WTA, those whose partners spend more time commuting increase their own WTA more in the joint task. This is the only instance in which the partner's current salary or travel time influence the preferences exhibited by either males or females.

Finally, Table 5 reports the models estimated to explain the differences that exist between the actual willingness to accept displayed by individuals in the choice task versus those that were assigned to them by their partner. In every instance for both males and females, the stated WTA in the joint task is higher than that assigned to them by their partner. In other words, individuals underestimated their partner's willingness to commute. The differences modelled in Table 5 are the individuals WTA in the joint task minus the WTA assigned to them by their partner, as this number is always positive, a positive regression coefficient represents a greater propensity to underestimate the WTAs.

Table 5: Differences in Preferences: Own in Joint Task minus Assigned by Partner

Model	*Variable*	*Beta*	*Std. Error*	*t*
Male Own-Joint vs Assigned $R^2 = 0.162$ S.E Est = 0.741 F = 10.489	(Constant)	2.599	.244	10.640
	Salary (m)	-0.00001	.000	-7.102
	Hours Worked / Wk (f)	.021	.005	3.826
	Salary (f)	-0.00001	.000	-4.679
	Employ Status (f) – Part-time	.260	.086	3.040
	Car Use by Need (f)	.073	.023	3.147
	Car Share (f) – Often Partner	.153	.053	2.896
	Days / Wk Commute Made (f)	.180	.065	2.771
	Education (f) – High School	-.160	.060	-2.659
	Days / Wk Commute Made (m)	-.131	.053	-2.478
	Years License Held (m)	.007	.003	2.143
	Work Flex. (m) – Shift	-.236	.109	-2.167
	Work Flex. (m) – Other	.669	.307	2.178
	Employ Status (f) – Parent Leave	.182	.093	1.952
	Work Flex. (f) – Fixed	.109	.057	1.924
	Education (m) – Primary School	-.191	.099	-1.923
Female Own-Joint vs Assigned $R^2 = 0.020$ S.E Est = 1.144 F = 4.606	(Constant)	6.841	.084	80.988
	Car Share (m) – Always Partner	-.826	.337	-2.450
	Car Share (f) – Always Me	.751	.332	2.266
	Salary (f)	-0.00006	.000	-2.571
	Employ Status (m) – Other	-1.073	.472	-2.270
	Work Flex. (m) – Fixed	-.139	.072	-1.923

Looking at the estimation of the male WTAs, females whose partner earns more underestimate the WTAs of their partner less, likewise females who themselves earn higher salaries assign more correct WTAs to their partner. With respect to sources of inaccuracy, females who work more per week, are employed part-time, who agree that the car is used by the one most in need of it and whose partner drives *most often* when car-sharing underestimate the WTAs of their partners more. The differences between the WTAs of females in the joint task and those assigned to them by males are relatively poorly explained by the covariates collected in the survey. Men who state that their partner *always* drives when they car share underestimate their partner's WTA less (i.e. they assign more accurate WTA values). Similarly men whose partners have a higher salary and men on a fixed work schedule underestimate their partners WTA less. On the other hand, men who state that they *always* drive when

car-sharing are prone to underestimate their partners WTA by larger amounts.

5. Discussions and Conclusions

This paper has reported on an analysis aiming to understand differences across individual people in their willingness to accept increased commuting time in return for higher salary. Crucially, we have not just studied differences between male and female respondents and the impact of other key socio-demographics, but also the differences between valuations obtained in choices where respondents are faced only with their own commute journeys and those where they make decisions jointly for themselves and their partner. The inclusion of these latter choice scenarios has also allowed us to study how a person's own preferences might be affected when making choices jointly for both members of a couple.

The analysis has revealed a very rich set of findings. We observe major differences between men and women in their preferences. We also note how these preferences change when respondents are faced with choices that affect both themselves and their partner. Finally, there are major differences between respondents' own preferences and those assigned to them by their partner in the joint choices. An extensive regression analysis has highlighted a diverse set of drivers for these differences, be they socio-demographics, attitudes, or current commute circumstances.

As established in the introduction, commuter behaviour is complex but understanding it is immensely important given the myriad ways in which it influences society. The volume and length of commutes have significant implications for urban planning and geo-spatial choice, there are large economic impacts of commuting with respect to labour productivity and the shaping of employment markets and health and quality of life issues are influenced by an individual's commute. The richness of the results produced here can assist researchers and policy makers to understand commuting behaviour in far greater detail, albeit in the context of this data; though the modelling methods are easily transferable to different contexts. In terms of implications for future work, the analysis has shown that a rich pattern of behavioural insights in terms of socio-demographic drivers of preferences can be obtained from posterior distributions obtained from a simple HB specification.

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