Does the income elasticity of road traffic depend on the source of income?

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Abstract

An extensive body of literature addresses the income elasticity of road traffic, in which income is typically treated as a homogenous quantity. Here we report evidence of heterogeneity in cross-sectional estimates of the elasticity of vehicle-kilometres of travel (VKT) with respect to income, when household income is disaggregated on the basis of income source.

The results are generally intuitive, and show that the cross-sectional income elasticity of road traffic is not homogeneous as is typically specified in transport planning models. We show that in a number of circumstances the cross-sectional elasticity with respect to aggregate household income is of the opposite sign in comparison to more refined estimates of elasticity disaggregated by income source. If further research confirms that the elasticities we report here are causal in nature, neglecting the elemental effects could result in misleading results affecting practical infrastructure-investment and policy decisions, particularly as the mix of income sources shifts (e.g. if, as society ages, pension income increases as a share of all income).

These results are of interest to both researchers and forecasters of travel demand, as well as designers of future travel survey instruments; the latter group must decide how to generate data about respondents' income. Current expert guidance is to collect a single estimate of aggregate income at the household level. Future travel survey design choices will bound the analyses that can be supported by the resulting survey data, and therefore methodological research to re-visit the trade-offs associated with such choices is warranted.

Keywords: Income elasticity, road traffic, income source, travel survey methods

1. Introduction

Road traffic has historically been linked positively with real income, both in cross-sectional and longitudinal studies. Indeed, a transport planning model for which a negatively-signed *ceteris paribus* income elasticity is estimated would be challenged on precisely those grounds. Some recent evidence suggests that the positive link may be weakening (cf. Goodwin and Van Dender 2013), but there is no credible argument that it has switched signs to become negative.

In large measure the typical result (a strong positive effect) reflects people choosing to use higher incomes to purchase faster speeds, and personal car travel being, in general and relative to the alternatives, a high-speed form of mobility. This standard empirical result is in keeping with the body of theory addressing the linked expenditure decisions of money and time (Becker 1965).

A wide set of issues associated with income and road traffic have been addressed. There is a gap, however, in understanding how road traffic levels relate with income of various sources. It is not obvious, for instance, that wage income from a job will relate with personal mobility in the same way as pension income, or in the same way as income from benefit schemes.

The reason that this issue has yet to be addressed is at least in part due to data limitations. Household travel surveys typically collect income information at a very aggregate level, and this design choice bounds all analyses that subsequently use the data that are generated. On the basis of the findings from this study, which arise from analysing a large-scale household travel survey with a very-detailed set of income descriptors, we suggest that travel survey designers consider collecting more-detailed income information from respondents. Before revising survey design practices, however, a line of methodological research is required to more fully understand the trade-offs of such changes.

The rest of this paper is structured as follows. Section 2 discusses the previous literature, and Section 3 presents the empirical data resource employed in this study. Section 4 outlines the methodology, with the findings and conclusions presented in Sections 5 and 6 respectively.

2. Background

Beginning with early landmark traffic studies (e.g. CATS 1959), researchers have generally found a positive relationship between income and road traffic levels, as well as related indicators such as car ownership (Mogridge 1967). This pertains both to cross-sectional analyses (richer people driving more vehicle-kilometres of travel [VKT] than less-well-off people) and longitudinal ones (overall levels of VKT rising as real incomes rise over time).

Most studies of road traffic levels incorporate income at either the household-level or person-level; when both of these are available researchers may test which of these characterisations provides better statistical fit (e.g. Ramjerdi et al. 1997 cited in Wardman 2001, Cao and Mokhtarian 2005, Choo and Mokhtarian 2004) or include both types of descriptors in a single model specification (e.g. Kitamura et al. 1997). In disaggregate analyses income is observed for each specific unit (either a person or a household), whereas in aggregate analyses these quantities may be proxied by dividing Gross Domestic Product (or similar measures) by the number of people or households (Wheaton

1982, Hymel et al. 2010, Su 2010, Su 2011). The typical empirical finding is that road traffic is positively associated with income but that this is an inelastic relationship – i.e. estimated elasticities are positive but generally smaller than 1.0 (Graham and Glaister 2004, Goodwin et al. 2004, Litman 2013).

Researchers have also studied a range of other aspects of the relationship between income and personal mobility. In a study of developing countries, Gakenheimer (1999) reported a close correlation between car ownership per capita and the income level of the top income-quintile of the population in low-income countries. Dargay and Hanly (2002) showed that while car use is positively associated with income, the opposite is the case for bus use. Schafer and Victor (2000) show a positive relationship across world regions (groupings of countries) between income and person-kilometres of travel by all modes, in part due to a positive relationship between income and the share of people's travel time that is spent travelling by mechanised forms of transport. Fouquet (2010) reports falling elasticities of passenger travel demand with respect to income over a long timescale (1850 to 2010). Wadud et al. (2009) investigated how the income elasticity of fuel demand varies across the income distribution (in the United States) and reported that income elasticities were higher for middle-income bands than for both lower-income and higher-income bands.

Although the marginal relationship between income and car use is typically strong and positive in the aggregate, there are plausible reasons to hypothesise that the relationship is more complex at a disaggregate level.

Each adult member of a given multi-adult household may, for instance, specialise in either market employment or household responsibilities. All members of a given household would be characterised by the same household income level, but their specialisation in different roles can be reasonably expected to manifest itself in different regimes of car use. For a household member who specialises in household roles rather than market employment, it may be that income from sources other than their own wages (i.e. non-wage income, or wage income earned by *other* household members) associates positively with *their* car use for non-work purposes.

Personal mobility is inherently temporal, and earning a high wage income is likely to involve a substantial time investment in work-related activities. Given that available time is fixed (24 hours/day) it could be that work-related activities crowd out non-work-related ones, and that therefore a person's high wage income might be associated with a low level of car use for non-work-related reasons. This might be different on weekdays versus weekends – using the travel diary dataset outlined in the next section, it was found that in Scotland 4.4 times as many VKT occur on an average weekday than on an average weekend day (authors' calculations).

Income from different sources may also have different profiles of temporal variability. For instance, pension/annuity income is likely to be less volatile year-on-year than wage income. Two such streams of income may plausibly relate differently with car use due to this characteristic. Whilst this is an important research question, we do not observe income volatility in the cross-sectional dataset employed in this study. We cannot therefore know whether empirical differences in income elasticities for different sources of income are in fact due to income volatility, or to other differences in the characteristics of the various types of income.

Another characteristic that may vary across income streams is the requirement for physical travel to out-of-home destinations to generate the income. Wage income is likely to involve work-related travel to an out-of-home worksite; we may however reasonably expect this to be a closer statistical association than that between a person's work-related VKT and their household's income from other sources (including wages earned by other household members).

3. Data

Scottish Household Survey (SHS) collected on behalf of the Scottish Executive are used in this study, from years 2007/8. It is a uniquely appropriate dataset for this analysis, as both travel-diary information and detailed income-source information are collected. (Hope, undated) contains a detailed description of the SHS instrument and protocol; the survey is administered via a computer-assisted personal interview.

One randomly-selected member of [a subset of] respondent households is asked to complete a one-day travel diary (which records travel undertaken on the day prior to the interview); the unweighted sample size of diary-eligible households is 16,183 and for the analyses reported here the sample is weighted to be representative of the Scottish adult population. 3% of responding households indicated that both the head of household and their spouse were not working, and that the household receives no government benefits or income from other sources. These households were excluded from the estimation data sample.

SHS respondents are asked a series of questions regarding their income, beginning with the interviewer asking them to indicate their usual take-home pay (net of taxes and other deductions, but inclusive of overtime, commission, bonuses, and tips) and the period of time that that pay covered (Hope, undated). If the respondent is unable to report their take-home pay they are then asked to indicate their gross pay, and if they are unable to report their 'usual' pay they are then asked to indicate their most recent pay. Income is grossed up to an annual level prior to coding into the data files. Wage income represents 75% of all income reported in the SHS dataset. Imputation was performed for 30% of respondents that reported wage income, due to respondents indicating missing or inconsistent data.

After reporting wage income, respondents are then presented with a showcard containing a list of government benefits and are asked to indicate which if any they receive. If they indicate that they receive any of the benefits, they are then asked (for each benefit) to indicate the amount that they received in their last payment and the period it covered. If they are unable to report a precise payment amount for any of their benefit category, they are asked to estimate how much they received in aggregate the most recent time that they received benefit. There was imputation for 42% of benefit-recipients in the SHS dataset. 10% of SHS respondents' aggregate income was in the form of benefits.

The questions for other sources of income (non-wage and non-benefits) are organised in the same structure as the questioning for benefits. Imputation was performed during data processing for 29% of SHS respondents that indicates that they receive any of the non-wage/non-benefit sources of income. 16% of respondents' reported income was from non-wage/non-benefit sources.

When all income sources are considered, it was found that 48% of households had an imputed value for income from at least one source. Therefore it was decided to determine whether the results presented in this study are robust to removing these households from the analysis (see Section 4).

For the purposes of this analysis the elemental categories of income listed below are aggregated into the 5 broader classes shown as column headings in Table 1

Wage income is the only income source which is observed at the person-level. All other income is known at the household-level; the data do not identify which household member the income accrues to.

The control variables employed on this study are as follows:

- Binary indicator for whether a respondent holds a driving licence
- Binary indicator for gender (zero if female, one if male)
- Age grouped into three bands: age 17 to 34, 35 to 59, and 60+
- Binary indicator for presence of children (aged 15 or under) in household
- Binary indicator for dwelling type (one if respondent lives in a house, zero otherwise)
- Housing tenure grouped into three classes: Owns outright, Owns and paying off mortgage, renting and all other housing tenure
- Binary indicator for spatial class, using Scotland's 6-category spatial classification system (Scottish Government 2013):
    - Large urban areas (>125K population)
    - Other urban areas (10K to 125K pop.)
    - Accessible small towns (3K to 10K pop., and within 30 minutes drive to a settlement of 10K+ pop.)
    - Remote small towns (3K to 10K pop., and more than 30 minutes drive to a settlement of 10K+ pop.)
    - Accessible rural areas (<3K pop., and within 30 minutes drive to a settlement of 10K+ pop.)
    - Remote rural areas (<3K pop., and more than 30 minutes drive to a settlement of 10K+ pop.)

It is worth noting that car ownership is not included as a control variable, due to its interaction with income. Had we controlled for car ownership the goodness-of-fit of the models would be better, however it would mean that the elasticities would need to be interpreted as not including the association between income and household car ownership.

Table 2 shows descriptive statistics for the estimation sample, including both the income-source data and control variables. Table 3 shows the correlation matrix for income from each of the 5 above-listed classes.

<<Table 2 about here>>

<<Table 3 about here>>

12,218 and 3,965 of the diaries took place on weekdays and weekend days respectively. Somewhat less than half (45%) of the observed VKT driven by the sample on their diary days was for work purposes (commuting and in-the-course-of-work), with other journey purposes accounting for the remaining 55%.

4. Methodology

Cross-sectional income elasticities were estimated, with car/van driving kilometres per day the quantity modelled. Socio-economic and spatial control variables were included in the specification to account for confounding effects. A log-log functional form was employed, therefore the estimated parameters for marginal income from each source can be interpreted as elasticities (i.e. a 1% change in an independent variable is associated with an X% change in the dependent variable, where X is the corresponding estimated marginal parameter).

Beyond the socio-economic and spatial control variables, parameters were estimated for dummy variables that each indicate whether a person receives *any* income from a given source, as well as marginal parameters that apply to the continuously-varying level of income (in British pounds)from each source. For instance, one parameter captures the effect of being a pension-recipient, so that therefore the separate parameter for the amount of pension income can be interpreted as a strictly marginal effect.

Separate models were estimated for work and non-work journey purposes, and for weekdays and weekends. The generic structure of the models are:

$$y = \beta_0 + \beta_1 * X_1 + \beta_2 * X_2 + \cdots \beta_k * X_k + \varepsilon$$

where y represents the natural log of each respondent's observed vehicle-kilometres of travel on their diary day; β_i denotes the regression coefficients; $X_i$denotes the independent variables, with $i = 1, \dots, k$; and ε denotes an idiosyncratic error term. Note that all independent variables that are continuous quantities are transformed prior to model estimation by taking their natural log.

In addition to the fully-specified models (with separate marginal parameters for each income source), three types of restricted model forms were estimated for comparison purposes. In all restricted form models a single marginal income effect was estimated. In restricted model #1 no control variables were entered, and in restricted model #2 the control variables were entered except for those related to income. In restricted model #3 the control variables were entered as in restricted model #2, as well as an additional set of five parameters estimated for binary variables that indicate whether a respondent receives any income from each of the income sources. For instance, the binary variable that indicates whether a respondent earns any wage income can be interpreted as indicating whether they are employed; this variable does not appear in the first two restricted model runs.

Due to the observation that nearly half (48%) of SHS respondents' income was subject to at least some imputation during data processing (see the previous section) we performed a sensitivity test to determine the degree to which the estimation results are robust to removing all such respondents. These estimation results can be found in the Appendix in tables A1 and A2 and figure A1.

5. Findings

Estimation results from 16 models (work/non-work, weekday/weekend-day, full-specification and three restricted specifications) are shown in Tables 4 and 5. The models for work-related VKT are in Table 4 and the non-work-related VKT models are in Table 5.

Goodness-of-fit (r^2) for the full model specifications ranges from a low of 0.08 (for work-related VKT on weekend days) to a high of 0.26 (for work-VKT on weekdays).

<<Table 4 about here>>

<<Table 5 about here>>

The r^2 values are in keeping with earlier studies that estimate VKT from disaggregate travel diary data. Taylor et al. (2013) report a set of model runs in which person-miles of travel (as observed in the one-day travel diary of the 2009 US National Household Travel Survey [NHTS]) is the dependent quantity. The adjusted r^2 values that Taylor et al. (2013) report range between 0.07 and 0.12. Likewise, Zhang et al. (2005) estimate vehicle-miles-of-travel (VMT) using the 2001 NHTS' one-day travel diary data, reporting an r^2 of 0.13. Finally, Kuhnimhof et al (2012) report models of weekly kilometres of travel with r^2 values of 0.10 (all person-kms of travel) and 0.18 (driving kms).

In all cases, the adjusted r^2 of the full specifications that we report are improvements on the corresponding restricted specifications and we therefore reject the restricted forms in favour of the full models.

A general point from this analysis is that the VKT elasticities we calculate with respect to various elemental income sources are all quite inelastic, with no estimate larger in absolute value than 0.30. We do not comment here on the estimated parameters for the control variables, except to note that they are generally in line with *a priori* expectations.

For ease of interpretation, Figures 1 through 4 show graphically the marginal parameters in which we are primarily interested. Each figure shows both the results from a full specification and the corresponding restricted model forms. With regards to the restricted specifications, it can be seen in Figures 1 through 4 that the estimated elasticities for all-household-income become smaller as control variables are entered into the model (comparing restricted model runs #1 and #2). There is also, for three of the four classes of models (the exception being for non-work weekday VKT), a further drop in the estimated elasticity when the binary variables that indicate whether a respondent received any income from a given class of income are entered.

We now consider each set of results in turn.

<<Figure 1 about here>>

<<Figure 2 about here>>

<<Figure 3 about here>>

<<Figure 4 about here>>

Weekday work-related VKT: From Figure 1, it can be seen that the elasticity of weekday work-related VKT is +0.28 with respect to one's own salary income, meaning that a 1% increase in one's own salary is associated with a +0.28% increase in work-related weekday VKT. When the full specification is compared to restricted model #3(the least-restricted form), the effect due to one's own wage income is stronger than the estimated effect when, as is commonly the case in the literature, all household income is taken into account as a homogeneous quantity (+0.15); this difference is statistically significant. It is the largest-magnitude elasticity of all the elasticities we report in this study for the five types of income, which is quite plausible as there are clear mechanisms for this effect (e.g. the increasing depth of labour markets if one is prepared to travel further). It is also intuitive that the effect becomes attenuated when it is proxied for by aggregate household income (+0.15 v. +0.28).

At the margin, income from benefits is estimated to have a positive *ceteris paribus* relationship with VKT and the opposite for income from the 'Other' category. Both of these effects were statistically significant at $p<0.10$ but not $p<0.05$, and the absolute value of these two elasticities are an order of magnitude smaller than the elasticity of VKT with respect to one's own wage income. For pension/annuity income a statistically significant negative relationship is found – it is estimated that a 1% increase in pension income is associated *ceteris paribus* with a -0.06% decrease in work-related VKT, which is an effect that is independent of one's salary income.

Weekend work-related VKT: Comparing Figure 2 to Figure 1, it can be seen clearly that the elasticities of work-related VKT are very different on weekdays versus weekend days. A negative elasticity is found with respect to one's spouse's salary – a 1% increase in one's spouse's salary is associated, all else equal, with a -0.06% decrease in weekend work-related driving mileage. A positive elasticity of weekend work-related VKT was estimated with respect to one's own income (significant only at $p<0.10$), but it is much smaller than weekday work-related VKT (+0.28 on weekdays versus +0.04 on weekends). It is worth noting that the SHS travel diary data show that 4.4 times as many work-related VKT occur on an average weekday in comparison to an average weekend day.

The marginal effects associated with the three other classes of income (benefits, pension/annuity, and 'Other') were not close to statistically significant.

Weekday non-work-related VKT: We see in Figure 3 that one's own salary is associated negatively with non-work-related weekday VKT. This effect is negative whereas the effect on work-related VKT is *positive*. The implication is that, all else equal, a higher-salary person is likely to drive more on weekdays for work reasons (elasticity of +0.28) but less on weekdays for non-work purposes (elasticity of -0.05).

We find precisely the opposite with respect to pension/annuity income. Marginal pension/annuity income is negatively linked with work-related VKT (elasticity of -0.06) on weekdays, but it is associated [quite plausibly] *positively* with non-work-related VKT on weekdays (elasticity of +0.08).

The marginal effects associated with income from benefits and from 'Other' sources were not found to be statistically significant.

Finally, we see in Figure 3 that the elasticity of weekday non-work-related VKT with respect to one's spouse's income is positive (+0.05), meaning that a person having a high-income spouse is associated, net of other effects, with them (not the high-income spouse) driving more VKT on weekdays for non-work purposes. This suggests intra-household dynamics (which we speculate are likely to be gendered) that are broadly plausible.

Weekend non-work-related VKT: In Figure 4 we see that non-work-related VKT on weekends is positively-linked with one's salary and that this effect is large in magnitude (an elasticity of +0.15), but not with marginal income from the other classes.

So, one's own salary was found to have a strong positive association with weekday work-related VKT and a somewhat weaker positive link with weekend non-work-related VKT. As with many of the other findings, this relationship is in line with *a priori* intuition.

None of the other four classes of income (benefits, pension/annuity, spouse's wages, or 'Other' income) were found to have a statistically significant elasticity with non-work weekend travel.

Tables A1 and A2 in the Appendix contain estimation results comparable to Tables 4 and 5, but they are generated from an estimation in which all SHS respondents that had any income imputed during data processing are removed from the estimation sample. Figure A1 in the Appendix shows the plot of the 20 parameter estimates of interest for the various streams of income (5 types of income, separately for weekday/weekend and also work/non-work) using the full SHS dataset against the same parameter estimates using the subset of the SHS dataset for which no income imputation was required. The line of best-fit (r^2=0.87) passes near to the origin (y-intercept of 0.002), and has a slope near unity (1.12).

6. Conclusions

This study shows quite clearly that income elasticities of road traffic are not homogeneous across different sources of income. Indeed, we show that in a number of circumstances the elasticity with respect to aggregate household income is of *the opposite sign* in comparison to more refined estimates of elasticity disaggregated by income source.

Our results are purely cross-sectional, and we cannot know whether these net effects (all-else-equal correlations) are causal. If this proves to be the case, neglecting the elemental effects could result in misleading results affecting practical infrastructure-investment and policy decisions. This would be especially problematic if the distribution of income by source shifts over time. For instance, in aging societies the share of income that is in the form of pensions is expected to increase. Other possibilities are that income from benefits could become either more or less prevalent, depending on overall economic trajectory and public policy decisions. If these cross-sectional findings prove to be indicative of underlying causal mechanisms, this would indicate that shifts in the nature of income might impact on traffic levels even if aggregate income levels remain constant. At the moment, however, such effects are not in general taken into account.

It is worth noting that the dataset employed in this study did not explicitly consider gifts, either in the form of money being exchanged amongst family members (or others), or through in-kind gifts

such as a parent purchasing a car for a young adult. Further research and novel data resources will be required to shed light on such issues.

Further research is also needed to better understand the mechanism(s) for the differential income elasticities with road traffic that we report here. An important aspect of this line of enquiry will be to identify the relative contribution of various possible components of the cross-sectional elasticity values (between various types of income and driving mileage). For instance, it will be of interest to identify the degree to which the differences in cross-elasticities manifest themselves as differences in income elasticities of car ownership versus differences in income elasticities of car use (conditional on car ownership level).

Travel surveys in general collect income-source information at a relatively coarse level of detail. Current expert guidance (Stopher et al. 2008) to agencies undertaking such surveys in the United States, for instance, recommends collecting aggregate pre-tax income at the household level. This study suggests that collecting additional data points regarding income may be worthwhile, though there are trade-offs to be considered (e.g. increases in non-response bias, imprecision in self-reporting, etc). Another possibility is, subject to respondents' consent, to link self-reported travel survey data with administrative data which can include information on sources and levels of income with potentially much less measurement error (cf. McKay 2012, Taylor et al. 2012).

This paper shows that, when analysing policy-relevant travel behaviour, there are real benefits to having access to richer-than-usual income-source data. But without weighing the trade-offs involved in collecting data of this sort it is not possible to pass judgment on whether changes should be made to standard protocols. Further research is urgently required to properly understand such trade-offs, and is also clearly warranted to more fully establish the causal mechanisms for the systematic variability in cross-sectional income elasticities reported here.

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Tables and Figures

Income from benefits (10%)	Income from pensions/annuities (14%)	Individual's wage income (42%)	Spouse's wage income (33%)	Other income (2%)
Child benefit (2%)	State retirement pension (7%)	Wages from one's own main job (41%)	Wages from spouse's main job (33%)	Incomings from rent (1%)
Child tax credit (1%)	Non-state pension (6%)	Wages from one's other jobs (<0.5%)	Wages from spouse's other jobs (<0.5%)	Investments (1%)
Disability living allowance (care component) (1%)	Pension credit (<0.5%)			Maintenance payments (<0.5%)
Disability living allowance (mobility component) (1%)	Widows pension (<0.5%)			'Dig money' transfers[2] (<0.5%)
Housing benefit (1%)	Annuity (<0.5%)			Student loan incomings (<0.5%)
Incapacity benefit (1%)				Grants (<0.5%)
Income support (1%)				Other miscellaneous income (<0.5%)
Working tax credit (1%)				
Job seekers allowance (income based) (<0.5%)				
Job seekers allowance (contribution based) (<0.5%)				
Council tax benefit(<0.5%)				
Maternity allowance(<0.5%)				
Maternity pay (<0.5%)				

[2] 'Dig money' refers to rent money that a young adult living with their parents pays to them.

Accident/sick scheme (<0.5%)
Industrial injury/disablement benefit (<0.5%)
Invalid care allowance (<0.5%)
Severe disablement benefit (<0.5%)
Statutory sick pay (<0.5%)
War disablement benefit (<0.5%)
Income support/housing benefit disablement premium (<0.5%)
Attendance allowance (<0.5%)
Other disability benefit (<0.5%)
Other [non-disability] state benefit (<0.5%)

Table 1: Income sources included in the SHS dataset and their aggregation into the classes used in this analysis. The percentage following each category of income is the percentage of all income by SHS respondents that the source accounts for.

Variable	Percentage / Mean
Presence of cars in household (Dummy)	76%
Male (Dummy)	47%
Age 34 or under (Dummy)	21%
Age 35 to 59 (Dummy)	49%
Age 60 or older (Dummy)	29%
Presence of children in household (Dummy)	30%
Residence is a house (Dummy)	70%
Residence is owned outright	29%
Residence is owned but with mortgage	41%
Residence is rented or any other housing tenure	30%
Resides in Large Urban Areas spatial class	39%
Resides in Other Urban Areas spatial class	30%
Resides in Accessible Small Towns spatial class	9%
Resides in Remote Small Towns spatial class	4%
Resides in Accessible Rural Areas spatial class	12%
Resides in Remote Rural spatial class	6%
Household is recipient of any benefit income (Dummy)	50%
Household is recipient of any pension/annuity income (Dummy)	31%
Individual is recipient of any wage income (Dummy)	60%
Spouse is recipient of any wage income (Dummy)	47%
Household is recipient of any income from other sources (Dummy)	16%
Amount of benefit income household receives, GBP/year	£2,390 (std. dev. £4,297)
Amount of pension/annuity income household receives, GBP/year	£3,371 (£6,518)
Amount of wage income individual receives, GBP/year	£10,525 (£13,241)
Amount of wage income spouse receives, GBP/year	£8,342 (£11,959)
Amount of income household receives from other sources, GBP/year	£509 (2,696)
Amount of income household receives from all sources, GBP/year	£25,136 (£17,819)
Car/van driving distance (kms) per day, work purposes	6.1 (21.8)
Car/van driving distance (kms) per day, non-work purposes	7.3 (23.4)

Table 2: Descriptive statistics of variables employed in this analysis

	Benefits	Pension/annuity	Wage (own)	Wage (spouse)	Other income
Benefits	1.0	-0.13	-0.18	-0.16	-0.04
Pension/annuity		1.0	-0.33	-0.29	+0.06
Wage (own)			1.0	+0.23	+0.02
Wage (spouse)				1.0	+0.02
Other income					1.0

Table 3: Correlations amongst income sources. All correlations are significant at p<0.05

	ln(Work-related distance, kms/day, weekdays) Restricted specification #1		ln(Work-related distance, kms/day, weekdays) Restricted specification #2		ln(Work-related distance, kms/day, weekdays) Restricted specification #3		ln(Work-related distance, kms/day, weekdays) Full specification		ln(Work-related distance, kms/day, weekend days) Restricted specification #1		ln(Work-related distance, kms/day, weekend days) Restricted specification #2		ln(Work-related distance, kms/day, weekend days) Restricted specification #3		ln(Work-related distance, kms/day, weekend days) Full specification	
Sample size (unweighted)	12,218		12,218		12,218		12,218		3,965		3,965		3,965		3,965	
r^2	0.116		0.203		0.245		0.257		0.019		0.061		0.074		0.077	
Adjusted-r^2	0.116		0.202		0.243		0.256		0.018		0.058		0.069		0.071	
	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
Constant	-5.90	<0.02	- 3.34	<0.01	- 1.72	<0.01	-0.36	<0.01	-1.39	<0.01	0.64	<0.01	0.07	0.78	-0.13	0.15
Male (Dummy)	--	--	0.34	<0.01	0.27	<0.01	0.20	<0.01	--	--	0.14	<0.01	0.12	<0.01	0.10	<0.01
Age 34 or under (Dummy)	--	--	0.37	<0.01	- 0.03	0.54	-0.06	0.31	--	--	0.13	0.01	0.00	0.97	0.01	0.86
Age 35 to 59 (Dummy)	--	--	0.41	<0.01	0.05	0.30	0.02	0.65	--	--	0.14	<0.01	0.03	0.54	0.04	0.47
Age 60 or older (Dummy)	--	--	Fixed at zero		Fixed at zero		Fixed at zero		--	--	Fixed at zero		Fixed at zero		Fixed at zero	
Presence of children in household (Dummy)	--	--	- 0.11	<0.01	- 0.01	0.83	0.02	0.65	--	--	0.02	0.53	-0.01	0.72	-0.02	0.70
Residence is a house (Dummy)	--	--	0.06	0.04	0.08	0.01	0.08	0.01	--	--	0.08	0.02	0.07	0.04	0.07	0.04
Residence is owned outright	--	--	0.03	0.37	0.01	0.72	0.03	0.41	--	--	0.06	0.15	-0.06	0.12	-0.07	0.08
Residence is owned (paying off mortgage)	--	--	0.35	<0.01	0.25	<0.01	0.21	<0.01	--	--	-0.02	0.60	-0.07	0.08	-0.09	0.03
Residence is rented or other housing tenure	--	--	Fixed at zero		Fixed at zero		Fixed at zero		--	--	Fixed at zero		Fixed at zero		Fixed at zero	
Resides in Large urban area	--	--	- 0.12	0.02	- 0.10	0.04	-0.11	0.02	--	--	0.06	0.29	-0.05	0.40	-0.05	0.41
Resides in Other urban area	--	--	- 0.02	0.70	0.01	0.90	-0.01	0.83	--	--	0.01	0.90	0.01	0.86	0.01	0.82
Resides in Accessible small town	--	--	0.09	0.11	0.12	0.04	0.10	0.08	--	--	0.04	0.59	0.04	0.53	0.04	0.51
Resides in Remote Small Town	--	--	- 0.15	0.04	- 0.14	0.04	-0.14	0.03	--	--	0.09	0.29	0.09	0.31	0.08	0.33
Resides in Accessible rural area	--	--	0.08	0.15	0.11	0.04	0.09	0.09	--	--	0.26	<0.01	0.26	<0.01	0.26	<0.01
Resides in Remote rural area	--	--	Fixed at zero		Fixed at zero		Fixed at zero		--	--	Fixed at zero		Fixed at zero		Fixed at zero	
Holds driving licence	--	--	0.46	<0.01	0.38	<0.01	0.40	<0.01	--	--	0.13	<0.01	0.11	<0.01	0.10	<0.01

Household is recipient of any benefit income (Dummy)	--	--	--	--	- 0.04	0.19	-0.26	0.05	--	--	--	--	0.02	0.50	0.18	0.24
Household is recipient of any pension/annuity income (Dummy)	--	--	--	--	- 0.03	0.57	0.62	0.01	--	--	--	--	0.02	0.78	0.07	0.80
Individual is recipient of any wage income (Dummy)	--	--	--	--	0.77	<0.01	-1.76	<0.01	--	--	--	--	0.26	<0.01	-0.15	0.50
Spouse is recipient of any wage income (Dummy)	--	--	--	--	- 0.04	0.17	0.10	0.58	--	--	--	--	0.07	0.04	0.65	0.01
Household is recipient of any income from other sources (Dummy)	--	--	--	--	- 0.07	0.03	0.15	0.19	--	--	--	--	0.02	0.60	0.16	0.21
ln(Amount of benefit income household receives, GBP/year)	--	--	--	--	--	--	0.03	0.07	--	--	--	--	--	--	-0.02	0.29
ln(Amount of pension/annuity income household receives, GBP/year)	--	--	--	--	--	--	-0.06	0.01	--	--	--	--	--	--	-0.01	0.81
ln(Amount of wage income individual receives, GBP/year)	--	--	--	--	--	--	0.28	<0.01	--	--	--	--	--	--	0.04	0.09
ln (Amount of wage income spouse receives, GBP/year)	--	--	--	--	--	--	-0.00	0.86	--	--	--	--	--	--	-0.06	0.01
ln(Amount of income household receives from other sources, GBP/year)	--	--	--	--	--	--	-0.03	0.08	--	--	--	--	--	--	-0.02	0.25
ln(Amount of income household receives from all sources, GBP/year)	0.67	<0.01	0.32	<0.01	0.15	<0.01	--	--	0.16	<0.01	0.06	0.02	-0.02	0.38	--	--

Table 4: Parameter estimates, models of work-related vehicle-kilometres of travel. B = mean parameter estimate; p = p-value

	ln(Non-work-related distance, kms/day, weekdays) Restricted specification #1		ln(Non-work-related distance, kms/day, weekdays) Restricted specification #2		ln(Non-work-related distance, kms/day, weekdays) Restricted specification #3		ln(Non-work-related distance, kms/day, weekdays) Full specification		ln(Non-work-related distance, kms/day, weekend days) Restricted specification #1		ln(Non-work-related distance, kms/day, weekend days) Restricted specification #2		ln(Non-work-related distance, kms/day, weekend days) Restricted specification #3		ln(Non-work-related distance, kms/day, weekend days) Full specification	
Sample size (unweighted)	12,218		12,218		12,218		12,218		3,965		3,965		3,965		3,965	
r^2	0.020		0.127		0.135		0.136		0.055		0.164		0.168		0.170	
Adjusted-r^2	0.020		0.126		0.134		0.135		0.055		0.161		0.163		0.165	
	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
Constant	-1.91	<0.01	0.03	0.89	-0.94	<0.01	-0.06	0.46	-4.07	<0.02	-1.35	<0.01	-1.16	0.01	-0.26	0.08
Male (Dummy)	--	--	0.06	0.02	0.08	<0.01	0.10	<0.01	--	--	0.35	<0.01	0.35	<0.01	0.31	<0.01
Age 34 or under (Dummy)	--	--	-0.17	<0.01	0.05	0.38	0.08	0.18	--	--	0.02	0.79	-0.06	0.61	-0.05	0.62
Age 35 to 59 (Dummy)	--	--	-0.11	<0.01	0.09	0.06	0.13	0.01	--	--	0.05	0.41	-0.01	0.90	-0.02	0.87
Age 60 or older (Dummy)	--	--	--		Fixed at zero		Fixed at zero		--	--	Fixed at zero		Fixed at zero		Fixed at zero	
Presence of children in household (Dummy)	--	--	0.18	<0.01	0.17	<0.01	0.18	<0.01	--	--	0.05	0.36	0.09	0.21	0.09	0.19
Residence is a house (Dummy)	--	--	0.09	<0.01	0.09	<0.01	0.10	<0.01	--	--	0.10	0.08	0.11	0.06	0.11	0.06
Residence is owned outright	--	--	0.15	<0.01	0.14	<0.01	0.13	<0.01	--	--	0.18	0.01	0.16	0.02	0.15	0.04
Residence is owned (paying off mortgage)	--	--	0.08	0.02	0.13	<0.01	0.15	<0.01	--	--	0.31	<0.01	0.30	<0.01	0.27	<0.01
Residence is rented or other housing tenure	--	--	Fixed at zero		Fixed at zero		Fixed at zero		--	--	Fixed at zero		Fixed at zero		Fixed at zero	
Resides in Large urban area	--	--	-0.22	<0.01	-0.23	<0.01	-0.22	<0.01	--	--	-0.06	0.55	-0.06	0.54	-0.07	0.51
Resides in Other urban area	--	--	-0.14	0.01	-0.14	<0.01	-0.14	<0.01	--	--	0.05	0.59	0.06	0.57	0.06	0.58
Resides in Accessible small town	--	--	-0.13	0.03	-0.13	0.02	-0.13	0.03	--	--	0.08	0.49	0.08	0.48	0.07	0.52
Resides in Remote Small Town	--	--	-0.23	<0.01	-0.24	<0.01	-0.24	<0.01	--	--	0.01	0.92	0.01	0.94	0.01	0.96
Resides in Accessible rural area	--	--	0.09	0.10	0.09	0.12	0.09	0.09	--	--	0.32	<0.01	0.31	<0.01	0.31	<0.01
Resides in Remote rural area	--	--	Fixed at zero		Fixed at zero		Fixed at zero		--	--	Fixed at zero		Fixed at zero		Fixed at zero	
Holds driving licence	--	--	0.87	<0.01	0.88	<0.01	0.89	<0.01	--	--	0.83	<0.01	0.80	<0.01	0.80	<0.01

Household is recipient of any benefit income (Dummy)	--	--	--	--	-0.00	0.95	0.12	0.42	--	--	--	--	-0.03	0.58	-0.02	0.94
Household is recipient of any pension/annuity income (Dummy)	--	--	--	--	0.10	0.04	-0.59	0.01	--	--	--	--	-0.04	0.69	-0.30	0.54
Individual is recipient of any wage income (Dummy)	--	--	--	--	-0.22	<0.01	0.32	0.09	--	--	--	--	0.11	0.09	-1.23	<0.01
Spouse is recipient of any wage income (Dummy)	--	--	--	--	-0.13	<0.01	-0.57	<0.01	--	--	--	--	-0.05	0.39	-0.21	0.60
Household is recipient of any income from other sources (Dummy)	--	--	--	--	0.14	<0.01	0.31	0.01	--	--	--	--	0.18	<0.01	0.10	0.64
ln(Amount of benefit income household receives, GBP/year)	--	--	--	--	--	--	-0.01	0.44	--	--	--	--	--	--	0.00	0.99
ln(Amount of pension/annuity income household receives, GBP/year)	--	--	--	--	--	--	0.08	<0.01	--	--	--	--	--	--	0.03	0.54
ln(Amount of wage income individual receives, GBP/year)	--	--	--	--	--	--	-0.05	0.01	--	--	--	--	--	--	0.15	<0.01
ln (Amount of wage income spouse receives, GBP/year)	--	--	--	--	--	--	0.05	0.01	--	--	--	--	--	--	0.02	0.56
ln(Amount of income household receives from other sources, GBP/year)	--	--	--	--	--	--	-0.02	0.17	--	--	--	--	--	--	0.01	0.65
ln(Amount of income household receives from all sources, GBP/year)	0.27	<0.01	0.01	0.70	0.10	<0.01	--	--	0.50	<0.01	0.11	0.01	0.10	0.05	--	--

Table 5: Parameter estimates, models of non-work-related vehicle-kilometres of travel. B = mean parameter estimate; p = p-value

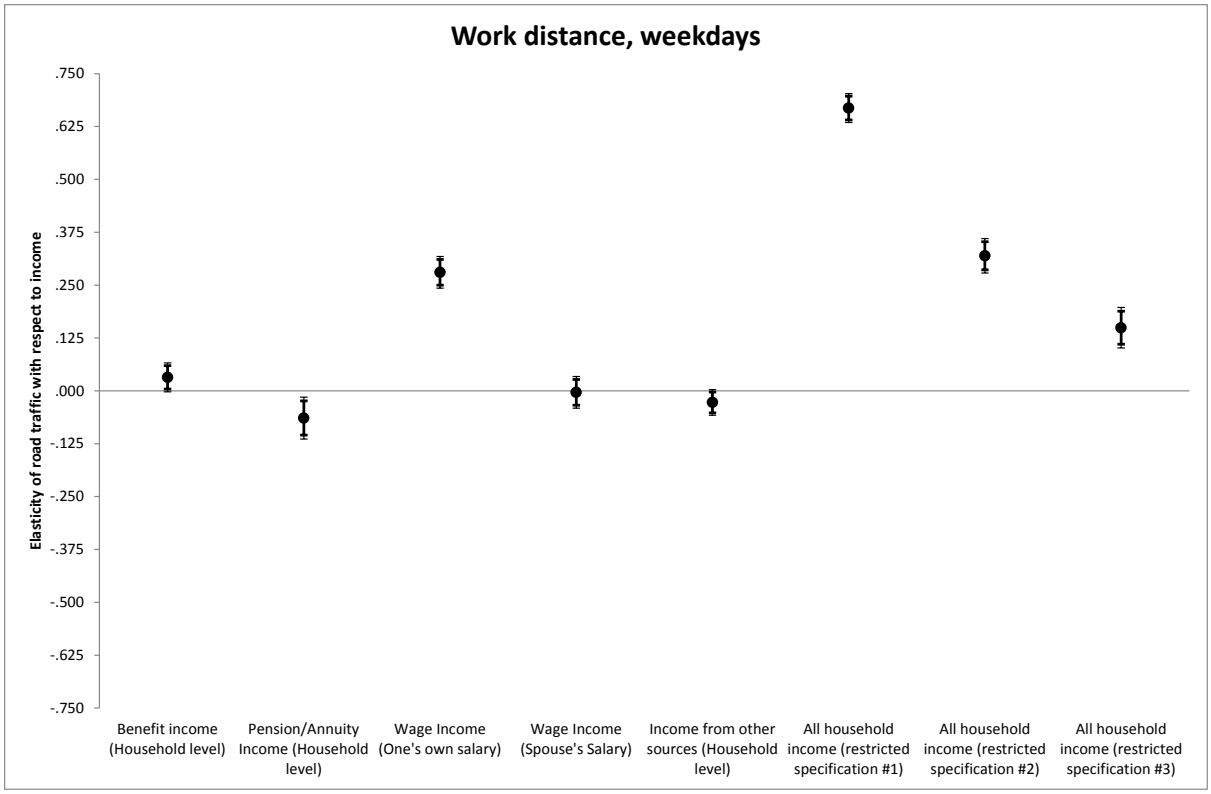

Figure 1: Estimates of elasticities in WEEKDAY WORK-RELATED road traffic VKT with respect to income of various sources. Bold and non-bold error bars are the 90% and 95% confidence intervals, respectively

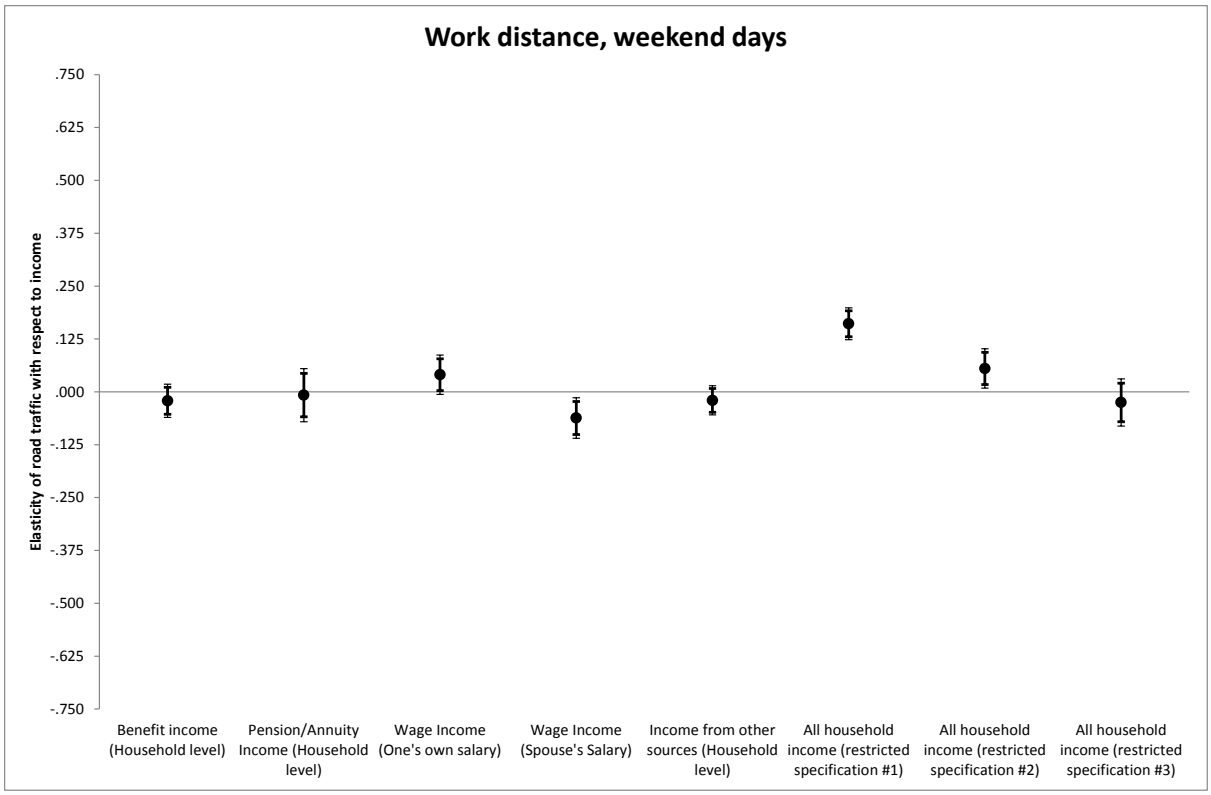

Figure 2: Estimates of elasticities in WEEKEND WORK-RELATED road traffic VKT with respect to income of various sources. Bold and non-bold error bars are the 90% and 95% confidence intervals, respectively

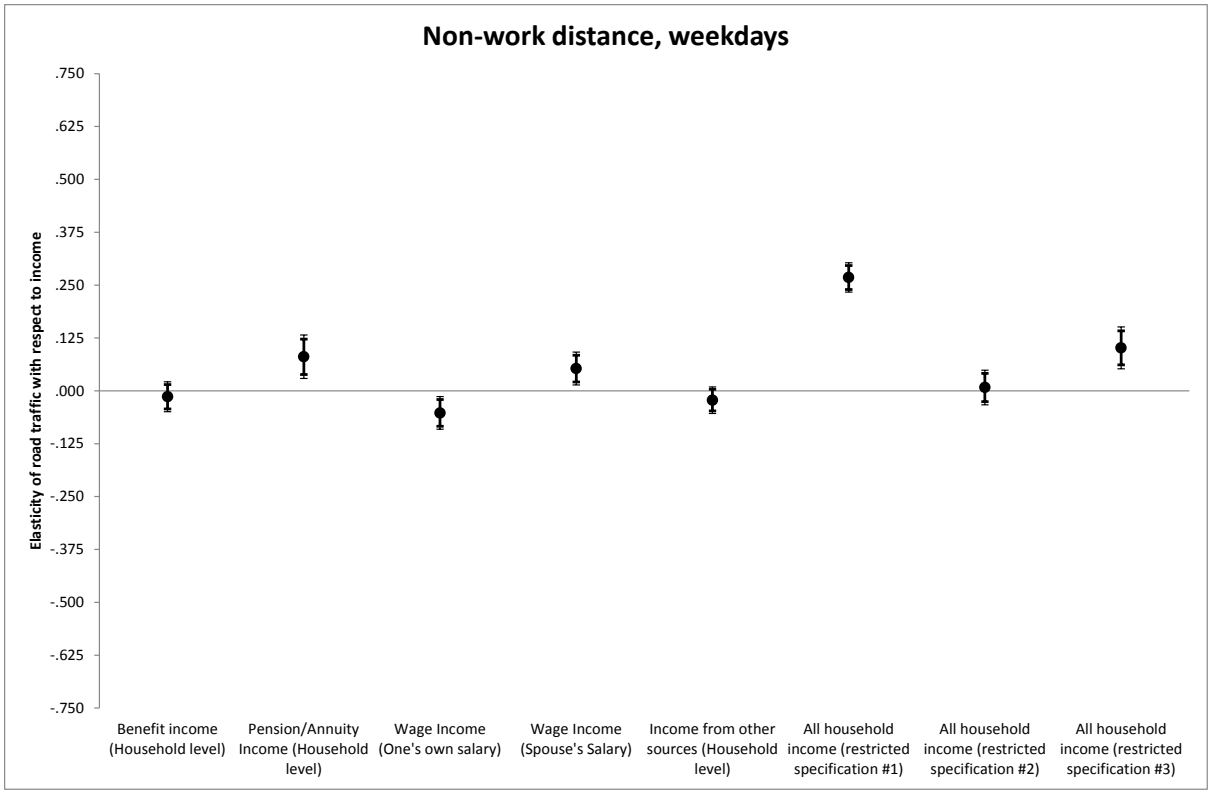

Figure 3: Estimates of elasticities in WEEKDAY NON-WORK-RELATED road traffic VKT with respect to income of various sources. Bold and non-bold error bars are the 90% and 95% confidence intervals, respectively

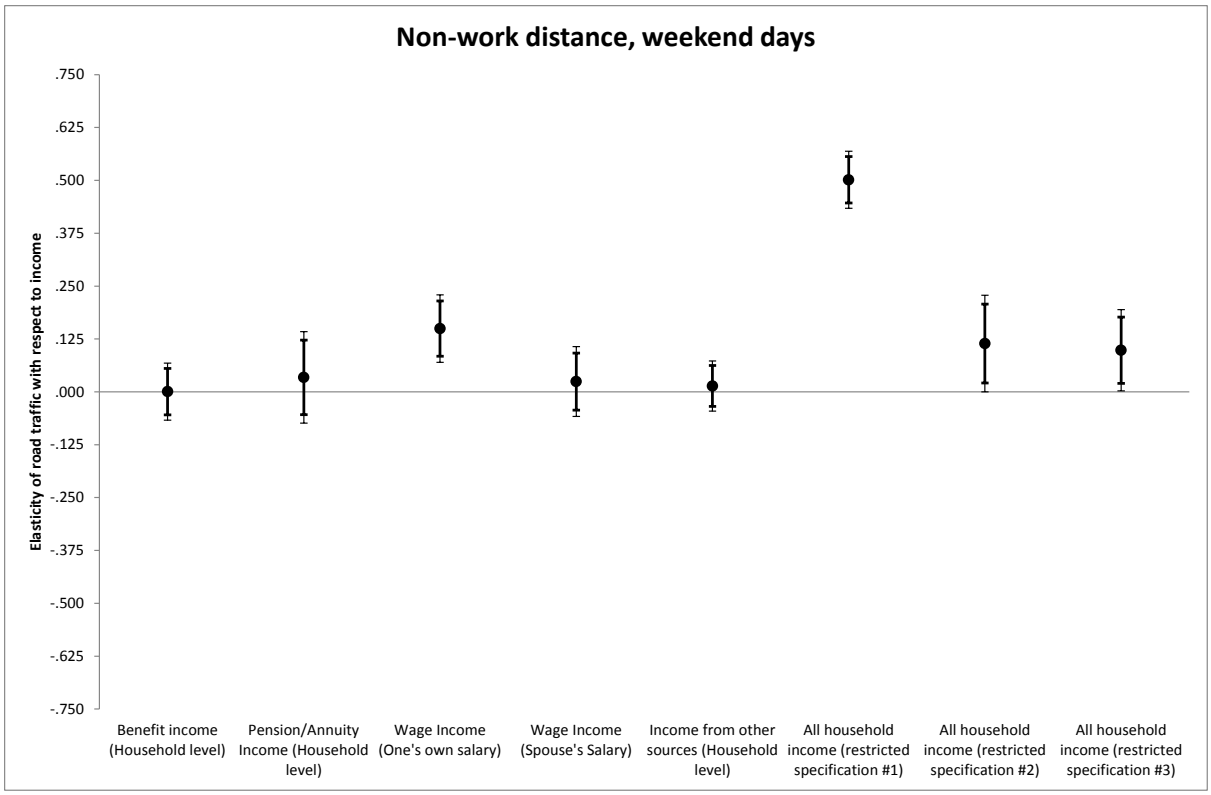

Figure 4: Estimates of elasticities in WEEKEND NON-WORK-RELATED road traffic VKT with respect to income of various sources. Bold and non-bold error bars are the 90% and 95% confidence intervals, respectively

Appendix

	ln(Work-related distance, kms/day, weekdays) Restricted specification #1		ln(Work-related distance, kms/day, weekdays) Restricted specification #2		ln(Work-related distance, kms/day, weekdays) Restricted specification #3		ln(Work-related distance, kms/day, weekdays) Full specification		ln(Work-related distance, kms/day, weekend days) Restricted specification #1		ln(Work-related distance, kms/day, weekend days) Restricted specification #2		ln(Work-related distance, kms/day, weekend days) Restricted specification #3		ln(Work-related distance, kms/day, weekend days) Full specification	
Sample size (unweighted)	6,217		6,217		6,217		6,217		2,027		2,027		2,027		2,027	
r^2	0.092		0.186		0.223		0.237		0.013		0.066		0.079		0.085	
Adjusted-r^2	0.092		0.185		0.220		0.234		0.013		0.059		0.070		0.074	
	β	p	β	p	β	p	β	β	β	p	β	p	β	p	β	p
Constant	-5.38	<0.01	- 3.14	<0.01	- 1.77	<0.01	- 0.55	<0.01	-1.26	<0.01	-0.52	0.12	0.32	0.42	- 0.20	0.13
Male (Dummy)	--	--	0.35	<0.01	0.27	<0.01	0.17	<0.01	--	--	0.18	<0.01	0.17	<0.01	0.12	<0.01
Age 34 or under (Dummy)	--	--	0.43	<0.01	- 0.05	0.55	- 0.09	0.29	--	--	0.12	0.07	- 0.01	0.90	- 0.01	0.91
Age 35 to 59 (Dummy)	--	--	0.52	<0.01	0.06	0.44	0.01	0.89	--	--	0.18	<0.01	0.05	0.57	0.04	0.66
Age 60 or older (Dummy)	--	--	Fixed at zero		Fixed at zero		Fixed at zero		--	--	Fixed at zero		Fixed at zero		Fixed at zero	
Presence of children in household (Dummy)	--	--	- 0.15	<0.01	- 0.05	0.39	- 0.02	0.66	--	--	-0.00	0.98	0.01	0.88	- 0.00	0.99
Residence is a house (Dummy)	--	--	0.12	0.01	0.14	<0.01	0.13	<0.01	--	--	0.09	0.05	0.08	0.10	0.08	0.12
Residence is ownedoutright	--	--	- 0.00	0.93	0.03	0.55	0.04	0.48	--	--	-0.06	0.38	- 0.04	0.51	- 0.04	0.54
Residence is owned (paying off mortgage)	--	--	0.28	<0.01	0.22	<0.01	0.17	<0.01	--	--	0.01	0.91	- 0.04	0.45	- 0.05	0.41
Residence is rented or other housing tenure	--	--	Fixed at zero		Fixed at zero		Fixed at zero		--	--	Fixed at zero		Fixed at zero		Fixed at zero	
Resides in Large urban area	--	--	- 0.03	0.67	- 0.03	0.69	- 0.05	0.51	--	--	-0.08	0.34	- 0.06	0.49	- 0.07	0.44
Resides in Other urban area	--	--	0.09	0.23	0.10	0.18	0.08	0.25	--	--	0.02	0.78	0.03	0.74	0.03	0.77
Resides in Accessible small town	--	--	0.17	0.06	0.17	0.05	0.16	0.07	--	--	0.11	0.26	0.12	0.22	0.12	0.24

Resides in Remote Small Town	--	--	- 0.05	0.67	- 0.04	0.69	- 0.04	0.67	--	--	0.02	0.88	0.01	0.97	0.00	0.99
Resides in Accessible rural area	--	--	0.14	0.09	0.17	0.04	0.15	0.08	--	--	0.31	<0.01	0.32	<0.01	0.31	<0.01
Resides in Remote rural area	--	--	Fixed at zero		Fixed at zero		Fixed at zero		--	--	Fixed at zero		Fixed at zero		Fixed at zero	
Holds driving licence	--	--	0.57	<0.01	0.53	<0.01	0.53	<0.01	--	--	0.13	0.01	0.12	0.03	0.12	0.03
Household is recipient of any benefit income (Dummy)	--	--	--	--	- 0.02	0.73	- 0.10	0.66	--	--	--	--	0.01	0.90	- 0.26	0.33
Household is recipient of any pension/annuity income (Dummy)	--	--	--	--	- 0.06	0.42	0.47	0.14	--	--	--	--	0.04	0.62	0.13	0.76
Individual is recipient of any wage income (Dummy)	--	--	--	--	0.80	<0.01	- 2.22	<0.01	--	--	--	--	0.27	<0.01	- 0.18	0.61
Spouse is recipient of any wage income (Dummy)	--	--	--	--	- 0.03	0.57	0.57	0.05	--	--	--	--	0.15	0.01	1.39	<0.01
Household is recipient of any income from other sources (Dummy)	--	--	--	--	- 0.06	0.23	0.17	0.39	--	--	--	--	- 0.02	0.76	0.13	0.59
ln(Amount of benefit income household receives, GBP/year)	--	--	--	--	--	--	0.01	0.64	--	--	--	--	--	--	0.03	0.31
ln(Amount of pension/annuity income household receives, GBP/year)	--	--	--	--	--	--	- 0.05	0.16	--	--	--	--	--	--	- 0.01	0.82
ln(Amount of wage income individual receives, GBP/year)	--	--	--	--	--	--	0.33	<0.01	--	--	--	--	--	--	0.04	0.23
ln (Amount of wage income spouse receives, GBP/year)	--	--	--	--	--	--	- 0.05	0.09	--	--	--	--	--	--	- 0.13	<0.01
ln(Amount of income household receives from other sources, GBP/year)	--	--	--	--	--	--	- 0.03	0.29	--	--	--	--	--	--	- 0.02	0.52
ln(Amount of income household receives from all sources, GBP/year)	0.62	<0.01	0.28	<0.01	0.13	<0.01	--	--	0.15	<0.01	0.04	0.29	- 0.06	0.16	--	--

Table A1: Parameter estimates, models of work-related vehicle-kilometres of travel where SHS respondents with any income imputation are removed from estimation sample.B = mean parameter estimate; p = p-value

	ln(Non-work-related distance, kms/day, weekdays) Restricted specification #1		ln(Non-work-related distance, kms/day, weekdays) Restricted specification #2		ln(Non-work-related distance, kms/day, weekdays) Restricted specification #3		ln(Non-work-related distance, kms/day, weekdays) Full specification		ln(Non-work-related distance, kms/day, weekend days) Restricted specification #1		ln(Non-work-related distance, kms/day, weekend days) Restricted specification #2		ln(Non-work-related distance, kms/day, weekend days) Restricted specification #3		ln(Non-work-related distance, kms/day, weekend days) Full specification	
Sample size (unweighted)	6,217		6,217		6,217		6,217		2,027		2,027		2,027		2,027	
r^2	0.017		0.113		0.122		0.122		0.046		0.145		0.150		0.153	
Adjusted-r^2	0.017		0.111		0.119		0.118		0.046		0.138		0.142		0.143	
	β	p	β	p	β	p	β	p	β	p	β	p	β	p	β	p
Constant	-1.70	<0.01	- 0.27	.273	- 1.36	<0.01	- 0.28	0.01	-3.72	<0.01	- 1.61	<0.01	- 1.56	0.01	- 0.29	0.17
Male (Dummy)	--	--	0.05	.033	0.08	0.02	0.10	<0.01	--	--	0.32	<0.01	0.32	<0.01	0.30	<0.01
Age 34 or under (Dummy)	--	--	- 0.19	.058	0.13	0.12	0.15	0.08	--	--	- 0.00	1.00	- 0.01	0.97	- 0.03	0.84
Age 35 to 59 (Dummy)	--	--	- 0.10	.049	0.20	0.01	0.22	<0.01	--	--	- 0.06	0.48	- 0.08	0.56	- 0.11	0.43
Age 60 or older (Dummy)	--	--	Fixed at zero		Fixed at zero		Fixed at zero		--	--	Fixed at zero		Fixed at zero		Fixed at zero	
Presence of children in household (Dummy)	--	--	0.19	.040	0.22	<0.01	0.23	<0.01	--	--	- 0.08	0.30	- 0.05	0.67	- 0.03	0.77
Residence is a house (Dummy)	--	--	0.10	.043	0.10	0.02	0.11	0.01	--	--	0.10	0.19	0.12	0.14	0.13	0.10
Residence is ownedoutright	--	--	0.20	.053	0.16	<0.01	0.17	<0.01	--	--	0.07	0.46	0.04	0.68	0.05	0.61
Residence is owned (paying off mortgage)	--	--	0.11	.046	0.15	<0.01	0.18	<0.01	--	--	0.35	<0.01	0.35	<0.01	0.33	<0.01
Residence is rented or other housing tenure	--	--	Fixed at zero		Fixed at zero		Fixed at zero		--	--	Fixed at zero		Fixed at zero		Fixed at zero	
Resides in Large urban area	--	--	- 0.07	.074	- 0.08	0.30	- 0.07	0.33	--	--	- 0.06	0.65	- 0.07	0.63	- 0.06	0.66
Resides in Other urban area	--	--	- 0.01	.073	- 0.01	0.84	- 0.01	0.84	--	--	0.02	0.90	0.02	0.86	0.03	0.82
Resides in Accessible small town	--	--	0.09	.087	0.09	0.32	0.09	0.31	--	--	0.17	0.29	0.18	0.25	0.18	0.28
Resides in Remote Small Town	--	--	- 0.09	.102	- 0.10	0.33	- 0.10	0.34	--	--	0.04	0.84	0.04	0.84	0.05	0.79
Resides in Accessible rural area	--	--	0.25	.083	0.24	<0.01	0.25	<0.01	--	--	0.28	0.07	0.28	0.07	0.28	0.07
Resides in Remote rural area	--	--	Fixed at zero		Fixed at zero		Fixed at zero		--	--	Fixed at zero		Fixed at zero		Fixed at zero	
Holds driving licence	--	--	0.86	.044	0.87	<0.01	0.88	<0.01	--	--	0.86	<0.01	0.84	<0.01	0.86	<0.01

Household is recipient of any benefit income (Dummy)	--	--	--	--	- 0.04	0.39	- 0.19	0.39	--	--	--	--	- 0.03	0.78	- 0.04	0.93
Household is recipient of any pension/annuity income (Dummy)	--	--	--	--	0.18	0.01	- 0.53	0.11	--	--	--	--	0.02	0.86	0.29	0.66
Individual is recipient of any wage income (Dummy)	--	--	--	--	- 0.25	<0.01	0.20	0.48	--	--	--	--	0.08	0.42	- 1.36	0.02
Spouse is recipient of any wage income (Dummy)	--	--	--	--	- 0.17	<0.01	- 0.64	0.03	--	--	--	--	- 0.05	0.57	- 0.83	0.15
Household is recipient of any income from other sources (Dummy)	--	--	--	--	0.06	0.24	0.04	0.83	--	--	--	--	0.30	<0.01	0.21	0.58
ln(Amount of benefit income household receives, GBP/year)	--	--	--	--	--	--	0.02	0.48	--	--	--	--	--	--	0.00	0.96
ln(Amount of pension/annuity income household receives, GBP/year)	--	--	--	--	--	--	0.08	0.02	--	--	--	--	--	--	- 0.02	0.74
ln(Amount of wage income individual receives, GBP/year)	--	--	--	--	--	--	- 0.04	0.20	--	--	--	--	--	--	0.16	0.01
ln (Amount of wage income spouse receives, GBP/year)	--	--	--	--	--	--	0.06	0.06	--	--	--	--	--	--	0.09	0.12
ln(Amount of income household receives from other sources, GBP/year)	--	--	--	--	--	--	0.01	0.85	--	--	--	--	--	--	0.02	0.74
ln(Amount of income household receives from all sources, GBP/year)	0.25	<0.01	0.02	.029	0.13	<0.01	--	--	0.47	<0.01	0.15	0.01	0.14	0.04	--	--

Table A2: Parameter estimates, models of non-work-related vehicle-kilometres of travel where SHS respondents with any income imputation are removed from estimation sample. β = mean parameter estimate; p = p-value

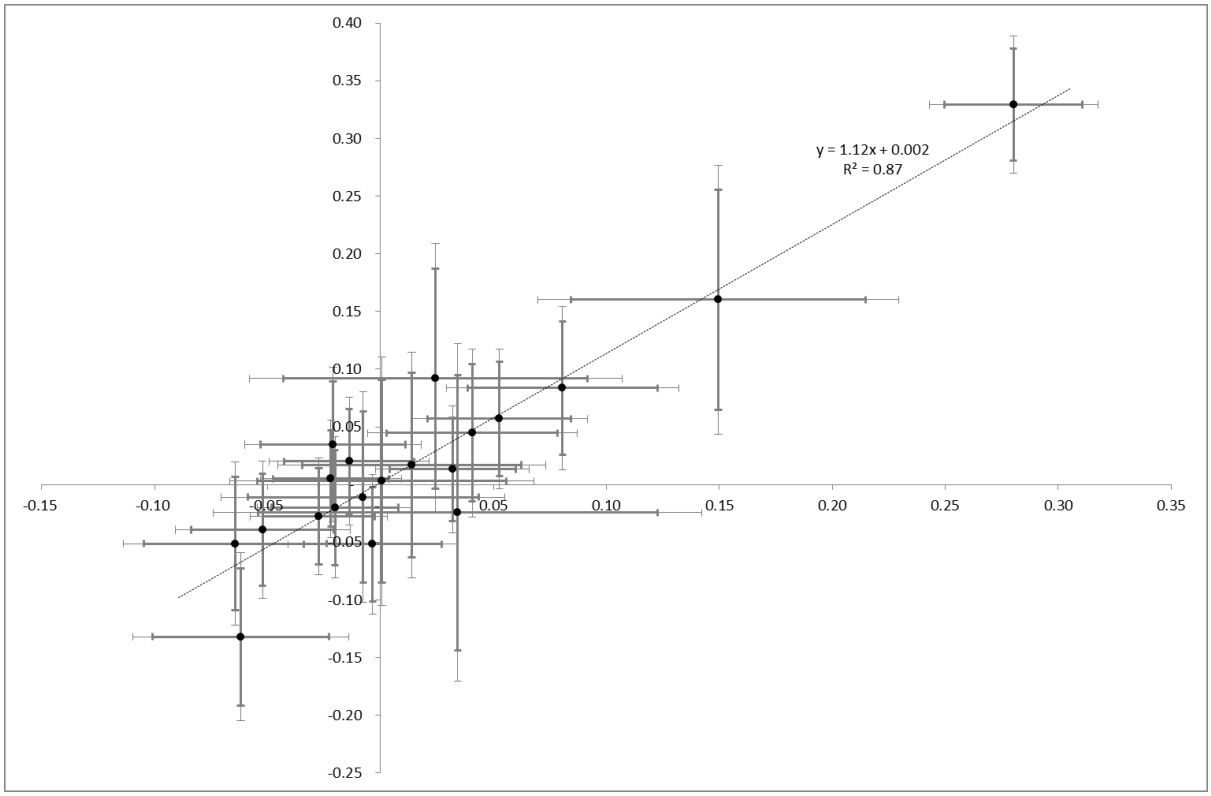

Figure A1: Comparison of estimated income elasticities from full model specification. X-axis and Y-axis show estimates from the estimation with the full data sample and only respondents with no income imputation, respectively. Bold and non-bold error bars are the 90% and 95% confidence intervals, respectively. Dashed line is the line of best fit.