Factors associated with young adults delaying and foregoing driving licences

Scott Le Vine, Research Associate, Centre for Transport Studies, Imperial College London,
Charilaos Latinopoulos, Doctoral Candidate, Imperial College London and
John Polak, Professor, Centre for Transport Studies, Imperial College London

1 Introduction

There is growing interest in the decline in young adults' licence-acquisition rates in a number of industrialised counties. While it is unclear whether this phenomenon is still ongoing or licence-acquisition has stabilised, across a wide set of OECD countries the current rates are well below the historic peaks of a decade or two ago (Delbosc & Currie 2013a, ifmo 2013, Kuhnimhof et al. 2012, Tefft et al. 2013, Grimsrud and El-Geneidy 2013).

Figure 1 shows that the peak rate of licence-holding for young adults (age 17 – 29) was in the early 1990s, after which a period of decline in the late 1990s was followed by a more or less steady-state pattern in the 2000s.

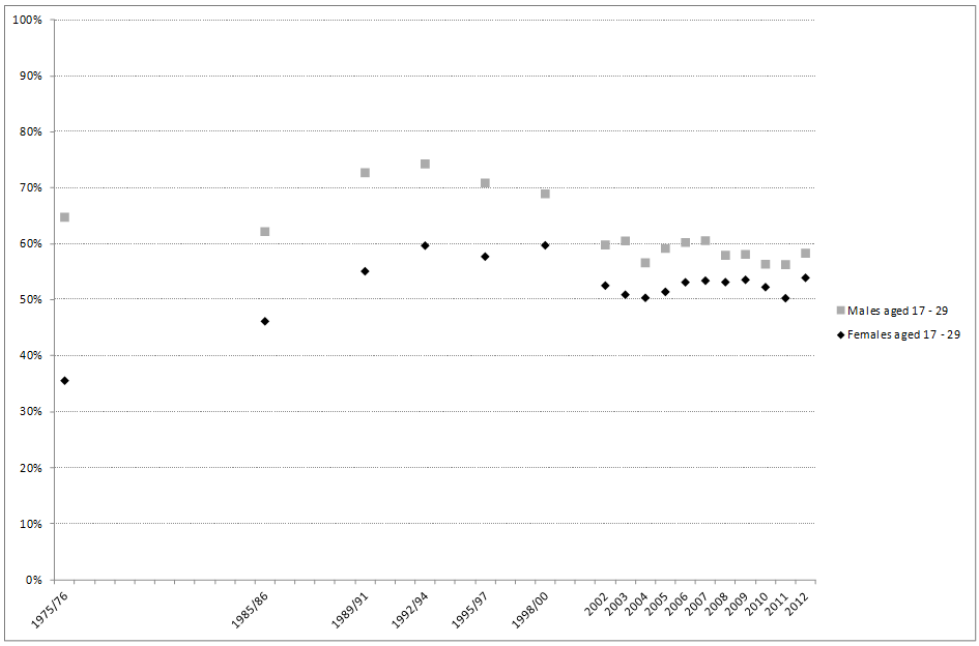

Figure 1: Time trend in percentage of 17-29 year old adult respondents to the British National Travel Survey that hold a full driving licence, separately for men and women

Researchers studying the historic drop in licence-acquisition rates generally appeal to one of two methods – attempting to draw statistical inferences from analysis of survey datasets where both driver-status and hypothesised correlates are observed (e.g. McDonald and Trowbridge 2009, Sivak & Schoettle 2012, Delbosc and Currie 2013b, Shults and Williams 2013), or collecting and analysing data in which unlicenced young people are asked explicitly why they do not have a driving licence (Tefft et al. 2013, Schoettle and Sivak 2013). The advantage of the former strategy is that it makes use of direct observations (*revealed-preference* data) of relevant personal attributes, whereas the latter relies on self-reported motivations. In the latter case the researchers may tailor the questionnaire

instrument to the specific needs of the research question, but run the risk of missing aspects of the issue that they do not design the instrument to take into account.

2 Analysis of stated reasons for not holding a full driving licence

This section uses data from the 2010 British National Travel Survey (NTS). NTS is a large-scale household survey of personal travel that is nationally-representative of the British population (Rofique et al. 2011). The survey consists of both a household interview and seven-day travel diary completed by all respondents, and the sample is a repeated cross-section (i.e. different households each year).

For the purpose of this analysis, 'young adults' are defined as those under age 30. The unweighted sample size of people aged from 17 (the minimum age for acquiring both a provisional and a full driving licence in Britain) to 29 is 2,972; the sample is weighted for analysis purposes to be nationally-representative of British adults in this age band.

Whether an NTS respondent is coded as holding a full car driving licence has consistently been defined by their response to the following questions: *"Do you hold a full driving licence valid in Great Britain to drive either a car, or a motorcycle, scooter or moped? [IF YES] Is it for a car only, a motorcycle only or for both, or is it for a car with special adaptations?*" 55% of young British adults in 2010 reported having a full car driving licence; the analysis in this section focuses on the remaining 45%.

All adult NTS respondents that do not hold a full car driving licence and are not learning to drive are asked why they do not drive. They are presented with a showcard with a list of pre-specified reasons; if they indicate more than one reason they are asked to identify one as the 'main' reason that they do not drive. 49% of young adult respondents that are not currently learning to drive cited only one reason for not driving; the mean number cited was 2.5. It must be kept in mind that NTS respondents' identified reasons for not driving are self-reported and are therefore inherently subject to a variety of errors and biases, such as social desirability bias (cf. Fisher 1993).

Table 1 shows the breakdown of not-fully-licenced young adults by the main and secondary reasons they report for not driving. Those that indicate that they are learning to drive are also shown; in those cases we observe that status but not any other information as they are not asked to self-report any further reasons for not driving.

Table 1: Percentage of NTS young respondents (age 17-29) that indicate each listed reason is the main (or a secondary) reason that they do not drive

	The main reason	A reason (either main or secondary)	Main ÷ (main + secondary)
Currently learning to drive	28%*	--	--
Cost of learning to drive	23%	36%	63%
Not interested in driving	9%	12%	71%
Family/friends drive me when necessary	8%	20%	42%
Other forms of transport available	7%	17%	39%
Too busy to learn	5%	10%	50%
Physical difficulties/disabilities/health problems	4%	4%	93%
Safety concerns/Nervous about driving	4%	8%	49%
Cost of buying a car	3%	24%	13%
Other	3%	4%	82%

Cost of insurance	3%	23%	13%
Put off by theory/practical test	1%	4%	38%
Other general motoring costs	1%	10%	10%
Environmental reasons	1%	3%	22%
Busy/congested roads	0%	3%	16%
Driving without licence	0%	0%	75%
Too old	0%	0%	0%

** Respondents indicating that they are learning to drive are not asked to self-report any further reasons for not driving*

We see that those learning to drive are the biggest single group of unlicenced young adults (28%). As 45% of British adults under age 30 do not have a driving licence, this implies that young British adults are spending a mean of 1.7 years learning to drive after they turn 17 (28% * 45% * 13 years of age between age 17 and age 29). This 28% is followed by those that indicate they are deterred by the costs of learning to drive (23%), and the implication is that for about half (51%) of unlicenced young British adults, learning to drive is the main stated reason for not driving. Recent studies of licence-acquisition have not directly addressed the costs of learning to drive, which in Britain have been shown to have a mean in excess of £1,000 ($1,600 U.S. dollars) for people that pass the driving test (Wells et al. 2008).

The next most prevalent main reasons for not driving relate to seeing driving as a relatively low priority. 9% report that they are not interested in driving, 8% indicate that family or friends drive them when necessary, 7% report that other forms of transport are available, and another 5% indicate that they are 'too busy to learn'. Thus, just under three in ten (29%) young adults seem to view driving as a low priority. A combined total of 7% cite costs other than learning to drive as the main reason (3% cite the cost of buying a car, another 3% cite the cost of insurance, and 1% cite other general motoring costs). All other reasons are cited as main reasons for not driving by fewer than 5% of unlicenced young adults.

Of the times that each reason is cited as a reason for not driving (either main or secondary), the furthest-right column in Table 1 looks at the percentage of the time that it is cited at the main reason. Analysis of this type of data structure – that investigates the relative explanatory power when multiple reasons for not driving are cited by an individual – was not possible on earlier studies, even those that did allow respondents to report multiple reasons. We see that, whilst physical/health difficulties were cited by only 4% of unlicenced young adults, over 90% of those mentioning this reason cited it as the main reason they do not drive. In other words, few young adults report that health reasons prevent them from driving, but those that do cite their health are very likely to indicate that this is the main reason that they do not drive. A similar pattern was found for the unspecified 'other' category (3% cited it, and of these people 82% said it was the main reason they do not drive). At the other end of the distribution are three 'cost' reasons – the cost of buying a car (cited as the main reason only 13% of all times that it is cited), the cost of insurance (also 13%), and other general motoring costs (10%). These reasons tend to be cited as secondary factors rather than the main reasons that young adults do not drive.

To look at socio-demographic correlates of stated reasons for not driving, unlicenced young adults that were not learning to drive at the time of their interview were segmented into three mutually-exclusive groups on the basis of their self-reported reasons for not driving. Main and secondary reasons for not driving were treated identically. For comparison purposes, the same statistics were also calculated for people that are fully-licenced and that are learning to drive. The five segments in this analysis were therefore:

- Those young adults that hold a full car driving licence
- Those that are learning to drive

- Those that cite at least one 'cost' reason for not driving, but none of the 'non-cost' reasons
- Those that cite at least one of the 'cost' reasons for not driving and at least one of the 'non-cost' reasons
- Those that cite at least one 'non-cost' reason for not driving, but none of the 'cost' reasons

Table 2 shows the characteristics of each of these five segments. Members of the 'cost-only' segment (mean age 21) tend to be younger than the 'cost plus non-cost' (22 years of age) and 'non-cost-only' segments (23 years of age). The 'cost plus non-cost' segment has a larger share of female members (63%) than the 'cost-only' (51%) or 'non-cost-only' (47%) segments, and the highest mean level of *personal* income (£8,100). Of young adults that cite costs as a reason for not driving, both personal incomes and incomes earned by other household members are lower for those that cite costs alone (£4,900 and £21,100 respectively), relative to the segment of young adults that indicate both cost and non-cost reasons for not driving (£8,100 and £26,900 respectively). On the basis of this segmentation analysis we can therefore identify the presence of two distinct groups of young people that indicate that costs deter them from driving – one group that is less well-off financially and that report that costs alone are the primary deterrent, and one that is somewhat better-off and that indicates that other reasons also apply.

Table 2: Characteristics of segments of young adults (age 17-29), with segments defined by licence-holding status, learning to drive status and aggregated classes of stated reasons for not driving

	Only cost reason(s) cited	Cost reason(s) and non-cost reason(s) cited	Only non-cost reason(s) cited	Young adults learning to drive	Young adults with a full driving licence
Percent of not-fully-licenced young adults that are not learning to drive	28%	28%	44%	--	--
Average age of segment members	21	22	23	21	24
Of segment members, percentage that is female	51%	63%	47%	51%	47%
Of segment members, average annual personal income	£4,900	£8,100	£7,380	£6,900	£15,000
Of segment members, average annual aggregate income earned by all other household members	£21,100	£26,900	£28,000	£37,300	£32,200
Of segment members, the percentage that is employed	35%	56%	44%	54%	81%
Of segment members, the percentage that was born outside of the United Kingdom	12%	17%	29%	13%	12%
Of segment members, the percentage that lives in London	17%	14%	28%	24%	13%

Of segment members, the percentage that lives with 'their own' children (more than 15 years younger)	16%	14%	13%	7%	13%
Of segment members, the percentage that lives with at least one 'parent' (an adult more than 15 years older)	59%	44%	56%	66%	40%
Unweighted sample size	277	273	424	412	1,586

Mean personal incomes are lower for all of the non-driving segments (including those indicating that they are learning to drive) than for the fully-licenced group of young adults, but the 'learning to drive' segment has the highest mean level of income earned by other household members. The employment rate is higher amongst young adults with a full car driving licence (81%) than any of the not-fully-licenced segments (values range from 35% to 56%).

Young adults in the 'non-cost' reason(s) segment are the most likely to have been born outside of the United Kingdom, and also the most likely to reside in London (Britain's largest city).

3 Logistic regression analysis of NTS dataset

In this section we look at demographic and economic correlates of whether a person has a driving licence or not, using a logistic regression model. As with any cross-sectional regression model the results show statistical association, which cannot be interpreted as unambiguous evidence of causality.

The set of variables we tested includes spatial variables as well as personal and household characteristics. The estimation results are shown in Table 3.

Table 3: Estimation results from binary logistic regression model of whether a NTS respondent age 17-29 holds a full car driving licence

	Mean parameter estimate	Implied odds ratio	p-value
Intercept	-5.17	--	--
Male gender	0.125	1.13	0.12
Age	0.1307	1.14	<0.01
Employed	0.647	1.91	<0.01
Employed full time	0.406	1.50	<0.01
Holds degree or higher academic qualification	0.94	2.56	<0.01
Presence of children under age 16 in household, with oldest child at least 15 years younger than the young adult	-0.0839	0.92	0.48
Presence of an adult in the household at least 15 years older than the young adult	-0.322	0.72	<0.01
Born outside of the UK	-0.809	0.45	<0.01
Natural log of young adult's own personal income (British pounds)	0.202	1.22	<0.01
Natural log of income of other household members (British pounds)	0.0533	1.05	<0.01
Residence in London	-0.668	0.51	<0.01
Residence in other urban settlements	-0.121	0.89	0.51
Residence in rural areas	Fixed at zero for normalisation		
Natural log of population denstiy of postcode sector (persons/hectare)	-0.140	0.87	<0.01
Walking time (minutes) to nearest public transport stop	0.02067	1.02	0.05
Null log-likelihood			-2,626.8
Final log-likelihood			-2,018.7
Rho-squared (McFadden's)			0.231
Adjusted rho-squared			0.226

We tested for a statistical association between licence-holding and migration status, and we found that being born outside of the UK is strongly negatively linked with holding a driving licence. The statistical relationship is that the odds of licence-holding are more than halved (-55%), net of other confounding relationships such as labour force participation, income level or place of residence. This analysis does not indicate, however, the causal mechanisms for this finding. Possibilities in need of further enquiry include paperwork difficulties, lifestyle preferences, and the unique spatial distribution of social networks and activity patterns. There is also the important question (which cannot be directly investigated with British NTS data) of the degree to which this effect is durable or may decay with the length of time one lives in the receiving country, which may well be context-dependent.

We estimated separate statistical relationships between licence-holding and income that is earned by the young adult versus the sum of income from other household members. We found that, in keeping with intuition, one's own income has a stronger relationship with licence-holding (roughly four times as large) than does residual household income, and that both of the associations are positive as we would expect. The implication is that changes in personal income versus earned-by-others-in-household income are likely to be associated with very different changes in a young adult's likelihood of holding a licence.

4 Analysis of the SHS dataset

This section describes the analysis undertaken to investigate the relationship between Internet use and acquisition of a driving licence in Scotland. The dataset employed here is the 2005/06 version of the SHS (Hope, n.d.).

The SHS is a large-sample general social survey that has been undertaken continuously by the Scottish government since 1999. The SHS interview collects limited information about all members of interviewed households, and a higher level of detail for a single randomly-selected adult (age 16+) in each household. The analysis draws from the "random-adult" SHS data for young adults between 17 and 29 years old. For the purposes of the analysis, the data has been weighted to represent the Scottish adult population in this age band. The unweighted sample size is 3,819 young adults.

Table 4 contains descriptive statistics for the analysed variables, including a cross-tabulation with licence-holding:

Table 4: Descriptive statistics of SHS sample of Scottish young adults (age 17 to 29). Values in brackets are standard errors

Indicator	All young adults in sample	Holders of a full car driving licence	Non-holders of a full car driving licence
Percentage that use the internet	73%(1%)	82%(1%)	64%(1%)
Age	23.1 (0.06)	24.2 (0.08)	21.9 (0.09)
Income	£22,344 (£232)	£25,024 (£318)	£19,389 (£324)
Percentage that hold a full car driving licence	52% (1%)	-	-
Percentage female	53%(1%)	51% (1%)	56% (1%)
Percentage living in large urban areas	48% (1%)	45% (1%)	51% (1%)
Percentage living in other urban areas	28% (1%)	27% (1%)	29% (1%)
Percentage living in small accessible towns	8% (<0.5%)	9% (1%)	7% (1%)
Percentage living in small remote towns	4% (<0.5%)	3% (<0.5%)	5% (1%)
Percentage living in accessible rural areas	8% (<0.5%)	11% (1%)	6% (1%)
Percentage living in remote rural areas	4% (<0.5%)	5% (1%)	2% (<0.5%)
Percentage that are employed full-time	50% (1%)	66% (1%)	32% (1%)
Percentage that are employed part-time	9% (1%)	8% (1%)	10% (1%)
Percentage that are not in workforce	11% (1%)	6% (1%)	16% (1%)

Percentage that are unemployed	8% (<0.5%)	3% (<0.5%)	13% (1%)
Percentage that are students at secondary school	3% (<0.5%)	0% (<0.5%)	6% (1%)
Percentage that are students in higher education	19% (1%)	17% (1%)	21% (1%)
Percentage that are in government work/training scheme	0% (<0.5%)	0% (<0.5%)	1% (<0.5%)
Percentage living with their 'own children'	23% (1%)	20% (1%)	26% (1%)
Percentage living with 'parents'	41%(1%)	35%(1%)	48%(1%)
Percentage that hold 'O' grade or equivalent qualification	25% (1%)	18% (1%)	34% (1%)
Percentage that hold H' grade/ 'A' level or equivalent qual.	31% (1%)	32% (1%)	30% (1%)
Percentage that hold HNC/HND or equivalent qual.	13% (1%)	16% (1%)	9% (1%)
Percentage that hold Degree or professional. qual. or higher deg.	20% (1%)	28% (1%)	10% (1%)
Percentage that hold no qualification	11% (1%)	6% (1%)	17% (1%)
Travel behaviour (from SHS travel diary instrument)			
Average annual car driving mileage	1,808 (77.6)	3,529 (139.3)	41 (17.5)
Average annual number of car driving journeys	302 (9.9)	591(16.8)	7 (1.9)
Average annual mileage (all but car driving)	1,964 (79.1)	1,493 (179.8)	2,447 (110.8)
Average annual number of journeys (all but car driving)	507 (12.1)	329 (14.8)	691 (18.3)
Classes of online-activity			
Buying or ordering tickets and services	46% (1%)	58% (1%)	33% (1%)
Finding information about goods/services	47% (1%)	57% (1%)	36% (1%)
Finding information related to education	39% (1%)	43% (1%)	35% (1%)
General browsing or surfing	59% (1%)	68% (1%)	49% (1%)
Grocery shopping	10% (1%)	13% (1%)	7% (1%)
Looking for work	35% (1%)	42% (1%)	28% (1%)
Non-grocery shopping	31% (1%)	40% (1%)	22% (1%)
Online learning	18% (1%)	19% (1%)	16% (1%)
Paying rent	2% (<0.5%)	2% (<0.5%)	2% (<0.5%)
Personal banking / financial / investment activities	28% (1%)	39% (1%)	17% (1%)
Playing or downloading games	24% (1%)	24% (1%)	25% (1%)
Playing or downloading music	42% (1%)	45% (1%)	40% (1%)
Using chat rooms or sites	21% (1%)	18% (1%)	24% (1%)
Using e-mail	65% (1%)	74% (1%)	54% (1%)
Using or accessing government/official sites	21% (1%)	27% (1%)	15% (1%)
Voting	1% (<0.5%)	1% (<0.5%)	1% (<0.5%)
None of these	1% (<0.5%)	1% (<0.5%)	1% (<0.5%)
Time spent online			
Up to 1 hour per week	15% (1%)	16% (1%)	13% (1%)
Over 1 hour, up to 5 hours per week	28% (1%)	33% (1%)	23% (1%)
Over 5 hours, up to 10 hours per week	15% (1%)	18% (1%)	12% (1%)
Over 10 hours, up to 20 hours per week	9% (<0.5%)	10% (1%)	8% (1%)
Over 20 hours per week	6% (<0.5%)	5% (1%)	7% (1%)

In order to discriminate between aspects of licence-holding of internet users that are due to confounding socio-demographics and those linked *ceteris paribus* to online behaviour, a series of multivariate logistic regression analyses were performed. For all models, the dependent variable indicates whether each young-adult SHS respondent holds a full car driving licence or not. As with Delbosc/Currie (2013a), all of the models are of binary logistic form with cross-sectional parameter estimates and year-specific error terms.

- **Model run #1** contains only the socio-demographic and spatial control variables.
- **Model run #2** adds a single dummy parameter for Internet usage into the model.
- **Model run #3** is identical to #2, with the addition of time-spent-online-per-week as a continuous quantity (with values allocated to the mid-points of each of the time-spent-online bands, and the 20-plus-hours-per-week category coded as 25-hours-per-week).

- **Model run #4** is identical to #3, but time-spent-online-per-week is entered as a series of dummy variables for each self-reported time band rather than a continuous quantity.
- **Model run #5** is identical to #4, with the addition of 17 dummy internet-activity variables for whether the respondent participated in the respective online activity or not (Buying or ordering tickets and services etc.).
- **Model runs #6 and #7** are analogous to #3 and #4 respectively, but using a sequential two-step estimation procedure. In the first step a linear regression model is estimated in which the Internet-activity binary variables are used as independent variables to calculate a simulated value of time-spent-online-per-week for each respondent In the second step a logistic regression model identical to model run #2 is estimated, but rather than respondents' self-reported time-spent-online-per-week includes the simulated calculation of this quantity. This two-step procedure is designed to address the potential for any cross-correlation between the time-spent and Internet-activity parameters in models #6 and #7 leading to biased parameter estimates. (NB: the largest such correlation coefficient in the SHS dataset was 0.44, between frequency-of-Internet-use and use-of-Internet-for-emailing). In model run #6 time-spent-online is treated as a continuous quantity (as in model run #3). The range of predicted time-spent-online values proved not to be wide enough to estimate model run #7 using the same categories as model run #4, therefore in model run #7 time-spent-online is binned into four quartiles to investigate possible non-linearities with respect to time-spent-online.

The results of the seven regression models are presented in Table 5. The rows associated with the Internet usage parameters (of primary substantive interest in this analysis) are highlighted in **bold** text; control-variables are in un-bolded text. As with any cross-sectional logistic regression, it must be borne in mind that the direction of causality is not shown by the estimated parameters, which merely capture *ceteris paribus* statistical association.

The estimated effects of the socio-demographic control variables on licence-holding are consistent with those reported in Delbosc and Currie (2013a), with two notable exceptions. The effects associated with living with 'one's children' and with 'one's parents' are both negative and statistically significant. By contrast, Delbosc/Currie (2013a) found them both to be positive and statistically significant. It cannot be known whether these different effects are due to data differences or differences in contexts; the accumulation of further findings from other contexts will be necessary to reach a conclusion. Of the two control-variable effects that extend from the Delbosc/Currie (2013a) set of covariates, with regards to the first (residence location) we find that living in larger settlements is nearly-monotonically negatively linked with licence-holding (the exception being the small-remote-towns spatial class), and that higher levels of educational attainment is also nearly-monotonically positively associated with licence-holding. The finding regarding spatial class is consistent with the findings of McDonald and Trowbridge (2009). With regards to the second such effect (highest level of educational attainment), we find a generally positive *ceteris paribus* relationship between educational attainment and licence-holding, with the largest difference being between holding a degree or higher qualification and holding no educational qualification.

Model run #2 shows that the estimated *ceteris paribus* statistical association between licence-holding and Internet-usage is positive and statistically significant. By converting the parameter estimate for Internet-usage into an odds-ratio (cf. Hosmer et al. 2013), it can be interpreted as implying that the odds of an Internet-using young adult holding a full-car-driving-licence are 70% larger than those of an otherwise identical young adult that does not use the Internet. In Model run #3 the effect associated with being an Internet user is still positive and statistically significant. We also find a statistically-significant ($p<0.05$) negative relationship with the amount of time spent online per week. By taking the

Table 5: Results from logistic regression models of full-car-driving-licence-holding by Scottish young adults (age 17-29), SHS data. (Values marked with * or ** are statistically significant at p<0.10 and p<0.05 respectively)

Model run #	#1	#2	#3	#4	#	#6	#7
Null log-likelihood	-2,914.93 for all model runs						
Final log-likelihood	-2,262.83	-2,246.15	-2,246.26	-2,240.35	-	-2,242.94	-2,239.74
McFadden's pseudo r^2	0.2237	0.2294	0.2301	0.2314	0	0.2305	0.2316
McFadden's adjusted pseudo r^2	0.2158	0.2212	0.2215	0.2218	0	0.2220	0.2224
Parameter estimates							
Constant	-3.044**	-3.317**	-3.345	-3.323	-	-3.284	-3.302
Lowest income quartile	Reference						
Second income quartile	0.108	0.094	0.098	0.101	0	0.094	0.099
Third income quartile	0.506**	0.453**	0.453**	0.449**	0	0.458**	0.464
Fourth income quartile	0.860**	0.772**	0.775**	0.776**	0	0.780**	0.784
Employed full-time	Reference						
Employed part-time	-0.675**	-0.686**	-0.684**	-0.687**	-	-0.678**	-0.682
Not in workforce	-1.367**	-1.332**	-1.321**	-1.325**	-	-1.331**	-1.331**
Unemployed	-1.677**	-1.658**	-1.630**	-1.606**	-	-1.648**	-1.652**
Secondary school student	-2.209**	-2.301**	-2.274**	-2.307**	-	-2.255**	-2.247**
Higher education student	-0.358**	-0.427**	-0.389**	-0.405**	-	-0.392**	-0.393**
On work training scheme	-1.881**	-1.947**	-1.953**	-1.959**	-	-1.933**	-1.950**
Lives with 'own children'	-0.236**	-0.176	-0.176	-0.171	-	-0.176	-0.169
Lives with 'parents'	-0.225**	-0.226**	-0.218**	-0.230**	-	-0.228**	-0.219**
Female	-0.102	-0.119	-0.140*	-0.141*	-	-0.149*	-0.158
Age	0.159**	0.161**	0.162**	0.161**	0	0.159**	0.159**
Year 2005	Reference						
Year 2006	0.054	0.033	0.044	0.032	0	0.044	0.042
Residence in remote rural areas	Reference						
Accessible rural areas	-0.217	-0.196	-0.197	-0.210	-	-0.189	-0.179
Remote small towns	-1.092**	-1.122**	-1.106**	-1.124**	-	-1.108**	-1.093**
Accessible small towns	-0.555**	-0.530**	-0.521**	-0.523**	-	-0.508**	-0.485**
Other (not large) urban areas	-0.955**	-0.971**	-0.960**	-0.966**	-	-0.953**	-0.931**
Large urban areas	-0.989**	-0.977**	-0.962**	-0.975**	-	-0.950**	-0.921**
No educational qualifications	Reference						
'O' grade or equivalent	0.085	0.008**	0.009	0.019	0	0.015	0.010
'H' grade / 'A' level or equivalent	0.828**	0.693**	0.697**	0.704**	0	0.715**	0.708**
HNC/HND or equivalent	0.789**	0.621**	0.623**	0.621**	0	0.650**	0.642**

Degree/professional qualification/higher degree	1.089**	0.897**	0.908**	0.900**	0	0.928**	0.910**
Status as internet-user	--	0.529**	0.604**	--	-	0.762**	--
Time spent online per week (hours/week)	--	--	-0.012**	--	-	--	--
Time spent online per week (up to 1 hour)	--	--	--	0.525**	0	--	--
Time spent online per week (over 1 hour, up to 5 hours)	--	--	--	0.526**	0	--	--
Time spent online per week (over 5 hours, up to 10)	--	--	--	0.709**	0	--	--
Time spent online per week (over 10 hours, up to 20)	--	--	--	0.531**	0	--	--
Time spent online per week (over 20 hours)	--	--	--	0.101	-	--	--
Predicted time spent online per week (hours/week)	--	--	--	--	-	-0.038**	--
Predicted time spent online per week (lowest quartile)	--	--	--	--	-	--	0.635**
Predicted time spent online per week (second quartile)	--	--	--	--	-	--	0.720**
Predicted time spent online per week (third quartile)	--	--	--	--	-	--	0.408**
Predicted time spent online per week (highest quartile)	--	--	--	--	-	--	0.341**
Buying or ordering tickets	--	--	--	--	0	--	--
Finding information about goods and services	--	--	--	--	0	--	--
Finding information related to education	--	--	--	--	-	--	--
General browsing or surfing	--	--	--	--	0	--	--
Grocery shopping	--	--	--	--	-	--	--
Looking for work	--	--	--	--	0	--	--
Non-Grocery shopping	--	--	--	--	0	--	--
Online learning	--	--	--	--	0	--	--
Paying rent	--	--	--	--	-	--	--
Personal banking/financial/investment activities	--	--	--	--	0	--	--
Playing or downloading games	--	--	--	--	-	--	--
Playing or downloading music	--	--	--	--	-	--	--
Using chat rooms or sites	--	--	--	--	-	--	--
Using email	--	--	--	--	0	--	--
Using or accessing governmental/official sites	--	--	--	--	-	--	--
Voting	--	--	--	--	0	--	--
None of these	--	--	--	--	0	--	--

ratio of the two parameters (0.604/-0.012), it can be calculated that the combined effects are positive for Internet users that spend less than 49 hours per week online and negative only for those that spend in excess of 49 hours per week online. In Model run #4 time-spent-online is entered as a set of independently-estimated parameters for each of the time-spent-online bands and there are two patterns in the results that are noteworthy. First, the effects for all time-spent-online categories are positive, and all except the 20-plus-hours-per-week (the heaviest-usage category) parameter are statistically significant. Second, the relationship is an inverted 'U' shape; the effects increase monotonically from no time spent online (i.e. non-users), which is fixed at zero for normalisation, up to a peak for the effect associated with the five-to-ten-hours-per-week category. The effects then decrease monotonically for all remaining categories, with the effect of the heaviest time-online-per-week category (20-plus-hours) not being statistically distinguishable from zero. Model run #5 extends from model run #4 by adding into the analysis the types of online activities that respondents indicate that they perform, in the form of 17 dummy variables. Of these online activities, four are found to be statistically significant at the $p<0.05$ level, two positively (personal-banking/financial-activities and finding-information-about-goods-and-services) and two negatively (playing/downloading-games and online-chat-rooms/sites). Two others are statistically significant at the $p<0.10$ level, both positively (e-mailing and buying/ordering-tickets-and-services). The remainder are not statistically significant, with p-values ranging from 0.15 to 0.85.

The results of Model run #6 are similar to those of Model run #3. Being an Internet user was positively associated with licence-holding, whilst the marginal effect of time-spent-online was negative. The point at which the combined effect switches from positive to negative was estimated to be 20 hours of online activity per week, compared to 49 hours in model run #3. Model runs #3 and #6 have the same number of parameters, hence the larger pseudo-r^2 of model run #6 indicates that it is statistically preferred. In Model run #7, where the predicted-time-spent-online variable is banded into quartiles, we see an inverted 'U' relationship whereby the estimated effect is largest for an intermediate category (the second quartile) and then decreases monotonically in both directions.

In order to illustrate the combined *ceteris paribus* relationship between licence-holding and these multiple aspects of Internet-usage, a sample-enumeration procedure was performed. This was required because the net effects of Internet usage arise from multiple parameters in model runs #3 through #7, rather than a single parameter that applies in the same way to all Internet users regardless of their Internet-usage profile. The sample enumeration method involved multiplying the estimated parameters associated with Internet-usage by the corresponding covariates representing the observed Internet-usage profile for each young adult in the SHS sample, in order to estimate the idiosyncratic aggregate effect of Internet usage for each respondent. For ease of interpretation, the effects were converted into odds-ratios (Hosmer et al. 2013). For each respondent, the odds ratio can be interpreted as the multiplicative effect of their idiosyncratic Internet usage profile on the odds that they hold a driving licence. Values larger than 1.0 imply a positive *ceteris paribus* relationship between licence-holding and Internet use, while the opposite applies to values below 1.0.

To expose this point via an example, let us consider the effect for a randomly chosen Internet-using SHS respondent who is at the 30th percentile of this distribution. This person is an employed 28-year-old man, living in the 'other (non-large) urban areas' spatial class in a household with an annual household income of £28,000. He works full-time and lives with 'his children' but not 'his parents'. He holds a degree-or-professional-qualification-or-a-higher-degree. He reports using the Internet less than an hour per week and the following types of online activities: finding information about goods and services, finding information related to education, general browsing or surfing, looking for work, using chat rooms or sites and using e-mails. This respondent is observed to hold a full driving licence and the full model specification predicts that with approximately 83% probability. Given his Internet-usage profile, the model suggests that this respondent's odds of holding a full driving licence are 1.41 times higher than an otherwise identical respondent who does not use the Internet.

The results of this sample-enumeration analysis are shown in Table 6. The aggregate odds ratio associated with Internet usage is shown for ten percentile points on the distribution (10%, 20%,…, 80%, 90%). The 50th percentile is the median effect; it ranges between 1.50 (run #7) and 1.76 (run #3). Note that for model run #2, where there is a single parameter that applies to each Internet user regardless of how they use the Internet, the odds ratio is the same (1.70) across all internet users. It can be seen that the all-else-equal relationship between online activities and licence-holding is predicted to be positive for a large majority of Internet users in the SHS sample, and this holds for all model runs using the SHS dataset. (NB: for all model runs but #5 the effect was strictly positive; for run #5 the odds ratio is less than 1.0 for the lowest 9% of the distribution).

Table 6: Amongst Internet-users, percentile distribution of ceteris paribus relationship between Internet usage and licence-holding, characterised as odds-ratios, for all SHS model runs

SHS	10th per/le	20th per/le	30th per/le	40th per/le	50th per/le	60th per/le	70th per/le	80th per/le	90th per/le
Model #1	--	--	--	--	--	--	--	--	--
Model #2	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
Model #3	1.53	1.53	1.67	1.67	1.76	1.76	1.76	1.76	1.82
Model #4	1.69	1.69	1.69	1.69	1.69	1.69	1.70	2.03	2.03
Model #5	0.99	1.23	1.41	1.57	1.75	1.96	2.21	2.56	3.16
Model #6	1.41	1.51	1.58	1.64	1.70	1.76	1.81	1.85	1.90
Model #7	1.41	1.41	1.50	1.50	1.50	1.89	1.89	2.05	2.05

5 Analysis of the OPN dataset

This section outlines the results of a second set of analyses of the links between licence-holding and online activity, using the OPN data (which covers the entirety of Great Britain including England, Scotland and Wales,[ONS n.d.]).

It is plausible that the findings from the analysis of the SHS dataset might reflect the idiosyncratic characteristics of Scotland, or that they may be influenced by the survey instrument or the SHS' specific survey practices. As the findings from analysis of the SHS dataset are at odds with earlier results (Sivak and Schoettle 2013), we sought to confirm the SHS results by reproducing as nearly as possible the same analysis with a second dataset (OPN) with different data-generation procedures and from a different temporal and spatial context.

A further distinction between the SHS and OPN datasets is that the OPN is newer (2008/9 v. 2005/6) and thus includes more recent developments in its definitions of online activity-classes (e.g. selling things online, video-conferencing, etc.).

The OPN dataset does not have the degree of richness the SHS contains in terms of travel information; unlike the SHS the instrument package does not include a travel diary. However a question on licence-holding is included, and can therefore be regressed against the detailed Internet-usage behaviour the OPN captures.

The same age group (17 – 29 years old) was used to analyse both the OPN and SHS datasets and, as with the SHS, the OPN sample is appropriately weighted to be nationally-representative. Although the coverage of the OPN dataset is wider (all of Britain, which includes Scotland), the unweighted sample size of young adults is much smaller, approximately 1/4 of the SHS sample size (895 v. 3,819).

Table 7 contains descriptive statistics for the relevant variables, including a cross-tabulation with licence-holding. The following models were estimated (results are in Table 8); for ease of interpretation the same numbering scheme is applied to the SHS and OPN model runs:

- **Model run #1** is the baseline specification using the OPN dataset, with no indicators of Internet usage. The parameter estimates are in keeping with the SHS baseline model; none are estimated to be statistically identifiable from zero but with opposite signs.
- **Model run #2** adds in a single binary indicator of whether each respondent self-reports having used the Internet at least once in the past three months which is estimated to be positive and statistically significant.
- **Model run #3** adds in a continuous variable of the number of days per week that each respondent reports using the internet which is estimated to be positive but not statistically significant (p=0.80). This is somewhat different from the results of SHS model run #3, where the marginal effect of time-spent-online was found to be negative and statistically significant.
- **Model run #4** estimates separate effects for each of the frequency-of-internet-usage categories, to investigate possible non-linearities. An inverted 'U' shape was found in the relationship between time-spent-online and licence-holding, and this was also found in Model run #4 using the SHS data.
- **Model run #5** is identical to #4, with the addition of 31 binary online-activity-class indicators.
- **Model runs #6 and #7** employ the same two-step estimation procedure as model runs #6 and #7 using the SHS dataset. What is found in Model run #6 is a positive (but not statistically significant) effect associated with being an Internet user, and a positive and statistically significant marginal effect associated with frequency-of-internet-usage. In Model run #7, the largest positive effect associated with frequency-of-Internet-use is the highest quartile (those predicted in the first-step estimation to be the most frequent Internet-users on the basis of the activities they perform online). This is different from the analogous SHS result, where the *smallest* effect was found to be associated with the highest quartile of time-spent-online.

Table 7: Descriptive statistics of OPN sample of British young adults (age 17 to 29). (Values in brackets are standard errors).

	All young people in the sample	**Holders of a full driving licence**	**Non-holders of a full driving licence**
Indicator			
Percentage that use the internet	93% (1%)	97% (1%)	87% (2%)
Age	23.0 (0.12)	23.8 (0.15)	22.0 (0.20)
Income	£13,598 (£367)	£16,153 (£490)	£9,480 (£446)
Percentage that hold a full car driving licence	58% (2%)	-	-
Percentage that are female	50% (2%)	47% (2%)	54% (3%)
Percentage that reside in London	16% (1%)	14% (2%)	19% (2%)
Percentage that are employed full-time	58% (2%)	71% (2%)	40% (3%)
Percentage that are employed part-time	23% (1%)	20% (2%)	27% (2%)
Percentage that are not in workforce	11% (1%)	6% (1%)	18% (2%)
Percentage that are unemployed	3% (1%)	1% (<0.5%)	6% (1%)
Percentage that are full time students	5% (1%)	2% (1%)	9% (2%)
Percentage living with their 'own children'	18% (1%)	17% (2%)	19% (2%)
Percentage that have degree level qualification (or equivalent)	22% (1%)	28% (2%)	13% (2%)
Percentage that have higher educational qualification below degree level	7% (1%)	9% (1%)	5% (1%)
Percentage that have A-Levels or Higher	22% (1%)	23% (2%)	20% (2%)
Percentage that have ONC/National level BTEC	5% (1%)	6% (1%)	3% (1%)
Percentage that have O level or GCSE equivalent (Grade A-C) or O	21% (1%)	17% (2%)	26% (2%)
Percentage that have GCSE grade D-G or CSE grade 2-5 or Standard Grade	6% (1%)	6% (1%)	5% (1%)
Percentage that have other qualifications	8% (1%)	6% (1%)	11% (2%)
Percentage that have no formal qualifications	10% (1%)	5% (1%)	17% (2%)
Class of online-activity			
Sending and receiving e-mails	85% (1%)	92% (1%)	75% (2%)

Finding information about goods or services	71% (2%)	79% (2%)	60% (3%)
Using services related to travel and accommodation	56% (2%)	65% (2%)	44% (3%)
Downloading software (no games)	44% (2%)	50% (2%)	36% (3%)
Reading or downloading online news	51% (2%)	55% (2%)	45% (3%)
Looking for job or sending application	41% (2%)	45% (2%)	35% (3%)
Seeking health related information	31% (2%)	37% (2%)	23% (3%)
Looking for information about education	42% (2%)	42% (2%)	42% (1%)
Doing an online course	9% (1%)	9% (1%)	8% (2%)
Consulting the internet for learning	37% (2%)	40% (2%)	32% (3%)
Internet Banking	51% (2%)	61% (2%)	36% (2%)
Selling goods or services	19% (1%)	25% (2%)	12% (2%)
Obtaining information from public authorities	36% (2%)	43% (2%)	27% (2%)
Downloading official forms	24% (1%)	30% (2%)	15% (2%)
Sending in filled forms	19% (1%)	22% (2%)	14% (2%)
Telephoning and video calls	24% (1%)	25% (2%)	23% (3%)
Uploading self-created content	47% (2%)	53% (2%)	39% (3%)
Listening to web radios/watching web tv	46% (2%)	50% (2%)	41% (3%)
Playing or downloading games/images/films/music	63% (2%)	66% (2%)	58% (2%)
Foods or groceries	11% (1%)	12% (1%)	11% (2%)
Household goods	24% (1%)	31% (2%)	14% (2%)
Films/music	40% (2%)	48% (2%)	27% (2%)
Books/magazines/newspapers/e-learning	25% (1%)	31% (2%)	18% (2%)
Clothes/sports goods	39% (2%)	45% (2%)	32% (2%)
Computers, software and upgrades	24% (1%)	27% (2%)	20% (1%)
Computer hardware	10% (1%)	11% (1%)	8% (2%)
Electronic equipment	21% (1%)	25% (2%)	15% (2%)
Share purchases/financial services/insurance	9% (1%)	14% (2%)	1% (2%)
Travel or holiday accommodation	31% (2%)	38% (2%)	20% (2%)
Tickets for events	27% (2%)	34% (2%)	18% (2%)
Lotteries or betting	11% (1%)	15% (2%)	6% (1%)
Frequency of internet use			
Every day, or almost every day	75% (1%)	78% (2%)	70% (2%)
At least once a week, but not every day	15% (1%)	16% (2%)	12% (2%)
At least once a month, but not every week	2% (1%)	2% (1%)	3% (1%)
Less than once a month, at least once in past three months	1% (<0.5%)	1% (<0.5%)	2% (1%)

Following the same sample-enumeration procedure as with the SHS analysis, the aggregate odds-ratios attributable to internet-usage are shown in Table 9. The table begins at the 10th percentile of this distribution, and therefore it must be noted that for two model runs (#4 and #5) there are some internet users for whom the odds ratio is less than 1.0 (1% of users in run #4; 7% in run #5). For all models the median odds ratio is well in excess of 1.0, within the range between 3.15 (run #7) and 3.99 (run #6).

6 Conclusions

This study reports several results that are made possible by applying novel methods and data to the issue of young adults' licencing. We show that the distinction between main reasons for not driving and secondary reasons appears meaningful, and that earlier studies that do not take this into account may miss important patterns. For instance, over 90% of those citing their health for not driving report that this is the main reason why they do not drive, whereas only 13% of those citing the costs of buying a car indicate the same.

We show with a segmentation analysis that there are distinct sub-groups of young non-drivers, even amongst those that cite the costs of driving as deterrents to driving. The members of one of the

segments we identified, for instance, cite costs as well as other ‘non-cost’ reasons for not driving and are relatively well-off financially, and by contrast members of a second segment have lower mean

Table 8: Results from logistic regression models of full-car-driving-licence-holding by Scottish young adults (age 17-29), OPN data. (Values marked with * or ** are statistically significant at p<0.10 and p<0.05 respectively)

Model run #	#1	#2	#3	#4	#	#6	#7
Null log-likelihood	-482.80 for all model runs						
Final log-likelihood	-396.39	-391.32	-391.29	-386.63	-	-388.78	-390.58
McFadden's pseudo r^2	0.1790	0.1895	0.1895	0.1992	0	0.1947	0.1910
McFadden's adjusted pseudo r^2	0.1396	0.1481	0.1460	0.1516	0	0.1512	0.1434
Parameter estimates							
Constant	-2.171	-3.280	-3.296	-3.412	-	-3.524	-3.301
Lowest income quartile	Reference						
Second income quartile	0.297	0.262	0.260	0.272	0	0.274	0.267
Third income quartile	0.757**	0.655**	0.655**	0.621**	0	0.642**	0.659**
Fourth income quartile	2.010**	1.890**	1.884**	1.875**	2	1.831**	1.867**
Employed full-time	Reference						
Employed part-time	-0.383*	-0.457**	-0.459**	-0.473**	-	-0.469**	-0.463**
Full time student	-1.863**	-1.923**	-1.924**	-1.955**	-	-1.985**	-1.970**
Unemployed	-1.563*	-1.471	-1.472	-1.316	-	-1.325	-1.472
Not in workforce	-0.596*	-0.612*	-0.613*	-0.639*	-	-0.624*	-0.652*
Lives with 'own children'	-0.049	0.043	0.051	0.120	0	0.136	0.056
Female	-0.033	-0.018	-0.016	-0.025	0	0.015	0.015
Age	0.069**	0.080**	0.080**	0.082**	0	0.089**	0.083**
Year 2008	Reference						
Year 2009	-0.020	-0.075	-0.083	-0.071	-	-0.134	-0.103
All of Britain except London	Reference						
Residence in London	-1.172**	-1.208**	-1.208**	-1.207**	-	-1.226**	-1.250**
No educational qualifications	Reference						
Degree level	1.031**	0.823**	0.808**	0.886**	0	0.615*	0.744
Higher qualifications (below degree level)	1.061**	0.862**	0.859**	0.946**	0	0.736*	0.816
'A' levels or higher	1.487**	1.275**	1.264**	1.340**	1	1.114**	1.242**
ONC / National level BTEC	1.769**	1.565**	1.563**	1.723**	2	1.506**	1.572**
'O' level or GCSE equivalent	0.431	0.291	0.289	0.354	0	0.263	0.279
GCSE Grade D-G or CSE grade 2-5 or Standard grade level 4-6	1.345**	1.205**	1.209**	1.207**	1	1.230**	1.219**
Other qualifications	0.094	-0.018	-0.024	0.057	-	-0.049	-0.026
Internet-user status		1.179**	1.111**	--	-	0.332	--
Frequency of internet use (days of internet use per week)			0.017	--	-	--	--

Frequency of internet use (less than once a month, at least once in last 3 months)	--	--	--	-0.588	-0.100	--	--
Frequency of internet use (at least once a month, but not every week)	--	--	--	0.344	0.000	--	--
Frequency of internet use (at least once a week, but not every day)	--	--	--	1.556**	-1.100	--	--
Frequency of internet use (every day, or almost every day)	--	--	--	1.180**	-0.900	--	--
Predicted frequency of internet use (days/week)	--	--	--	--	-	0.224**	--
Predicted frequency of internet use (lowest quartile)	--	--	--	--	-	--	1.104**
Predicted frequency of internet use (second quartile)	--	--	--	--	-	--	1.147**
Predicted frequency of internet use (third quartile)	--	--	--	--	-	--	0.998**
Predicted frequency of internet use (highest quartile)	--	--	--	--	-	--	1.398**
Sending and receiving e-mails	--	--	--	--	0	--	--
Finding information about goods or services	--	--	--	--	-	--	--
Using services related to travel and accommodation	--	--	--	--	-	--	--
Downloading software (no games)	--	--	--	--	0	--	--
Reading or downloading online news	--	--	--	--	-	--	--
Looking for job or sending application	--	--	--	--	0	--	--
Seeking health related information	--	--	--	--	0	--	--
Looking for information about education	--	--	--	--	-	--	--
Doing an online course	--	--	--	--	-	--	--
Consulting the internet for learning	--	--	--	--	0	--	--
Internet Banking	--	--	--	--	0	--	--
Selling goods or services	--	--	--	--	0	--	--
Obtaining information from public authorities	--	--	--	--	0	--	--
Downloading official forms	--	--	--	--	0	--	--
Sending in filled forms	--	--	--	--	0	--	--
Telephoning and video calls	--	--	--	--	-	--	--
Uploading self-created content	--	--	--	--	-	--	--
Listening to web radios/watching web tv	--	--	--	--	-	--	--
Playing or downloading games/images/films/music	--	--	--	--	-	--	--
Foods or groceries	--	--	--	--	-	--	--
Household goods	--	--	--	--	0	--	--
Films/music	--	--	--	--	0	--	--
Books/magazines/newspapers/e-learning	--	--	--	--	0	--	--
Clothes/sports goods	--	--	--	--	-	--	--
Computers, software and upgrades	--	--	--	--	-	--	--

Computer hardware	--	--	--	--	-	--	--
Electronic equipment	--	--	--	--	0	--	--
Share purchases/financial services/insurance	--	--	--	--	1	--	--
Travel or holiday accommodation	--	--	--	--	-	--	--
Tickets for events	--	--	--	--	0	--	--
Lotteries or betting	--	--	--	--	0	--	--

Table 9: Amongst Internet-users, percentile distribution of ceteris paribus relationship between Internet usage and licence-holding, characterised as odds-ratios, for all OPN model runs

OPN	10th percentile	20th percentile	30th percentile	40th percentile	50th percentile	60th percentile	70th percentile	80th percentile	90th percentile
Model run #1	--	--	--	--	--	--	--	--	--
Model run #2	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25
Model run #3	3.16	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32
Model run #4	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	4.74
Model run #5	1.12	1.65	2.23	2.96	3.82	4.94	6.46	9.23	18.41
Model run #6	3.18	3.49	3.68	3.82	3.99	4.14	4.28	4.47	4.76
Model run #7	2.71	2.71	3.02	3.02	3.15	3.15	3.15	4.05	4.05

income levels and only cite costs as the reason they do not drive. An important issue for the future research agenda is to more fully establish the relationship between age and motivations for not driving; there is now for the first time a growing cohort of British adults in their late 20s and early 30s that do not hold a full driving licence (Le Vine and Jones 2012).

On the basis of multivariate logistic regression analysis with NTS, we find that being an international migrant to Britain is negatively associated with holding a driving licence, an effect that is net of other confounding effects such as income and place of residence. We suggest a number of plausible reasons why this might be, but further research will be needed to disentangle them. We report the new finding that different types of income relate to licence-holding in distinct ways, with one's own income being about four times as salient in this respect as the income of others in one's household. This has important implications for future rates of licence acquisition by young people in Britain, where income growth in the 2000s has been principally amongst adults over age 30, with young women's' incomes stagnating and young men's falling in real terms.

Focusing on the Internet use factor, we report analyses of two different nationally-representative databases, which both show a positive (or complementary) relationship between Internet-usage and licence-holding, net of confounding effects. This finding is robust across a range of model specifications, including multi-stage estimations to address cross-correlation between indicators of Internet usage. Both datasets are cross-sectional, and therefore it cannot be asserted that the cross-sectional relationship between online-activity and licence-holding identified in this study necessarily would hold were we able to observe individuals over time. In the latter case we would be able to more confidently assert a finding of causality. These findings however are the first to the authors' knowledge to employ disaggregate multi-variate regression to investigate this research question.

In addition to this principal finding, several other noteworthy relationships were found. No comparable effects due to any specific online activity were of opposite signs and statistically significant in the two datasets. Also, an inverted 'U' effect associated with time-spent-online was found using the SHS dataset, and with the OPN's measure of Internet-usage intensity (frequency of days/week using the Internet) when the self-reported frequency-of-use covariate is entered directly into the estimation. But when a synthetic frequency-of-use variable is constructed using in a two-step estimation process (model run #7), this relationship did not hold in the OPN dataset. The accumulation of further evidence will be required to ascertain the generic nature of this relationship, which may well be context-dependent.

Our findings show a relationship different than the most comparable study (Sivak and Schoettle, 2012) in the literature, though that study employed aggregate country-level analysis while our findings arise from analysis of disaggregate person-level microdata. These results require confirmation from other geographic contexts outside of Britain, and more recent data that take account of new developments in information technologies.

7 Acknowledgements

This material extends from earlier research presented in Le Vine and Polak (2014) and Le Vine et al. (2014). The authors are grateful for assistance regarding the Scottish Household Survey and the National Travel Survey from Transport Scotland and the Department for Transport, respectively. Any errors remain the responsibility of the authors.

8 References

Delbosc, A., Currie, G. Causes of youth licencing decline: a synthesis of evidence. *Transport Review*s. 2013a; 33(3):271-290.

Delbosc, A., Currie, G. Changing demographics and young adult driver license decline in Melbourne, Australia (1994-2009). *Transportation.* 2013b; DOI 10.1007/s11116-013-9496-z.

Fisher, R.J. Social Desirability Bias and the Validity of Indirect Questioning. *Journal of Consumer Research*. 1993; 20(2):303-315.

Grimsrud, M., El-Geneidy, A. (2013) Driving transit retention to renaissance: trends in Montreal commute public transport mode share and factors by age group and birth cohort. Public Transport. 5:3. p.219-241.

Hope, S (undated) *Scottish Household Survey: Methodology 2005/2006*. Prepared by Ipsos Mori for Scottish Executive.

Hosmer, D.W., Lemeshow, S., Sturdivant, R.X. (2013) *Applied Logistic Regression*, 3rd edition, Wiley. ISBN: 978-0-470-58247-3. Hoboken, New Jersey.

Institute for Mobility Research (ifmo) 2013. *'Mobility Y' – The Emerging Travel Patterns of Generation Y. Munich*

Kuhnimhof, T., Armoogum, J., Buehler, R., Dargay, J., Denstadli, J.M., Yamamoto, Y. Men Shape a Downward Trend in Car Use among Young Adults—Evidence from Six Industrialized Countries. *Transport Reviews*. 2012; 32(6):761-779.

Le Vine, S. and Jones, P. On the Move: Making sense of car and train travel trends in Britain. RAC Foundation, 2012; London

Le Vine, S., Latinopoulos, C., and Polak, J. (2014) *What is the relationship between online activity and driving-licence-holding amongst young adults?*. Paper presented at the 93rd Annual Meeting of the Transportation Research Board, Washington DC.

Le Vine, S. and Polak, J. (2014) *Factors associated with Factors associated with young adults delaying and foregoing driving licences.* Traffic Injury Prevention.

McDonald, N. And Trowbridge, M. Does the built environment affect when American teens become drivers? Evidence from the 2009 National Household Travel Survey. *Journal of Safety Research*. 2009; 40:177-183.

Office for National Statistics [ONS] (undated) *National Statistics Opinions Survey - Technical Report January 2009*.

Rofique, J., Humphrey, A., Pickering, K., Tipping, S. National Travel Survey 2010 Technical Report. Prepared for Department for Transport. 2011; London.

Schoettle, B., Sivak, M. The reasons for the recent decline in young driver licensing in the U.S. *Traffic Inj Prev*. 2013; 15(1):6-9.

Shults, R.A., Williams, A.F. Trends in driver licencing status and driving among high school seniors in the United States, 1996-2010. *Journal of Safety Research*. 2013; 46:167-170.

Sivak M, Schoettle B. Recent changes in the age composition of drivers in 15 countries. *Traffic Inj Prev*. 2012; 13(2):126-132.

Tefft, B.C., Williams, A.F., and Grabowski, J.G. Timing of Driver's License Acquisition and Reasons for Delay among Young People in the United States, 2012. Prepared for: AAA Foundation for Road Safety. 2013.

Wells, P., Tong, T. Sexton, B., Grayson, G., and Jones, E. Cohort II: A study of learner and new drivers. Road Safety Research Report #81. 2008; Transport Research Laboratory.