An examination of the factors that impact upon multiple vehicle ownership: The case of Dublin, Ireland

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Abstract

This paper examines the characteristics of households with multiple car ownership in Dublin, Ireland. Data from the 2006 Census of Ireland are analysed to ascertain the characteristics of these households. The analysis of multiple car ownership presented herein examines individual specific, transport availability, and household characteristics to provide an indication of the individuals most likely to have access to more than one vehicle. Understanding the characteristics of households with more than one car is important for many reasons, such as how policies for emissions reductions or pricing regimes might affect households. Ireland, like many countries has recently launched a number of electric vehicle and car sharing schemes. Traditionally these schemes have been aimed at reducing multiple car ownership, therefore it's important to develop an understanding of the households that would most likely give up an extra car and use a car sharing scheme or an electric vehicle. Also from a sustainability point of view, greater levels of car ownership can result in unsustainable transport patterns.

This paper examines the Census data using a multinomial logit regression model to determine what are the relationships between multiple car ownership levels and several household characteristics. The findings of the paper demonstrate that occupation, public transport availability and residential density all have an impact upon the decision to own more than one vehicle.

1. Introduction

Higher levels of car ownership present several problems, such as greater car dependency, increased carbon emissions and congestion. Several factors can encourage households to own more than one car. This paper examines the trends in multiple car ownership in Dublin to ascertain what specific factors impact upon these trends. In recent years Dublin, like many other international cities, has seen increases

in levels of car ownership (Salon, 2009; Maat and Timmermans, 2009; Giuliano and Dargay, 2006). One of the interesting factors of this growth in car ownership is the large increase in households with more than one car available. The research presented in this paper seeks to determine, through the analysis of a number of explanatory variables, what factors impact upon household vehicle ownership.

The next section of the paper presents a review of the literature in this field; this is followed with a description of the methodologies used in this paper. The first results section presents a number of descriptive statistics and the second details the results of the multinomial logistic regression modelling. Following the results of the modelling an area is identified in Dublin with the highest multiple car ownership. The paper concludes with a summary of the main findings and a number of key conclusions.

2. Literature review and background

In Ireland over the past 20 years, the number of registered passenger vehicles has increase by over a million vehicles, which represents a 39% increase in the number of vehicles. Figure 1 below shows the trend of increasing car ownership in Ireland (CSO, 2009).

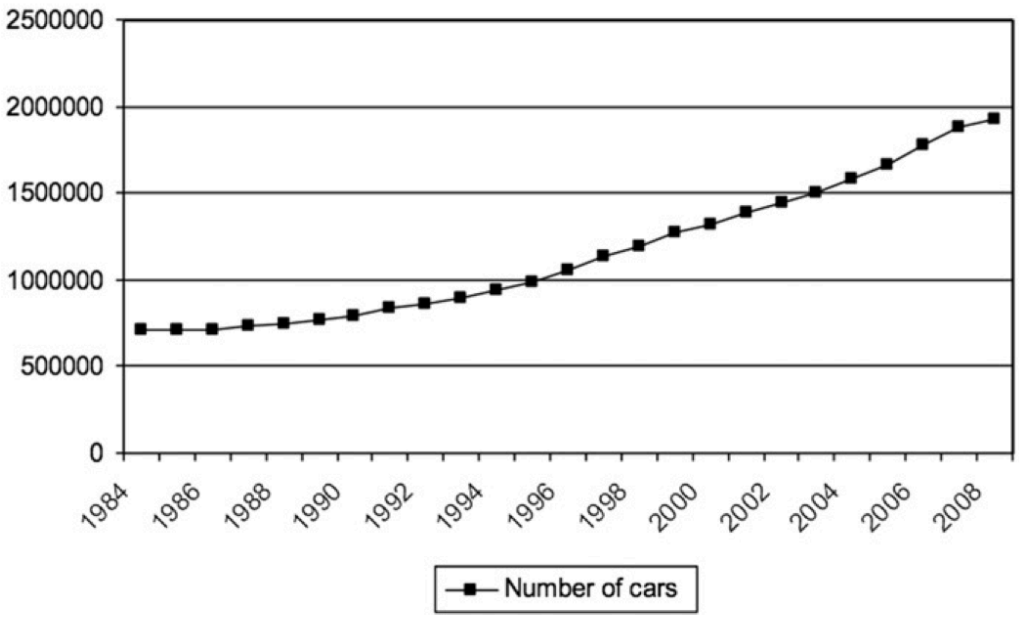

Fig. 1. Growth in car ownership in Ireland.

Car ownership rates in Dublin in 2002 and 2006 are presented in Table 1. The results show that between 2002 and 2006 there has been little change in car ownership levels. The findings demonstrate that in both years, 37% of households had two cars and 12% had three or more cars. The final column in Table 1 shows the growth in the households with differing car ownership levels. The results show that in the four-year period that there was a 7% increase in the number of households with two or three or more cars. Interestingly the findings also show that there was an 18% increase in the number of households with no car.

Table 1
Multiple car ownership levels in Dublin.

	2002		2006		% Change in absolute terms (%)
	N	%	*N*	%	
One	179,481	38	183,394	36	2
Two	172,671	37	185,457	37	7
Three or more	53,865	12	57,882	12	7
None	64,944	14	76,764	15	18
Total	470,952	100	503,497	100	

Given the rapid growth in car ownership over the past 20 years in Ireland it is not surprising to note that almost 50% of individuals in Ireland drive to work every day in comparison, in 1991 when 40% drove to work (Central Statistics Office, 1997). In terms of energy usage, the transport sector in Ireland is responsible for 43% of the final energy demand, and has grown by 181% between 1990 and 2007 (SEI, 2009). Also, in terms of carbon emissions the transport sector was responsible for 19.8% of CO_2 emissions in 2007 (EPA, 2006).

A number of studies have examined the key factors that result in households owning more than one vehicle. Whelan (2007) presents a model of car ownership for Great Britain. This model uses the national travel survey; a family expenditure survey and census data to examine what factors can contribute to the growth in car ownership. The results of this study show, as one might expect, that car ownership decisions are based on income, licence holding, employment, and purchase costs. Dargay (2002) also examines car ownership levels in Great Britain, but focuses on the differences in car ownership in urban and rural areas. The findings of this study demonstrate that urban car owners are more sensitive to changes in motoring costs compared to their rural counterparts. This result suggests that car ownership in rural areas is a greater necessity. The results presented in McDonagh (2006) concur with this rural/urban gap and highlights the necessity for car ownership in rural Ireland indicating that car ownership is a necessity rather than a luxury in rural areas.

Matas and Raymond (2008) found that car ownership was lower in areas with good quality public transport options. This was also shown in Cullinane (2002) where in a study in Hong Kong found that where individuals had access to good public transport, they were unlikely to purchase a car. Dissanayake and Morikawa (2010) examined the characteristics that influence car ownership in Thailand and found that distance travelled, age, and the number of children in the household all impacted upon car ownership decisions. Potoglou and Kanaroglou (2008) examined the factors that cause households to own more than one car in Hamilton in Canada. The authors found that, as one would expect, as the number individuals per household and income increased, so too did the probability of owning more than one car. This study also used the number of bus stops in the surrounding area as a proxy variable for public transport availability and found that in areas with greater public transport access households were more likely to own fewer cars.

One of the objectives of this research is to identify areas with high car ownership and then target these areas for sustainable transport policies that could result in a decrease in multiple car ownership. Internationally, two methods of

improving the sustainability, and reducing car ownership, which policymakers have used, are car sharing schemes or electric vehicles. The use of either of these forms of transport can reduce emissions and provide a more sustainable method of private mobility and reduce the need to own multiple cars. The research presented in this paper does not examine the feasibility, sustainability or examine the market dynamics of these modes in the Dublin context, but suggests that these are methods by which individuals could substitute for current trips by private vehicle.

Car sharing schemes have been found to be very successful in reducing multiple car ownership. Cervero (2007) demonstrated that since the introduction of CarShare in San Francisco, 29% of members have reduced their car ownership by at least one vehicle. In a survey of members of car sharing schemes in North America it was found that car ownership dropped by 50% (Martin et al 2010). The PhillyCarShare scheme reported similar results with 24.5% of respondents indicating that they had given up at least one vehicle since joining the scheme (Lane, 2005).

The use of electric vehicles could also encourage sustainability in car ownership. While the research presented in this paper does not examine the relative benefits of electric vehicles compared to traditional vehicles, or whether the energy and emissions footprint from PHEV's, given how electricity used was generated, is significantly different from traditional gasoline powered vehicles, several authors have provided in-depth analysis on the relative benefits of these vehicles (Göransson et al, 2010; Smith, 2010; Doucette and McCulloch, 2011). Due to the limitations of plug-in hybrid electric vehicles (PHEV) it's long been reported that the growth potential of this market is in limited to the second vehicle market (Brady and O'Mahony, 2011 and Collantes and Sperling, 2008). Axsen and Kurani (2009) examined the target market for PHEV's in the United States and found that a third of households in this target market had the required infrastructure for charging these vehicles. The issue of the range that an electric vehicle can travel before needing to be charged has been widely researched. Pearre et al (2011) show that when looking at current driving patterns and ranges, in a study of 484 instrumented gasoline vehicles, that even with low range vehicles, the current electric vehicles could provide for a large percentage of current transport needs. Duke et al (2009) showed that while electric vehicles would reduce emissions, the current ranges of these vehicles would not be sufficient for commuters in New Zealand. One method of ensuring greater access to these charging stations is to locate charging points in neighbourhoods. The results of this paper could be used to inform a policy of introducing PHEV charging points.

3. Methodology

3.1 Data

The census data used in this paper was taken on the night of Sunday, 23rd April 2006 with 1.5 million Irish homes receiving the census forms two weeks before that. The dataset used is called the place of work census of anonymised records dataset (POWCAR) (CSO, 2007). The POWCAR dataset contains information on the regular work trips of 1,834,472 individuals in Ireland. Unfortunately, income levels of respondents are not included in the dataset.

3.2 Model Formulation

Two multinomial logit regression models were estimated in this research. The choice variables examined in each of the models were the number of cars per household.

Three levels of car ownership examine where 'one car available', 'two cars available' and 'three or more cars available'. Within the model the referent variable is 'one car available'. The first model estimated examined the impact of a number of household and personal characteristics such as age, household composition, and occupation, on multiple car ownership rates. Occupation is used in the analysis as a proxy for income as the POWCAR dataset does not include data on income. The second model examines the impact the mode of transport used and the proximity to other modes of transport has upon multiple car ownership rates. A multinomial logistic regression analysis was constructed to analyse the relationship between these factors and the number of cars per household. The model takes the following functional form:

$$\text{logit (p)} = \log \frac{p}{1-p} \equiv a + \beta I + \gamma H + e \qquad (1)$$

Where p is the probability that event Y occurs (decision to own two cars or three or more cars), βI is the set of individual specific characteristics, γH is the set of household specific characteristics and e is a random error term. Table 2 details each of the variables estimated in the models presented in Tables 4 and 5.

Table 2
Details of variables examined.

Variable	Definition
Mode of transport	
Mode of transport walk	=1 if mode of transport walk
Mode of transport cycle	=1 if mode of transport cycle
Mode of transport bus	=1 if mode of transport bus
Mode of transport rail	=1 if mode of transport rail
Mode of transport motorcycle	=1 if mode of transport motorcycle
Mode of transport car—driver	=1 if mode of transport car—driver
Mode of transport car—passenger	=1 if Mode of transport car—passenger
Mode of transport lorry/van	=1 if Mode of transport lorry/van
Mode of transport other means	=1 if Mode of transport other means
Mode of transport work from home	(reference category=mode of transport working from home)
Age	
Age 15–24	=1 if Age 15–24
Age 25–34	=1 if Age 25–34
Age 35–44	=1 if Age 35–44
Age 45–54	=1 if Age 45–54
Age 55–74	(Reference category=Age 55+)
Household composition	
Single person	=1 if single person
Lone parent 1 child < 19	=1 if lone parent 1 child < 19
Lone parent 1 child > 19	=1 if lone parent 1 child > 19
Couple with 1 child < 19	=1 if couple with 1 child < 19
Couple with 1 child > 19	=1 if couple with 1 child > 19
Couple—no children	=1 if couple—no children
Other households	(Reference category=other households)
Occupation	
Employers and managers	=1 if employers and managers
Higher professional	=1 if higher professional
Lower professional	=1 if lower professional
Non-manual	=1 if non-manual
Manual skilled	=1 if manual skilled
Semi-skilled	=1 if semi-skilled
Unskilled	=1 if unskilled
Own account workers	=1 if own account workers
Farmers	=1 if farmers
Agricultural workers	=1 if agricultural workers
Other	(Reference category=Other)
Rail available	
No	=1 if no
Yes	(Reference category=yes)
Bus stops per DED	
None	=1 if none
1–5 stops	=1 if 1–5 stops
6–10 stops	=1 if 6–10 stops
11–20 stops	=1 if 11–20 stops
21+stops	(Reference category=21+ stops)
Residential density	
Less than 1000/km^2	=1 if Less than 1000/km^2
1001–3000/km^2	=1 if 1001–3000/km^2
3001–6000/km^2	=1 if 3001–6000/km^2
6001–9000/km^2	6001–9000/km^2
9001–12,000/km^2	9001–12,000/km^2
12,001+per km^2	12,001+per km^2

4. Results and Analysis

This section of the paper presents a number of descriptive statistics and the results from the multinomial logistic regression modelling. These findings are then used to identify an area in Dublin with high levels of car ownership.

4.1 Descriptive statistics

Table 3 contains the descriptive statistics of the population of Dublin and a description of the variables examined in the regression modelling. The number of cars owned per household segments the descriptive statistics presented in Table 3. The results for the age characteristics demonstrate that younger individuals were shown to be in households with multiple cars. These statistics would seem to make intuitive sense as these individuals may still be living with their parents, who would most likely also have one or more cars available. The second group of characteristics details the number of resident workers per household. As one would expect households with greater numbers of resident workers were shown to have more than one car. Household composition was also examined, as one would assume that this variable would have an impact upon the number of cars per household. The results show that couples with children were more likely to have more than one car.

The occupation of the respondent was also examined to determine what impact an individual's profession has upon the decision to own more than one car. The results show that professionals, employers and managers had greater likelihood of coming from households with more than one car. The variable that represents the mode of transport used to travel to work indicates that households with two or more cars were shown to have a higher proportion of individuals driving to work. The final three variables examined in this study relate to the area in which the individual lives. Geographical areas called Dedicated Electoral Districts (DED) are the smallest area size in which the Census data examined in this study are enumerated. The public transport availability variables examine if the respondent lives in a DED that has a rail station and the number of bus stops in the DED. These variables are examined to ascertain if public transport availability impacts upon a household's decision to own more than one car. The final variable examined measures the impact that residential density has upon the decision to own more than one car. The residential density variables range from less than 1,000 individuals per km^2 to more than 12,000 individuals per km^2. The results show that those individuals living in lower density areas were more likely to own more than one car.

Table 3
Description of variables used in the logit regression modelling.

	Population		One car		Two cars		Three or more cars	
	N	%	*N*	%	*N*	%	*N*	%
Age								
15–24	70,652	14	20,468	11	18,857	10	13,274	23
25–34	174,409	34	63,587	35	56,989	31	17,641	30
35–44	116,611	23	45,184	25	51,035	28	5,537	10
45–54	92,482	18	32,149	18	37,304	20	12,582	22
55+	58,826	11	22,006	12	21,272	11	8,848	15
Household composition								
Single person	47,338	9	30,883	17	1,522	1	266	0
Lone parent 1 child < 19	27,400	5	13,976	8	4,474	2	1,770	3
Lone parent 1 child > 19	21,879	4	8,838	5	6,283	3	2,071	4
Couple with 1 child < 19	165,364	32	49,558	27	86,898	47	19,524	34
Couple with 1 child > 19	61,365	12	13,452	7	23,480	13	20,406	35
Couple—no children	85,942	17	35,020	19	37,001	20	1,500	3
Other households	103,692	20	31,667	17	25,799	14	12,345	21
Occupation								
Employers and managers	90,296	18	29,190	16	41,972	23	11,245	19
Higher professional	51,323	10	18,215	10	21,647	12	5,869	10
Lower professional	76,228	15	27,996	15	29,531	16	8,233	14
Non-manual	146,392	29	52,892	29	47,847	26	16,558	29
Manual skilled	43,325	8	16,182	9	14,225	8	6,007	10
Semi-skilled	42,086	8	16,470	9	10,625	6	3,440	6
Unskilled	18,729	4	6,959	4	3,335	2	1,219	2
Own account workers	18,877	4	6,251	3	8,628	5	2,830	5
Farmers	838	0	211	0	357	0	203	0
Agricultural workers	604	0	225	0	152	0	72	0
Other	24,282	5	8,803	5	7,138	4	2,206	4
Means of travel to work								
Walk	70,080	14	26,026	14	11,000	6	3,365	6
Cycle	20,602	4	9,062	5	3,958	2	954	2
Bus	76,816	15	29,064	16	14,028	8	4,477	8
Rail	39,534	8	16,133	9	11,397	6	3,113	5
Motorcycle	6,607	1	3,313	2	1,660	1	474	1
Car—driver	260,754	51	83,558	46	131,006	71	41,439	72
Car—passenger	19,977	4	9,706	5	5,448	3	1,917	3
Other means	1,028	0	401	0	235	0	103	0
Work from home	8,218	2	2,636	1	3,880	2	1,175	2
NA	9,364	2	3,495	2	2,845	2	865	1
Rail available								
No	407,629	79	146,070	80	149,063	80	46,975	81
Yes	105,351	21	37,324	20	36,394	20	10,907	19
Bus stops per DED								
None	115,984	23	41,470	23	43,654	24	13,792	24
1–5 stops	178,111	35	66,078	36	59,058	32	19,367	33
6–10 stops	120,903	24	41,443	23	45,625	25	14,469	25
11–20 stops	48,259	9	16,870	9	17,856	10	5,472	9
21+stops	49,723	10	17,533	10	19,264	10	4,782	8
Residential density								
Less than 1000/km^2	58,183	11	18,711	10	26,236	14	8,346	14
1001–3000/km^2	129,864	25	44,917	24	53,419	29	17,045	29
3001–6000/km^2	228,171	44	83,296	45	87,704	47	27,483	47
6001–9000/km^2	67,057	13	26,596	15	15,085	8	4,394	8
9001–12,000/km^2	21,680	4	7,936	4	2,664	1	522	1
12,001+per km^2	8,025	2	1,938	1	349	0	92	0

4.2 Results of the multinomial logistic regression models

The results of the estimated multinomial logistic regression models are presented in Tables 4 and 5. Two models were estimated to examine the factors that impact upon an individual's car ownership decisions. The descriptive statistics presented in Table 3 are used in the models estimated in Tables 4 and 5. The first model presented in Table 4 details the impact that household characteristics have upon car ownership decisions. The second model in Table 5, examines the impact that several transport availability and location characteristics have upon levels of household car ownership. The results for the age variables, in Table 4, demonstrate that individuals aged 25-34 and 35-44 were most likely to come from a two-car household. The inverse of this relationship was shown for three or more car households. This result may be as a result of children being of driving age in these households.

The second set of variables related to household structure and examine how household composition impacts upon the number of cars available. The findings demonstrate that single persons and lone parents are most likely not to own multiple cars. Couples and couples with children were shown to be most likely to have multiple cars available. Couples with resident children older than 19 where shown to be most likely to have three or more cars available. Presumably this high probability

is because the resident children may have purchased a car. As one would expect couples with no children were shown to be unlikely to own three or more cars.

The occupation of the individual was shown to have an impact upon probability of owning more than one car. The results show that semi skilled or unskilled workers and agricultural workers were unlikely to come from a household with more than one car. The findings also show that employers and managers, higher professionals and farmers were the individuals most likely to come from a household with multiple vehicles.

Table 4
The impact of household characteristics on multiple car ownership.

	Two cars available	Three or more cars available
	−.678**	−1.332**
Age		
15–24	.214**	.559**
25–34	.288**	−.024**
35–44	.314**	−.856**
45–54	.290**	.029*
55+	Ref	Ref
Household composition		
Single person	−2.865*	−3.743**
Lone parent 1 child < 19	−.886**	−1.034**
Lone parent 1 child > 19	−.120**	−.480**
Couple with 1 child < 19	.723**	.178**
Couple with 1 child > 19	.779**	1.313**
Couple—no children	.176**	−2.147*
Other households	Ref.	Ref.
Occupation		
Employers and managers	.681**	.891**
Higher professional	.539**	.657**
Lower professional	.363**	.415**
Non-manual	.125**	.208*
Manual skilled	.062*	.330**
Semi-skilled	−.293**	−.272**
Unskilled	−.589**	−.499**
Own account workers	.696**	1.048**
Farmers	.920**	1.774**
Agricultural workers	−.120**	.245**
Other	Ref.	Ref.
Number of cases	448,494	
R-squared	.258	
Log likelihood	1673.12	

** Significant at 1%.
* Significant at 5%.

The second model presented in Table 5 examines how transport availability impacts on multiple car ownership. The results for the mode of transport used to travel to work, as one would expect, demonstrated that those with two or three or more cars available where shown to be more likely to drive alone to work over any other mode of transport. The results also show that those individuals with more than one car available were unlikely to walk or cycle or to use public transport.

The model presented in Table 5 examines what impact public transport availability and urban density has upon a household's decision to own multiple cars. The first variable measures the impact of rail availability on the decision to own multiple cars. The rail availability coefficient demonstrates that households without access to a rail station are more likely to own a car or multiple cars. The second set of public transport availability variables examine the impact of the number of bus stops per DED has upon the decision to own multiple cars. The results show that in areas with no bus stops or fewer numbers of bus stops that individuals were shown to have a greater likelihood of owning multiple cars. The final set of variables estimated measure the impact of urban density on the number of cars per household. As one would expect individuals living in high density areas were less likely to own multiple cars.

Table 5
The impact of transport characteristics on multiple car ownership.

	Two cars available	Three or more cars available
Intercept	−1.781**	−3.690**
Means of travel to work		
Walk	−.543*	−.491**
Cycle	−.563**	−.757**
Bus	−.527**	−.450**
Rail	−.203**	−.253**
Motorcycle	−.551**	−.584**
Car—driver	.628**	.684*
Car—passenger	.419**	.236**
Other means	−.007**	−.332**
Work from home	−.375*	−.003**
NA	Ref.	Ref.
Rail available		
No	.141**	.191**
Yes	Ref.	Ref.
Bus stops per DED		
None	.271**	.494**
1–5 stops	.015**	.355**
6-10 stops	.073**	.388**
11–20 stops	.076**	.305**
21+stops	Ref.	Ref.
Residential density		
Less than 1000/km^2	1.581**	1.803*
1001–3000/km^2	1.553**	1.950**
3001–6000/km^2	1.498**	1.912**
6001–9000/km^2	.966**	1.224**
9001–12,000/km^2	.494**	.378**
12,001+per km^2	Ref.	Ref.
Number of cases	448,494	
R-squared	.308	
Log likelihood	−1701.32	

** Significant at 1%.
* Significant at 5%.

5. Identifying an area with high car ownership

This section of the paper examines an area identified in Dublin with high car ownership rates to explore potential options for reducing the need for a second and third car. Table 6 details the average car ownership per household for each of the administrative areas and the chosen study area. Dublin is split into four administrative areas, Dublin City, South Dublin, Fingal and Dun Laoghaire-Rathdown. The area identified was selected due to the large car ownership levels.

Figure 2 shows a map of the DEDs in Dublin and the average car ownership for each of the areas. The map shows, as one would expect that in Dublin City Centre the car ownership levels are low and they gradually increase further away from the city. The study area is the area marked with the red border. The study area was chosen as it had the highest car ownership rate. As shown in Table 6, the study area identified has a population of 41,515 and an average car ownership of 2.14 cars per household. The results show that average car ownership in the study area was 45% higher than the Dublin county average.

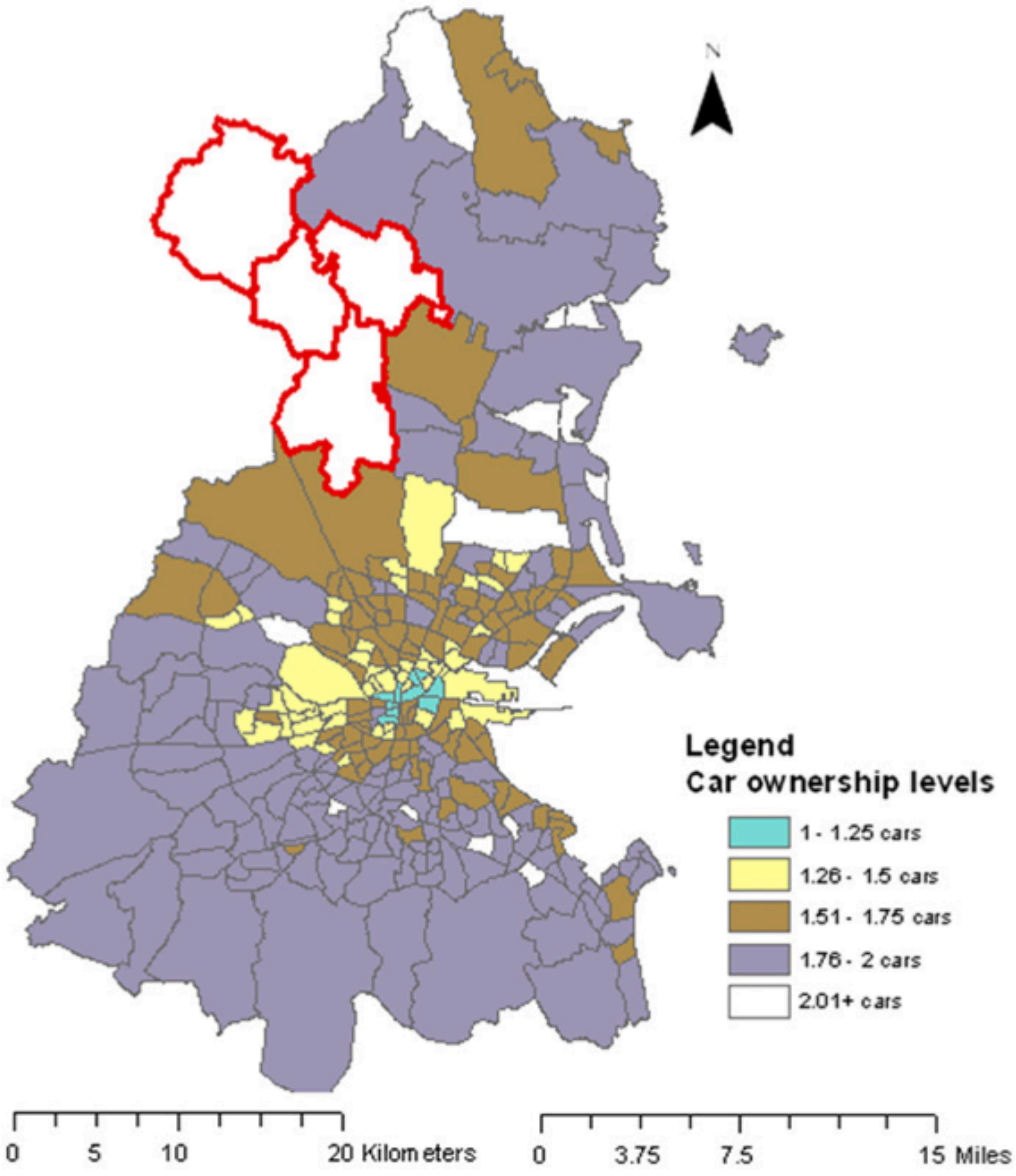

Fig. 2. Car ownership rates in Dublin.

Table 6
Comparison of car ownership rates in Dublin.

Region	Population	Average car ownership per household	Comparison to the county average (%)
Dublin (Total)	503,497	1.47	–
Dublin city	210,054	1.15	−22
South Dublin	106,054	1.70	+16
Fingal	107,687	1.67	+14
Dun Laoghaire-Rathdown	79,644	1.72	+17
Study area	41,515	2.14	+45

The results in Table 7 compare the results of the study area to the descriptive statistics for Dublin County. The purpose of this comparison is to demonstrate what factors in the study area impact upon the increase levels of car ownership in this area.

The results show that in the study area individuals tended to be marginally older compared to the Dublin average. The difference in household composition shows that households in the study area have a higher percentage of resident workers and tend to be couples with and without children. A greater percentage of individuals in the study area were shown to drive or take a train to work compared to the Dublin average. Data showed that 54% of individuals in the study area have access to a rail station compared to 21% of the rest of the Dublin area. The number of individuals with access to bus stops in the study area was shown to be less than the rest of Dublin. This is an interesting finding in that the area examined is relatively well serviced by public transport, but there is still high car ownership. Finally, the population density of the study area was also shown to be considerably less than the rest of Dublin.

Table 7
Descriptive statistics of the study area.

	Study area		Dublin County		
	N	%	*N*	%	% Difference
Age					
15–24	4306	10	70,652	14	−4
25–34	12,131	29	174,409	34	−5
35–44	10,693	26	116,611	23	+3
45–54	8859	21	92,482	18	+3
55+	5526	13	58,826	11	+2
Number of resident workers					
0	–	–	56,377	10	−10
1	2750	7	145,216	27	−20
2	10,006	24	258,028	48	−24
3	8817	21	55,784	10	+11
4+	19,749	48	24,698	5	+43
Household composition					
Single person	2750	7	47,338	9	−2
Lone parent 1 child < 19	1403	3	27,400	5	−2
Lone parent 1 child > 19	1322	3	21,879	4	−1
Couple with 1 child < 19	17,475	42	165,364	32	+10
Couple with 1 child > 19	5949	14	61,365	12	+2
Couple—no children	7716	19	85,942	17	+2
Other households	4900	12	103,692	20	−8
Occupation					
Employers and managers	9579	23	90,296	18	+5
Higher professional	4087	10	51,323	10	–
Lower professional	6579	16	76,228	15	+1
Non−manual	10,200	25	146,392	29	−4
Manual skilled	3201	8	43,325	8	–
Semi−skilled	2342	6	42,086	8	−2
Unskilled	796	2	18,729	4	−2
Own account workers	1998	5	18,877	4	+1
Farmers	390	1	838	0	+1
Agricultural workers	238	1	604	0	+1
Other	2105	5	24,282	5	–
Means of travel to work					
Walk	1875	5	70,080	14	−9
Cycle	520	1	20,602	4	−3
Bus	2670	7	76,816	15	−8
Rail	5952	15	39,534	8	+7
Motorcycle	393	1	6,607	1	–
Car—driver	24,987	63	260,754	51	+12
Car—passenger	1453	4	19,977	4	–
Other means	102	0	1,028	0	–
Work from home	958	2	8,218	2	–
NA	505	1	9,364	2	−1
Rail available					
No	19,122	46	407,629	79	−33
Yes	22,393	54	105,351	21	+33
Bus stops per DED					
None	22,440	54	115,984	23	+31
1–5 stops	15,810	38	178,111	35	+3
6–10 stops	–	–	120,903	24	−24
11–20 stops	3265	8	48,259	9	−1
21+stops	–	–	49,723	10	−10
Residential density					
Less than 1000/km^2	16,333	39	58,183	11	+28
1001–3000/km^2	22,979	55	129,864	25	+20
3001–6000/km^2	2203	5	228,171	44	−39
6001–9000/km^2	–	–	67,057	13	−13
9001–12,000/km^2	–	–	21,680	4	−4
12,001+per km^2	–	–	8,025	2	−2

A comparison between the results in Table 7 and the model results in Tables 4 and 5 shows that the coefficients estimated mirror the descriptive statistics in Table 7. The model results showed that couples with children, 'employers and managers', 'higher professionals' and 'lower professionals' were more likely to have multiple cars per household, this was also shown in the descriptive statistics of the study area. The model in Table 5 shows that households in with multiple car ownership levels are more likely to live in low density areas, have fewer bus stops available and drive alone to work. Each of these characteristics was found in the study area.

6. Conclusions

The results of this paper show that several factors impact upon a household's decision to own multiple cars. The findings demonstrate that in Dublin 49% of households have two or more vehicles and this increased to 66% in the study area. These high figures detail the extent of the problem in Dublin.

The results of the analysis presented in this paper demonstrate that several factors impact upon the number of cars owned. As one would expect factors such as the number of resident workers, the age of the individual and the household composition all impact upon the number of cars available. The occupation of the respondent didn't have as significant an impact as one would have thought. The results demonstrated it was not just the individuals in higher paid occupations that were disposed to multiple car ownership. The availability of public transport options was also shown to impact upon car ownership. In the study area despite 54% of the population having access to a rail station, car ownership levels were still found to be high. This result may be due to the fact that the service provided does not service areas desired by the residence or other factors such as household composition being more important.

The research presented in this paper provides an example of what factors impact upon multiple car ownership. The findings presented in this paper could also be used as a first step in the process for identifying neighbourhoods that would be best suited as areas for pilot schemes to promote car sharing or electric vehicles, or indeed any other policy to reduce car ownership levels.

The results presented in this paper open the discussion on the factors that impact upon multiple car ownership levels. Having identified areas with higher car ownership levels, the next steps would be to examine the factors that impact on car ownership using focus groups or local surveys. The results presented in this paper act as a first step to explaining the factors that impact upon multiple car ownership.

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