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Article

Measuring the Failure of Planning and Its Impact on Sustainable Travel in Dublin, Ireland

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Abstract: With the end of the recent housing boom in Dublin, Ireland, it is perhaps a good time to analyze how the commuting and development patterns have been impacted by this unprecedented level of housing construction in recent years. In this research, the authors focus specifically on the commuting patterns of those individuals living in the newest housing stock to see how these patterns adhere to the Irish government's stated transportation and sustainability goals. Data from the 2006 Census of Ireland is used to explore the commuting patterns of individuals living in the four counties that make up Dublin who lived in the most recently constructed housing stock (built between 2001 and 2006, constituting almost one fifth of all housing units in Dublin). The results demonstrate that the latter populations were more likely to have longer commute times and to depart earlier to get to work. The findings also suggest that, despite ambitious government level goals, housing built during the property boom was more likely to be in low-density areas.

Keywords: land use patterns; sustainable travel

1. Introduction

After almost fifteen years of unprecedented economic growth, the Irish economy is now experiencing one of the largest declines experienced by any developed country since World War II [1].

After an export-led boom that was fuelled by large increases in productivity *per capita* in the last years of the 20th century and the first years of this one, recent economic growth was largely driven by the construction of housing units. Ireland experienced perhaps the largest expansion in housing supply of any economy in Europe. The number of units built annually peaked at 88,000 in 2007 which translated to 18 units per 1000 people, more than three times the average rate for eighteen other European countries measured [2]. In tandem with this, house prices increased by 65% and the amount of total mortgage debt almost trebled to €140B between 2002 and 2007, reflecting an increased demand and a doubling in the average loan size for new mortgage holders [3].

In that period, Dublin, as capital of Ireland, was an economic driver and the area, like the rest of the country, underwent significant economic and demographic changes with increases in employment, income, and population. Already a low-density city by European standards [4], rapidly increasing house prices (along with other pressures such as road congestion and demand for oversubscribed services) incentivized developers and potential buyers to locate further from the traditional Central Business District (CBD) [5]. What is more, the nature of local government in Ireland further incentivized development activity. Local authorities, with little power to levy taxation on property or land, engaged in large-scale rezoning's as a way to raise additional revenue through development levies [6]. These pressures led to rapid development activity and population increases beyond the traditional boundaries of the city and are changing the relatively monocentric nature of the City [7]. Consequently, the population of the Greater Dublin Area (GDA), an area defined as the four counties of Dublin and the three adjacent counties, increased by 20% between 1996 and 2006 while the numbers in employment increased by almost a half with the largest increases occurring outside Dublin City [4].

In tandem with the increases and dispersion in economic and settlement activity, transportation patterns also changed significantly. Firstly, the oft-reported relationship between economic growth and increased car ownership was particularly pronounced in Ireland [8]. While Irish car ownership levels, at 437 cars per 1000, remains slightly below the European Union average of 463 in 2007 [9], the number of registered private cars has almost doubled since 1996, standing at 1.9 million cars in 2007, of which the GDA accounted for some 720,000 cars [3]. This increase in car ownership was also reflected in a larger share of GDA commuter trips (which are defined as trip to work, school or college) undertaken using cars, increasing from under 47% to almost 52% in the 10 years to 2006 [4]. The combination of increasing economic and transport activity, dependence on car travel and the diffusion of settlement patterns are all closely interrelated. Other researchers have found that mode choice and transit usage are impacted primarily by density and land use [10]; in Ireland both variables are largely defined by policy decisions (e.g., through zoning). Distance from the central business district is also an important determinant of mode choice [11]. Similar to other economies, these interrelationships have resulted in worsening congestion and environmental performance as the private cost of motoring is often less than the costs imposed on society, especially in urban areas [12]. Not only have travel speeds decreased for road commuters, with the possible exception of the City's network of Quality Bus Corridors [13], carbon dioxide (CO_2) emissions from transport increased by almost 170% between 1990 and 2006 in Ireland [14].

With the city and the country undergoing a significant economic reversal, it is perhaps an appropriate time for researchers to conduct an overview of the boom's impacts on transportation

patterns for the Dublin area. As Scott [15] notes when questioning if longer journey times were the result of current government policy, planning laws need regular assessment in terms of their effects. In this research the authors focus on the residents living in the four counties that make up Dublin city and county. Data from the 2006 census is used to analyse how transport patterns differ based upon some key housing and land use characteristics, such as the number of public transportation options available, density and the year of housing construction. With this last variable, the authors want to explore how commuting patterns differ, if at all, as a result of the housing age, holding all else equal, from those living in housing units constructed in earlier periods.

The paper is outlined as follows: in the next section there is a short review the policy context for our research question by outlining some of the stated transportation and sustainability goals of the Irish government and review the relevant academic literature. The following section outlines our methodological approach for answering our research question. The results of the research are presented in the last section of the paper. The paper concludes with an overview of the results and a policy discussion.

2. Policy Context and Literature Review

The Irish government have outlined a number of very ambitious strategies in the transportation and sustainability realms for both the medium and long term. In the transport sphere, response has generally taken two forms—infrastructural (increased road capacity by widening and expanding the road network, provision of additional heavy rail capacity, light rail, bus priority, *etc.*) and demand side management aimed at tackling congestion (parking pricing, transportation allowances, transit and rideshare financial incentives, public transport pass programmes, *etc.*). Despite interest from many researchers about congestion charging, there remains little appetite for first or second-best policy instruments approximating the marginal external costs of private transport in advance of the provision of a large scale investment in a mass transit alternative. This was meant to be achieved through the implementation of a number of National Development Plans (NDP) and various strategic transport plans. The latest plan, a massive infrastructural investment program entitled *Transport 21* [16] outlined an investment of almost €35 billion ($46 billion) in transport infrastructure nationally, with about 50% going to public transportation. However, the delivery of these plans have been characterised by administrative, regulatory and financing holdups. The latter of which is likely to be the primary constraint as the finances of the Irish government worsen [17]. In the interim, as previously noted, the car has gained an increased share of the peak time travel market. A key concern in the environmental sphere has been to maintain or even reverse this trend. This latter point is especially important given that, as of 2005, Ireland was emitting 25% more CO_2 than in 1990 levels, 12 percentage points more than it is permitted under is Kyoto commitments [18] and with a requirement to reduce greenhouse gas emissions by 20% over 2005 levels by 2020 under its "20-20-20" obligations [19]. A number of strategies have been developed by the government to better integrate transportation and land use polices, but the diffuse nature of decision making in Dublin has hindered integrated land use planning; the City and County of Dublin, with a population of 1.2 million people is divided into four jurisdictions, each with their own planning powers.

In the international context, the interaction between land use and transportation is an extremely well explored topic [20]. As already noted, the continued disconnect between land use and transportation planning in Dublin has also spurned considerable interest amongst researchers in Ireland. In qualitative analyses, Williams and Shiels [21] characterise the development patterns in the GDA as *laissez faire* and Williams *et al.* [22], defined these patterns as unsustainable. In this context, it perhaps the right time to offer a quantitative insight into what these policy and economic processes delivered in terms of land use and transportation patterns and whether they offer signs of being sustainable in the longer run. It also allows the next generation of policymakers insights into what happened in Dublin over the period of the recent economic boom and how to plan accordingly.

Figure 1. Map of Dublin City and County and the Greater Dublin Area.

Mode choice, of course, is determined by many factors. In Dublin recent analysis by Commins and Nolan [4] explores the major influences of modal choice in the GDA using the 2006 Census of Population data. Using a conditional logit structure, the authors find the importance of individual demographic and socioeconomic characteristics on modal choice for commuters travelling to work. For instance, older people are less likely to walk, cycle or take public transit. Females are significantly

more likely to travel to work by bus or train. Higher levels of income and social class, as well as the presence of children in a household, reduces the probability of using public transit, a finding similar to McDonnell *et al.* [23]. Mode choice is also influenced by local and regional transportation characteristics. Unsurprisingly, the authors find that city centre residents and those with rail coverage are more likely to walk, cycle or use public transit while those households with higher car ownership are less likely to use these modes. While the authors conduct a detailed analysis of the determinants of mode choice, their focus does not extend to the age of the housing stock and associated development patterns and how this relates to modal choice. Our analysis is also confined to the four counties that make up Dublin City and County (Dublin City, Dun Laoghaire-Rathdown, Fingal and Dublin South) rather than the seven counties that make up the GDA (see Figure 1).

3. Methodology

3.1. Data

The census data used in this paper was taken on the night of Sunday, 23rd April 2006 in 1.5 million Irish homes. Our data are taken from the place of work census of anonymised records dataset (POWCAR) [24]. It contains information on the regular work trips of 1,834,472 individuals over the age of 15. Unfortunately, income levels of respondents, an important determinant of travel behaviour, are not included in the dataset; however, data on the respondent's socio-economic status is collected by the CSO.

3.2. Descriptive Analysis

The purpose of this paper is to ascertain how the modal choice of residents in the City and County of Dublin relates to a number of housing and transportation characteristics. The variables analysed include the mode choice of the respondent, the number of cars per household and the level of housing density, the number of bus stops in the respondent’s vicinity and if a rail station is within the resident's vicinity (both of which are defined as an electoral district, the smallest level of geography currently available to us). A number of activity variables are also examined such as, travel time and distance and departure time. The research also examined the year that the respondent's housing unit was constructed. Although, the authors conducted binary logistic and multinomial logit models on our data, with mode choice as our dependent variable, poor model fits suggested that such models were inappropriate. Future work will explore in more detail the relationship between mode choice and these variables, however, it is currently beyond the scope of this research. As such, the focus of this paper will be on presenting a descriptive overview of commuting patterns as they relate to housing characteristics and particularly the vintage of housing stock.

4. Results and Analysis

This section of the paper reports the results of the analysis conducted on the 2006 Census dataset. The first section provides a descriptive overview of the increases in the number of houses built in the City and County of Dublin and the modes of transport used to travel to work.

4.1. Characteristics of the Sample

The top portion of Table 1 details the number of houses built in the City and County of Dublin from 1919 to 2006. As already discussed, recent growth in the Irish economy was largely fuelled by growth in the housing stock. This is especially evident when one considers the results presented in Table 1. In fact, between 2001 and 2006, over 15% of the total housing stock in Dublin was built and almost 25% of the housing stock was built within a decade of the last census. The annual construction rate of over 15,000 housing units in the last five year period is almost twice the rate experienced for houses built between 1971 and 1995.

Table 1. Number of houses built and mode of transport.

Year Built				
	N	**%**	**Number of Houses Built per Annum**	
1919–1970	182,786	36	3584	
1971–1995	196,603	39	8192	
1996–2000	49,102	10	12,276	
2001–2006	76,828	15	15,366	
Total	505,319	100		
Mode of Transport				
	N	**%**	**Average Distance (KM)**	**Average Travel Time (minutes)**
Walk	70,080	13	2.17	19
Cycle	20,602	4	5.48	22
Bus	76,816	14	9.51	43
Rail	39,534	7	13.47	45
Motorcycle	6607	1	10.84	25
Car-Driver	260,754	49	11.24	31
Car-Passenger	19,997	4	9.75	28
Lorry/Van	19,239	4	13.91	35
Other means	1028	0	-	-
Work from home	8218	2	-	-
NA	9354	2	-	-
Total	532,219	100	-	-

The bottom portion of Table 1 details the modes of transport used by residents in Dublin City and County. The results show that the majority of individuals use the car to commute, either as a passenger or a driver (53%). A sizable proportion of individuals walk to work (13%). Public transport accounts for 21% of daily work trips with the bus accounting for two thirds of that. Unsurprisingly, walkers and cyclists have the shortest commutes, both in terms of distance and time. Bus users and car passengers commute almost the same distance on average but travel times for bus users are approximately 50% longer. Rail users have tend to have longer travel distances and travel times than other groups.

4.2. Characteristics of the Housing Location

To understand these patterns more clearly, a cross-tabulation analysis was conducted to develop a clearer picture of the housing stock with respect to a number of factors related to sustainability and livability (see Table 2). The research examines public transport availability, residential density and the number of cars per-household in relation to the year of housing construction. The first set of results relate to the number of bus stops available. Our measure represents the average number of bus stops available per-person in electoral district for each of the housing categories examined. This measure, along with the rail measure, is designed to capture public transport option available. It is noted that the size of electoral districts are not uniform so the measure is less than perfect; they tend to be smaller in more dense areas. However, the electoral district is the smallest geographical district available to us at the time of writing. Results should be read in that context. The results show that the number of bus stops in each of the housing categories increase from 5.35 for those houses built before 1919 to 8.11 for those built in 2001–2006. This maybe as a result of the larger electoral districts further from the City's core. One interesting result to note is the 5% increase in housing units with no access to a bus stop between 1996–2000 and 2001–2006. However, the results also indicate that housing units built before 1980 were at least as likely to be located in electoral districts without bus stops. In contrast, the results for rail availability shows that housing stock built before 1940 had greater access to rail, this then decreases until the housing stock built in 1991–1995 where there is slight increase. Our rail accessibility measure is a binary one. Dublin has a limited radial rail network and the bus network is the workhorse of the public transport network; therefore it is not surprising to see only 20–30% of the population of the city with access to a rail station.

The next set of results examines the relationship between residential density and vintage of housing stock. This measure is calculated by estimating the housing unit density in each electoral district and cross-tabulating these results with our housing vintage categories. For instance, 30% of housing units built between 2001 and 2006 were constructed in electoral districts with less than 1000 housing units per km^2 compared to only 5% of units constructed before 1919. Between 1996–2000 and 2001–2006 there was a 16% increase in housing units built in the lowest density category. In contrast, the percentage of new units built in areas with densities of 3001–6000 units per km^2 declined from over half of all units constructed in 1996–2000 to just over a third between 2001 and 2006. This result demonstrates that during this period that the housing constructed was predominantly in areas with lower-density development patterns and reflects the pattern of large scale rezonings in land previously designated as agricultural identified by authors such as McGuirk and MacLaran [6]. The percentage figures hide the fact that absolute number of units constructed in the lowest density areas increased from just over 7000 units in 1996–2000 to over 23,000 units in 2001–2006. It also reflects the low density nature of Dublin City and County, these units, representing over 4% of the total housing stock, were all built within a less than 30 kilometer radius of the city center, yet in areas of low density. The final set of results presented in Table 2 examines the rates of car ownership per household. The highest levels of car ownership were shown to be in households living in housing stock built in the period 1961–1995. Interestingly average car ownership levels were shown to drop from 1.54, for those living in housing built in 1996–2000, to 1.40 for those living in housing built in 2001–2006. This perhaps reflects an income effect, which are unable to capture with our data. There may also be some lifecycle

effect occurring; results (outlined in more detail below) show that residents of the newest housing stock are heavily skewed to the under-34 age group.

4.3. Characteristics of the Households

A cross-tabulation analysis was conducted on a number of household characteristics and the year the house was built (see Table 3). Gender is the first characteristic examined. The results for gender show a fairly consistent gender split, indicating that the year the house was built has little relationship with gender split. The average age for each of the housing groups was shown to be 37–41 for all housing built before 1995. As already alluded to, the average age falls to 35 for those living in housing built between 1996–2000 and to 33 for those living in housing built from 2001 to 2006, of which, almost 60% are in the 25–34 range compared to 44% in the earlier periods and under a third for all housing constructed pre-1996. This result confirms that the main consumers of new units during the construction boom tended to be younger. In fact, it can be seen that there were almost 46,000 members of this cohort living in these newest units, almost as many as the total construction of units in 1996–2000.

The SEG (socio-economic group) variables are ordered in highest profession first. A full definition of each of the SEG variables can be found in Table 5 in Appendix 1. The results in Table 3 demonstrate that there is very little difference in the distribution between the SEG variables. As with the gender and age variables, this result suggests that socio-economic grouping has little relationship with the age of the house a person lives in. The final set of variables examined in Table 3 represents the number of individuals' per-household. The average number of residents for each of the housing groups is also calculated. The results show that the average number of people per-household ranges from 2.7 to 3.6. Housing stock built 2001–2006 was shown to have the lowest average number of residents of 2.7, perhaps reflecting the typical life stage of this age cohort. A much lower proportion of residents living in the newest housing stock live in households with three or more people than any other vintage. Unfortunately our data does not contain information on the number of children in a household. The average number of people per household peaks for those living in units constructed between 1961 and 1970.

5. Conclusions

Over the last decade and a half, the Irish government and local Dublin policymakers faced almost unprecedented economic growth. As shown in this paper, the latter part of the boom was characterised a rapid and unprecedented increase in the housing stock. At the same time, planners committed themselves to ensuring sustainable patterns of development and transportation through a number of very ambitious strategies, either through the provision of new public transportation infrastructure or through incentives to improve the sustainability of land use patterns.

Table 2. Cross tabulation between housing stock and location characteristics.

Year Built	**Before 1919**		**1919–1940**		**1941–1960**		**1961–1970**		**1971–1980**		**1981–1990**		**1991–1995**		**1996–2000**		**2001–2006**	
No. of Bus Stops	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
None	9655	24	9463	28	18,372	31	12,754	26	21,020	22	12,224	19	6587	17	8459	17	17,267	22
1–5 stops	16,189	41	15,347	45	25,840	44	18,471	37	34,559	37	20,927	33	11,047	28	13,263	27	19,104	25
6–10 stops	8286	21	6555	19	11,413	19	12,919	26	24,043	25	16,168	26	9921	25	9232	19	20,005	26
11–20 stops	4314	11	1898	6	3250	5	4764	10	7830	8	6864	11	5480	14	4719	10	7965	10
20+ stops	1353	3	514	2	457	1	972	2	6960	7	6702	11	6271	16	13,429	27	12,487	16
Total	39,797	100	33,777	100	59,332	100	49,880	100	94,412	100	62,885	100	39,306	100	49,102	100	76,828	100
Average		5.35		4.17		4.0		5.16		6.01		7.19		8.56		9.6		8.11
Rail Available																		
No	27,762	70	25,521	76	49,454	83	42,101	84	77,555	82	50,194	80	29,802	76	38,929	79	61,634	80
Yes	12,035	30	8,256	24	9,878	17	7,779	16	16,857	18	12,691	20	9,504	24	10,173	21	15,194	20
Total	39,797	100	33,777	100	59,332	100	49,880	100	94,412	100	62,885	100	39,306	100	49,102	100	76,828	100
Density of Housing Units																		
Less than 1000 per km^2	2140	5	1361	4	1674	3	3475	7	9145	10	7018	11	4680	12	7001	14	23,094	30
1001–3000 per km^2	5064	13	5830	17	11,812	20	12,139	24	29,761	32	25,233	40	11,783	30	10,701	22	17,265	22
3001–6000 per km^2	11,908	30	13,263	39	32,459	55	27,284	55	48,216	51	24,518	39	16,295	41	24,797	51	26,932	35
6001–9000 per km^2	11,552	29	10,191	30	10,850	18	5928	12	6397	7	4630	7	3947	10	3963	8	6151	8
9001–12,000 per km^2	7524	19	2397	7	2059	3	855	2	632	1	1079	2	1605	4	1267	3	2342	3
12,001+ per km^2	1609	4	735	2	478	1	199	0	261	0	407	1	996	3	1373	3	1044	1
Total	39,797	100	33,777	100	59,332	100	49,880	100	94,412	100	62,885	100	39,306	100	49,102	100	76,828	100
Average		6356		5444		4722		4109		3593		3435		4060		4047		3288
Number of Cars per Household																		
One	14,462	37	12,879	39	22,526	38	16,463	33	30,128	32	22,480	36	13,241	34	16,495	34	31,380	41
Two	11,397	29	11,211	34	20,897	36	19,966	40	37,627	40	24,399	39	16,335	42	20,754	43	28,519	38
Three or more	3741	10	3424	10	6587	11	7621	15	18,021	19	8587	14	3870	10	4162	9	4334	6
None	9575	24	5856	18	8758	15	5409	11	7846	8	6889	11	5511	14	7249	15	11,617	15
Total	39,175	100	33,370	100	58,768	100	49,459	100	93,622	100	62,355	100	38,957	100	48,660	100	75,850	100
Average		1.33		1.47		1.54		1.76		1.90		1.69		1.58		1.54		1.40

Table 3. Household characteristics.

Year built	**Before 1919**		**1919–1940**		**1941–1960**		**1961–1970**		**1971–1980**		**1981–1990**		**1991–1995**		**1996–2000**		**2001–2006**	
Gender	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Male	21,665	54	18,183	54	32,254	54	27,439	55	51,977	55	33,686	54	21,450	55	26,965	55	40,348	53
Female	18,132	46	15,594	46	27,078	46	22,441	45	42,435	45	29,199	46	17,856	45	22,137	45	36,480	47
Total	39,797	100	33,777	100	59,332	100	49,880	100	94,412	100	62,885	100	39,306	100	49,102	100	76,828	100
Age																		
15–24	4040	10	3795	11	7389	12	6373	13	15,384	16	10,021	16	4516	11	5641	11	9191	12
25–34	12,868	32	8744	26	13,929	23	12,273	25	22,999	24	15,850	25	13,105	33	21,514	44	45,704	59
35–44	9373	24	8254	24	15,038	25	11,593	23	15,319	16	13,779	22	12,798	33	15,295	31	15,853	21
45–54	8003	20	7795	23	14,574	25	9733	20	21,380	23	16,550	26	6827	17	5015	10	4326	6
55–64	4654	12	4390	13	7128	12	8034	16	17,860	19	6134	10	1856	5	1418	3	1495	2
65+	859	2	799	2	1274	2	1874	4	1470	2	551	1	204	1	219	0	259	0
Total	39,797	100	33,777	100	59,332	100	49,880	100	94,412	100	62,885	100	39,306	100	49,102	100	76,828	100
Average		39		40		40		41		40		39		37		35		33
Socio-Economic Grouping																		
SEG1	7551	19	6087	18	9688	16	8567	17	14,688	16	11,000	17	8262	21	9786	20	15,001	20
SEG2	6614	17	3859	11	4912	8	3884	8	6066	6	5136	8	4383	11	5435	11	9092	12
SEG3	7110	18	5229	15	7691	13	6704	13	11,659	12	8428	13	6136	16	7370	15	12,135	16
SEG4	8686	22	8720	26	16,590	28	14,285	29	28,676	30	17,906	28	10,317	26	12,784	26	20,141	26
SEG5	2083	5	2739	8	6134	10	4961	10	11,196	12	6346	10	3125	8	4069	8	6044	8
SEG6	2384	6	2571	8	5608	9	4438	9	8694	9	5208	8	2466	6	3449	7	5314	7
SEG7	1261	3	1345	4	2686	5	1758	4	3442	4	2386	4	945	2	1451	3	2220	3
SEG8	1833	5	1534	5	2951	5	2626	5	4779	5	2840	5	1683	4	2135	4	2440	3
SEG9	156	0	86	0	90	0	77	0	176	0	108	0	61	0	71	0	116	0
SEG10	52	0	31	0	44	0	77	0	104	0	67	0	34	0	57	0	112	0
SEG11	2067	5	1576	5	2938	5	2503	5	4932	5	3460	6	1894	5	2495	5	4213	5
Total	39,797	100	33,777	100	59,332	100	49,880	100	94,412	100	62,885	100	39,306	100	49,102	100	76,828	100

Table 3. *Cont.*

No. of People per Household																		
1	6460	16	3624	11	4762	8	2947	6	4425	5	5174	8	3916	10	4556	9	10,626	14
2	12,260	31	8336	25	13,548	23	10,498	21	16,809	18	12,753	21	10,103	26	14,516	30	32,815	43
3+	20,749	53	21,526	64	40,497	69	36,062	73	72,174	77	44,251	71	25,035	64	29,787	61	33,072	43
Total	39,469	100	33,486	100	58,807	100	49,507	100	93,408	100	62,178	100	39,054	100	48,859	100	76,513	100
Average		2.9		3.2		3.3		3.4		3.6		3.5		3.2		3.1		2.7

However, as shown, the attempt to better integrate transportation and land use planning has been hindered by the diffuse nature of policymaking in the Dublin Area. Local authorities, incentivized by the potential for development-related revenues, engaged in widespread rezonings of previously agricultural land for low density developments, largely unregulated by the central government. Accordingly, it is very possible that a unique opportunity to reshape development patterns in Dublin has been lost. As this research shows, approximately a sixth of the total housing stock in the City and County of Dublin were built in the five years up to 2006 and that fully a quarter of the housing stock is less than 10 years old. This suggests that policymakers had a tremendous contemporaneous opportunity to influence transport, land use and development patterns in a way that would likely have brought significant changes. The strategies outlined by the central government were aimed at better integrating these strands of policymaking.

Yet, the results of this research show individuals living in housing built during the most recent period were less likely to use alternative forms of transport than those living in the pre-existing housing stock. Further, the results also indicate that most of the recent housing stock was built in low density areas, as a result the provision of such services, such as public transportation, will likely be more difficult in the future. Commuters living in the newest housing stock, who are also likely suffering the effects of negative equity as a result of the housing collapse and, as a result are less mobile, are also the ones with the least sustainable transportation patterns. One of the most compelling findings is in relation to where the newest housing stock was situated. Over 50% of the newest housing units were built in areas with existing population densities were low. Even more tellingly, the proportion of housing units built in the lowest density areas (less than 1000 housing units per square kilometre), increased from approximately one in seven units for those units built between 1996–2000 to almost a third built in the most recent period. These areas typically lack the services available to residents in higher density areas. Government provided operations such as public transport are generally more costly and less effective, accordingly residents will more likely need the use of a car.

This should give tremendous pause for thought on behalf of Irish policymakers, despite many strategies to encourage sustainable development and transportation patterns, the development patterns were, as one researcher called it, *laissez-faire*. In fact, the development patterns in the most recent period of construction were moving in the opposite direction of stated land use goals. The diffuse nature of policymaking in the Dublin area has often been cited as the main administrative barrier to integrated planning. Given the recent vintage of much of the housing, policymakers should, at the very least, look towards the mistakes of the recent past, and investigate concrete ways to reverse the backwards steps of recent years. There is some evidence of this in central government [25]. However, it will require a much larger investment in integrated land use and transportation planning than hitherto exhibited and the process should include ways to implement already existing strategies and mitigating the mistakes of recent years. As a result of the housing collapse, it is unlikely that much new housing will be built in Dublin for the foreseeable future, as such, policymakers should also explore "retrofit" policy possibilities for the existing stock of housing. On the transportation side, one such example could be the use of increased bus priority measures, already shown to be effective in parts of Dublin [23], as a relatively low cost way to improve the efficiency of existing infrastructure and make alternative modes more attractive to current non-public transport users. As well as improving the efficiency of infrastructure, policymakers should also explore institutional reform. The public

transportation market in Dublin is highly regulated with little access for new operators [13], in light of the trends highlighted here, it is perhaps time that planners explored liberalising the bus market to see if private operators may see opportunities for feeder services that are not currently provided by the state operated bus company. If and when housing construction begins again in the Dublin region, perhaps the mistakes of the last decade may act as guidance to future policymakers both in Ireland and abroad.

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