PREPARED BY
Future Analytics FOR

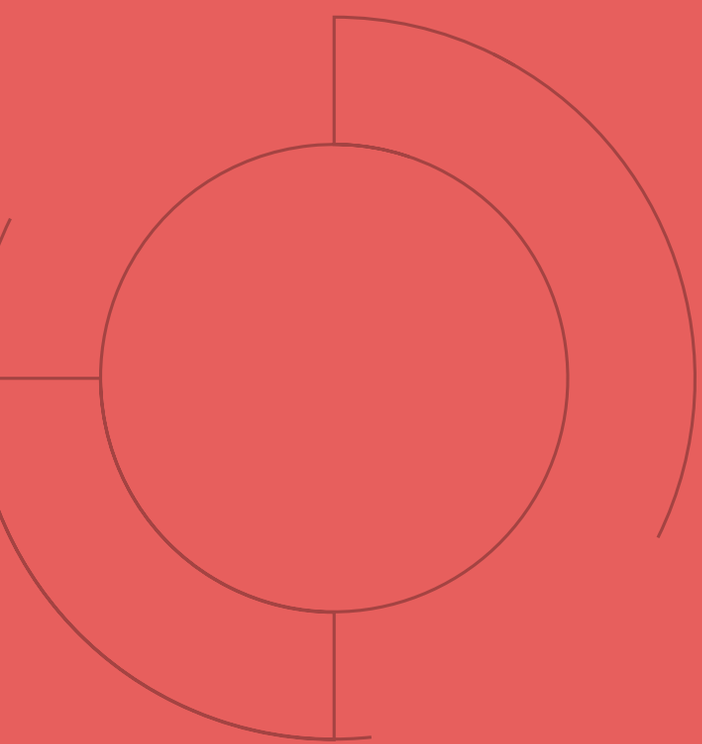
Ardstone Capital

Demographic Drivers and Changing Housing Demands in Dublin Over the Coming Decade.

February 2019

Demographic Drivers and Changing Housing Demands in Dublin Over the Coming Decade

A quantitative assessment of changing household composition and occupancy demands in Dublin over the past 10 years and its impact on future needs.



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EXECUTIVE SUMMARY

The following report has been prepared by Future Analytics Consulting Ltd. on behalf of Ardstone Capital Ltd, with its purpose being to provide a 5–10-year outlook with respect to housing demand in Dublin. In particular, the study aims to address the size and composition of the housing market in Dublin now and how will it change over the next 10 years. The assessment will also outline how composition has changed from a global cities perspective and what potential housing options could be required. The report has sought to utilise the best available data on population growth, socio-economic changes, income, market analysis and awareness of stock and a range of other inputs to create the outlook. The intention is to inform decision-making in terms of investment in the housing sector in Dublin.

The analysis has been carried out at a 'Dublin-wide' scale, but has been sub-divided in places to provide further detail as it relates to 'Dublin City' or 'Dublin Suburbs'. Given the important economic role Dublin plays in Ireland, and its influence on the wider Eastern and Midland Region, following the publication of the NPF, the study recognises the need for a high-level strategic document to present the compositional changes in households over the past decades and to identify how the demand for units is changing.

With the continued high levels of population growth, it is imperative that future urban development occurs in a sustainable manner, which makes most efficient use of the limited land available. This will ensure that future communities are connected and integrated within Dublin's urban form and are well placed to avail of existing and proposed services and infrastructure.

It is with this strategic approach in mind that the study has considered how different drivers of demographic change have influenced demand over the past decade. The assessment then models the direction in which demand is likely to go in the coming decade, quantifing the household typologies required to meet demand. The main document provides a summary assessment of high level outputs from a modelling process. For a comprehensive review of all assumptions, model steps and outputs, please refer to Appendix 1 of this document.

Methodological Note.

The CCM projection methodology has been used to quantify future population growth within the study area. The housing demand projections use population projection as an input alongside variables like household composition, vacancy, obsolescence to determine demand per-person-household. Projections focus on two key target years, 2024 and 2029 (i.e. 5 and 10 year horizons).

The analysis covers all areas within County Dublin. The assessment has further divided in places to two sub-areas; 1) 'Dublin City' references the Dublin City administrative area and 2) 'Dublin Suburbs' references data from the remaining three local authority areas of Fingal County, South Dublin County and Dun-Laoghaire Rathdown County.

Section 01

INTRODUCTION

Dublin's population continues to expand robustly, despite net outward migration during the economic downturn. In the ten years to 2016, it grew by 13.5% to 1.35 million. The composition of Dublin households is also changing rapidly, partly because of social trends.

Despite the economic recession, Irelands population has grown by +12.3% over the past decade from 4.24m to 4.76m in 2016. The population living in urban areas has also increased by +16% from 2.57m to 2.98m. Over the same period, the population of Dublin increased from 1.19 to 1.35 million (13.5%); An average population growth rate of 1.3% per annum. Dublin's population is set to continue expanding due to natural growth and net inward migration. In 2019, it is estimated at over 1.38 million.

There has also been a shift in household occupancy and composition within existing and new households. This situation represents something of a 'paradigm shift' as different housing profiles and needs have developed that were not historically present. The characteristics of households, including their size and composition, are closely associated to a wide range of societal changes that impact demography and preference.

The primary driver of this shift is lower fertility rates. The fertility rate in Ireland and Dublin has dropped significantly over the past 50 years the our replacement rate is now below the rate of two children per woman. This reduction in fertility has decreased the average size of families and as a consequence, the demand for larger unit sizes. The average household size in Dublin was 2.73 persons per household in 2016. This is down from 2.99 in 1996 and 3.94 in 1971. When isolating just those persons living in apartment units, the average household size is significantly lower at 2.2 persons per household in 2016.

In line with this pattern, residential stock in Dublin has grown by approximately 14.0% since 2006. The share of semi-detached houses of total has remained in and around 35% of stock, increasing in absolute terms by 7.8% on 2006 figures by 2016. Apartments were the highest growing housing type in that same period though, seeing an almost 39% increase on 2006 figures. They are presently just under 24.9% of the total residential stock share and are reflective of the new demands of the resident population.

Occupancy within the housing market also shifted significantly in the last number of years, evidenced by the relative growth of the private rental sector. The lack of housing supply, limited availability of finance for purchases, fall in property prices and increase in the unemployment rate all combined to see a transition away from the well-established owner-occupier market. The private rental sector has grown; increasing from 14.5% of households in 2002 to account for 23.9% of households in 2016. Its absolute growth has been from nearly 55,000 to over 114,000; growth of 109% between 2002 and 2016. Consequently, there is now a greater level of competition amongst those households choosing, or being forced to choose, privately rented housing.

In addition to fertility, trends in household size are influenced by trends in: health, longevity and migration; cultural patterns surrounding intergenerational co-residence, home leaving, cohabitation, marriage and divorce, lower mortality; and socioeconomic factors that shape trends in education, employment and housing markets. For example, in 2016 there were 40,271 persons living alone in Dublin over the age of 65, accounting for over 1-in-4 (26.8%) of all persons over 65. This rate increases to 46.8% for persons over 80 years old. Taken as a whole, these trends mean that there is a need to plan for more homes, particularly to meet the accommodation needs of smaller families and single person households (including older people), both of which are likely to increase in number.

In parallel with these social changes, the residential development sector has not functioned correctly over the past 10 years. The completion of just 12,596 units in 6 years between 2010 and 2015 (average at 2,099 units per year) was not sufficient to meet the needs of a growing/changing population (caused by issues such as finance availability, uncertainty to whether what is being built will be marketable and wider household affordability created a significant 'pent-up' demand for new units in the capital (Figure 1)).

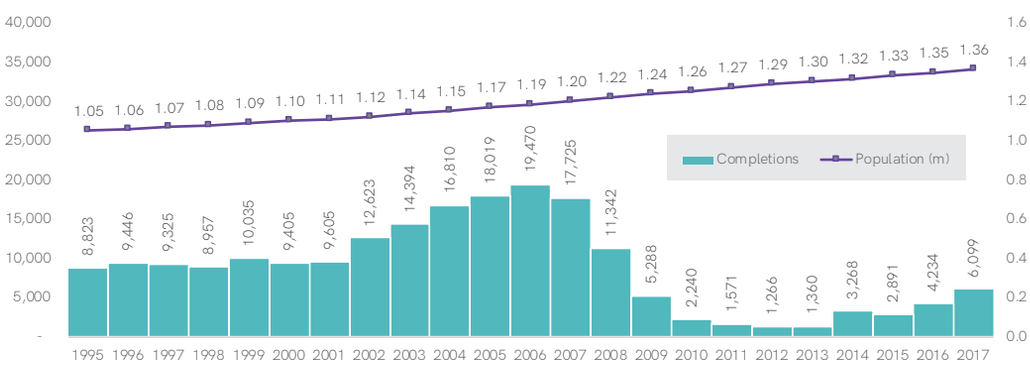


Figure 1: Population Growth and Housing Completions 1995 - 2017 (Dublin)

However, the outlook is relatively positive from a housing supply capacity perspective. Granted residential planning permissions in Dublin total of 35,774 residential units (in schemes of 10+ units). While a significant quantum of housing units awaits the commencement of construction, there are 5,915 units currently classified as commenced. This accounts for 16.5% of total extant permissions currently in the pipeline. Apartments are the dominant unit type for which permission has been sought (65% or 23,223 of all pipeline units).

While this is a significant quantum of new units, the level of consent will need to continue at a similar pace to ensure a constant supply of new units. Based on available information, it is envisaged that a shortfall in supply will persist in Dublin in the face of strong, sustainable demand, until such time as unit delivery dramatically increases or population restructuring occurs.

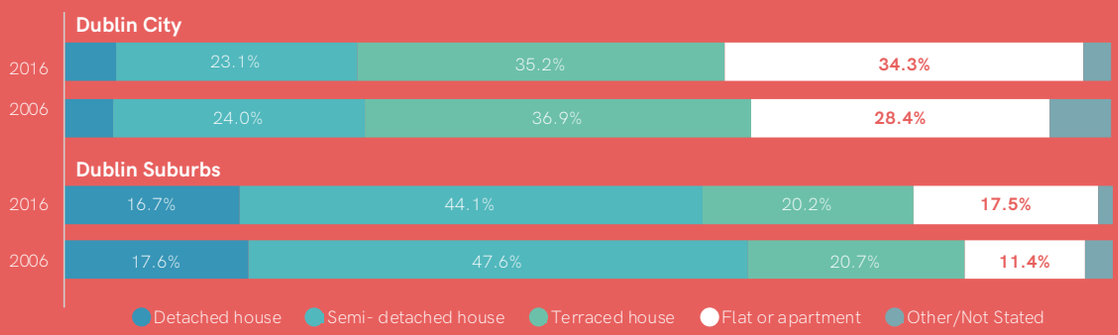
Section 02

CHANGING TRENDS IN PROPERTY

Over the past few decades there has been marked changes in the size, composition and occupancy of households in Dublin. These changes are partly because of social trends, the nature of highly developed countries, and our demographic composition.

New House Types

The proportion of all existing housing types has shrunk over the past 10 years in Dublin with the exception of apartment units. The proportion of apartments has increased by 39.0% over this period.



Household Size

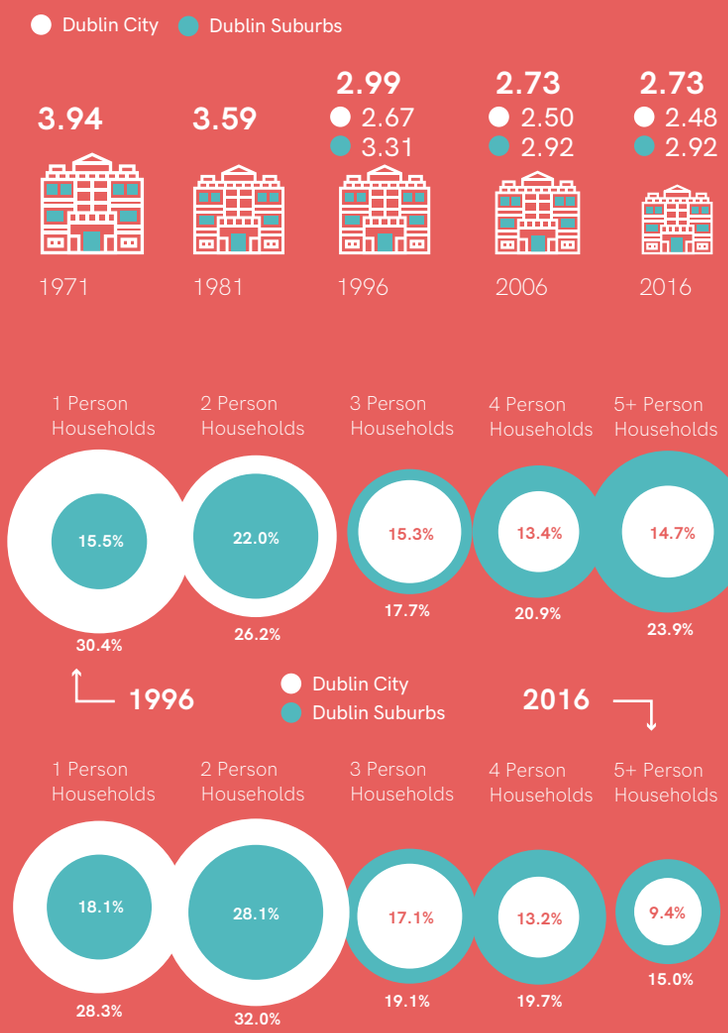
The shift in demand for unit types has been as a result of a shrinking average household size and larger increases in smaller per person households (ph) over the period.

In 2016, the average household size in Dublin was 2.73 persons per household. This is down from 2.99 in 1996 and 3.94 in 1971.

Dublin City is home to the largest cohort of 1 and 2-ph. In 2016, the combined 1 and 2 ph accounts for 60.3% of all households.

Dublin Suburbs are home to a large mix of 3, 4 and 5+ ph, though the largest growth has been in 1 and 2-ph (2 ph have grown by 6.1% since 1996). While 3 ph has also seen growth over the past 20 years, both 4 and 5+ ph have shrunk.

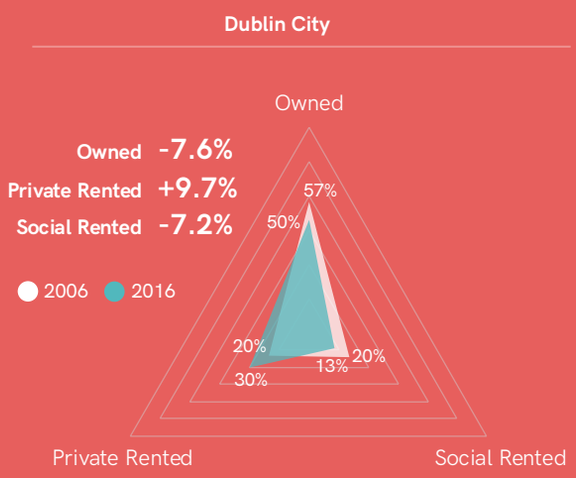
Both the city and suburban areas have seen significant contraction in household of sizes 5 persons and over since 1996.

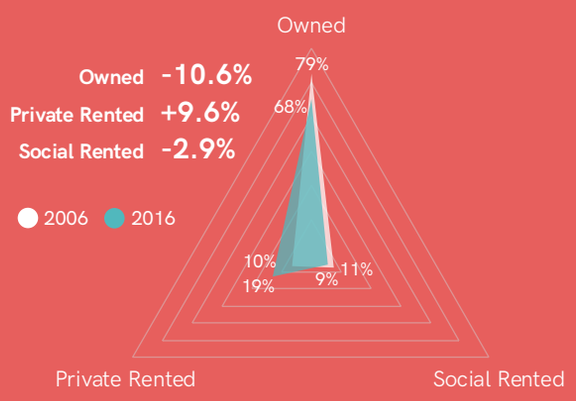


Housing Occupancy

The housing market has also shifted significantly, evidenced by the relative growth of the private rental sector, the lack of housing supply, all combined with a shifting household composition stemming from shifting socio-economic norms and demographic change.

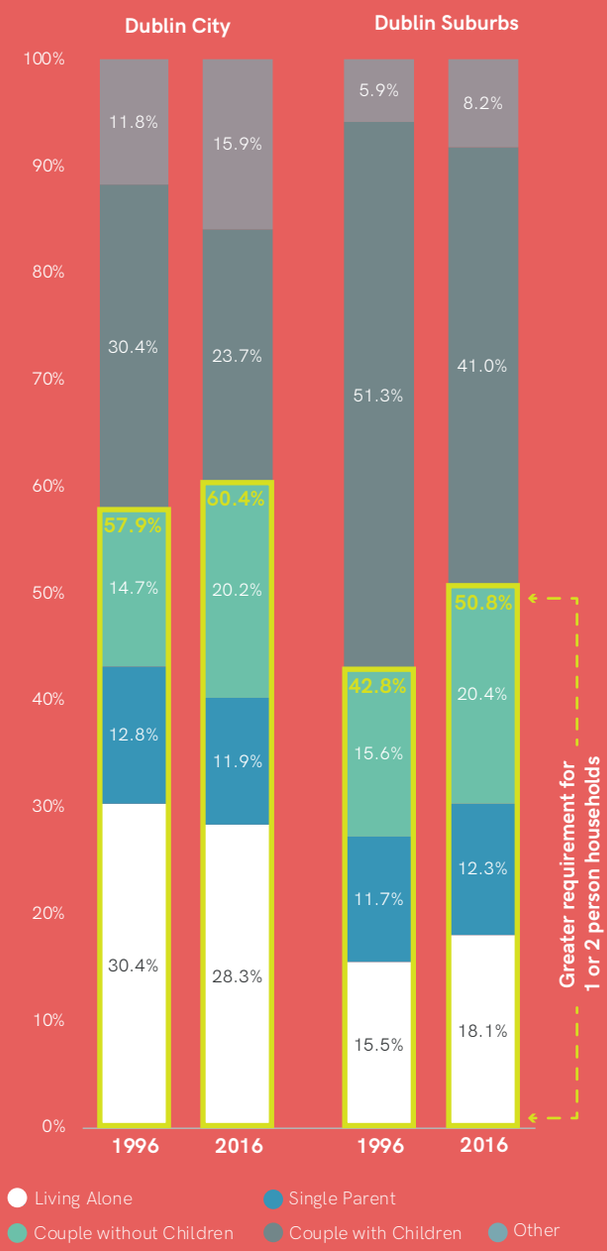
The private rented sector has more than doubled in size between 2006 and 2016, with approximately one in five households (24%) in Dublin now renting their home.





Housing Composition

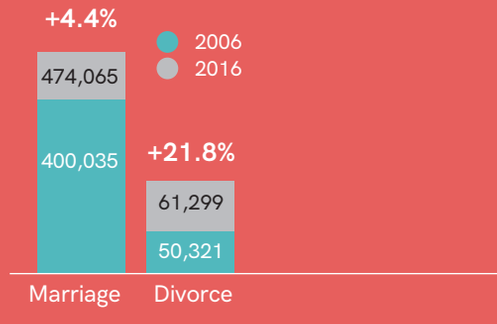
The proportion of adults living alone in Dublin has increased to 23.9% between 1996 and 2016. Dublin City consistently ranks highest, due to its highly urbanised environment and larger offering of accommodation suited to the needs of a one person household.



Marriage, Civil Partnerships and Divorce

The rate of marriage and civil partnerships in Dublin has been decreasing over the past two decades. While there has been an increase in total numbers the growth has diminished.

Divorce was legalised in Ireland in 1996. In 2006, the rate of divorce and separation in Dublin was 42.4 per 1,000 population. This figure increased to 45.5 per 1,000 population in 2016 which constitutes a 21.8% increase in the number of persons divorced or separated in Dublin.



Section 03

A GLOBAL VIEW

A way to view the direction and format of the shift in household requirements is through an examination of other european or international cities; specifically cities that have operated within more urbanised, socially liberal and affluent economies for longer periods of time. Given the rapid urbanisation and per capita wealth change in Ireland since joining the European Union, Irish statistics on household composition do not parallel other similarly developed nations around the world. For example, Dublin, while following the trend, still has a significantly higher average household size than the EU-28, and particularly countries like France, Germany or Sweden (Figure 2)

Analysing the number of persons by household, almost two-thirds of all households in the EU-28 were composed of one or two persons in 2016. The most common type of household is that composed of a single person (Figure 3); one third (33.1%) of the total number of households. This group also recorded the highest relative increase from 2006 to 2016 (3.4 percentage points (pp)). Households composed of two persons correspond to 31.7% of the total number of households in 2016 (0.8 pp increase since 2006). Larger households are becoming less common and their share has decreased, with 15.9% of households composed of three persons, 13.4% by four persons, and households with five persons or more accounted for 5.8% of the total number of households in 2016. Over the last decade, the relative importance of the larger households has fallen significantly, with the biggest reduction recorded among those households composed of four persons (a fall of 1.7 pp.).

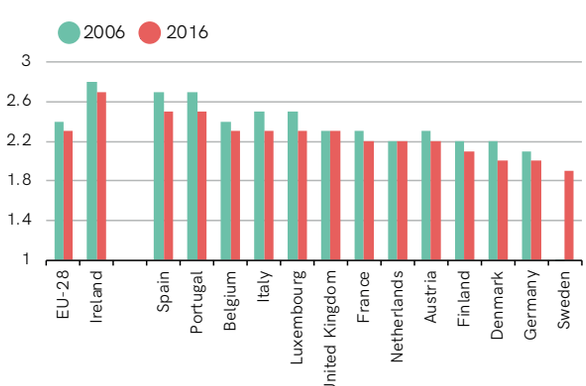


Figure 2: Average household size, 2006 and 2016 (average number of persons in private households)

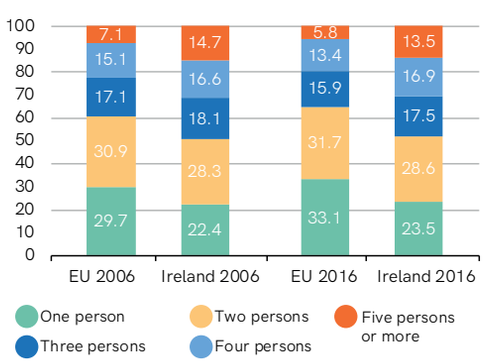


Figure 2: Distribution of households by size, EU-28, 2006–16

The presence of one or more children in the household has important implications for a household's priorities, particularly with respect to the demand and allocation of resources for education and health care. In most of Europe and Northern America, only a minority (less than 40 per cent) of households include children. In Bulgaria and Germany, less than 20% of households counts a child among its members.

While the reduction in household size is evident at a country level, this trend is more evident in urban locations and city regions. Over the past decade, there has been a decrease in the number of married couples (offset by increases in cohabiting couples), an increase in one person households, particularly among older people, and in lone parent and other multi-adult but non-family based households. This pattern is more significant also where the private rental sector is larger.

This study illustrates these trends in six comparator city areas across the world (below). Dublin has a smaller private rental sector than most of the cities evaluated, with a larger average household size and lower number of persons living alone (except in the case of London).

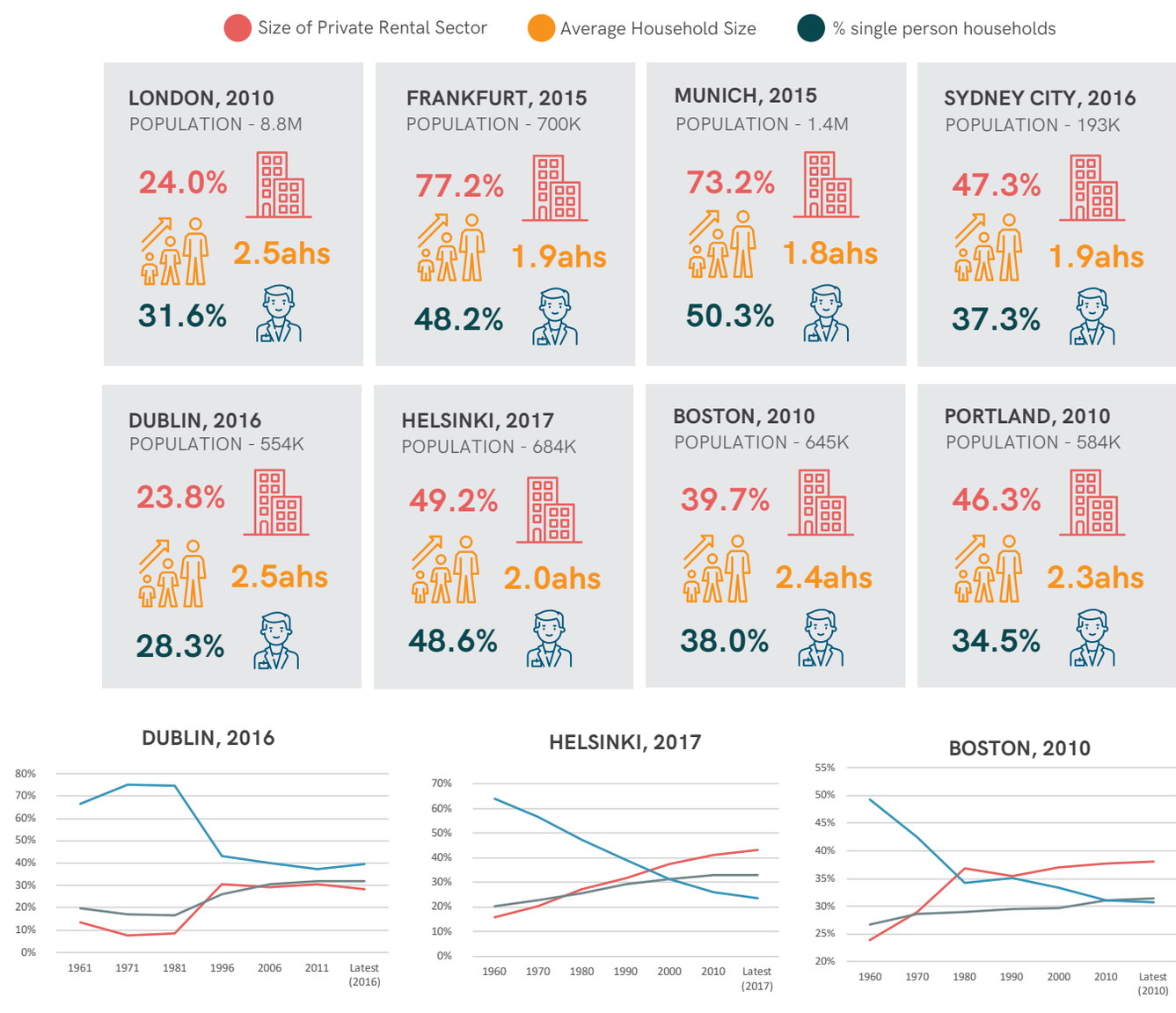


Figure 4: Changing Size of Households Over Time in Key Cities (1960-2017)

Section 04

LOOKING TO THE FUTURE

Population growth and a return to economic performance have increased the need to deliver housing. Looking forward, year-on-year rates of growth are expected to pick up and the population is projected to reach 1.50 million by 2024 and 1.60 million by 2029. However, the composition of Dublin's population is changing as it grows and the type of supply will need to adapt accordingly.

Population and Housing Demand

Dublin's population is set to continue expanding due to natural growth and net inward migration. In 2018, it is estimated at over 1.38 million. Looking forward, year-on-year rates of growth are expected to pick up and the population is projected to reach 1.50 million by 2024 and 1.60 million by 2029.

The City and Suburbs of Dublin are projected to grow at similar rates over the next decade. Dublin City will increase by 7.3% (42,427 persons) by 2024 and and a further 6.6% (38,067 persons) by 2029. The growth in the suburbs will be greatest in the Fingal area but the wider suburban population will increase by 6.9% (56,694 persons) by 2024 and a further 6.9% (56,566 persons) by 2029.

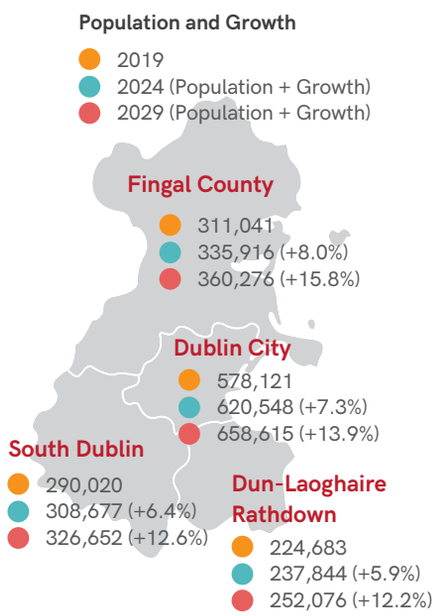


Figure 5: Population Growth in Dublin 2019-2029

A modelled assessment of housing needs indicates that there will be a minimum cumulative housing requirement for 65,201 units to be completed in Dublin over the next 5 years to meet population growth and changing household preference (13,040 units a year, on average). The majority of this demand will be for 1-and 2-person households, which will account for 44,525 units or 68.3% of preferences. 12.3% (8,034) of total demand will be in Dublin City for 1-person households.

Looking ahead to 2029, the minimum cumulative housing requirement will increase by a further 45,159. The pattern of falling household size requirements will persist and the majority of this demand will be for 1-and 2-person households which will account for 31,816 or 70.5% of preferences. The annual requirement for completed units will be on average around **11,035 per year** to meet the minimum requirements of Dublins' population over the coming decade.

+65,201
UNITS REQUIRED BY 2024

+110,360
UNITS REQUIRED BY 2029

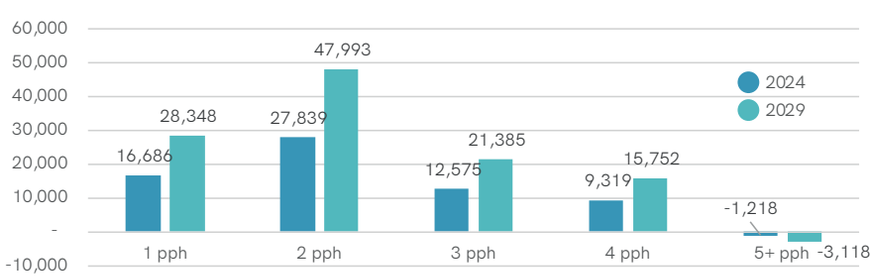


Figure 6: Unit Demands in Dublin (total) 2019-2029 (Per-person household (pph))

Housing Supply and Type

With regard to granted planning permissions which have yet to commence construction (or are classified as 'under construction' as of November 2018), the outlook is relatively positive from a housing supply capacity perspective. Planning permissions remain in place in the Dublin Region for the development of a combined total of 35,774 residential units (Figure 6). While a significant quantum of housing units awaits the commencement of construction, there are 5,915 units currently classified as commenced. This accounts for 16.5% of total extant permissions currently in the pipeline.

Apartments are the dominant unit type for which permissions have been sought accounting for 65% (23,223 units) of all units in the pipeline. 2-and 3-bed units are the most numerous at just over 70% of all units being developed. 1-bed units make up just 11% of units being developed (Table 1).

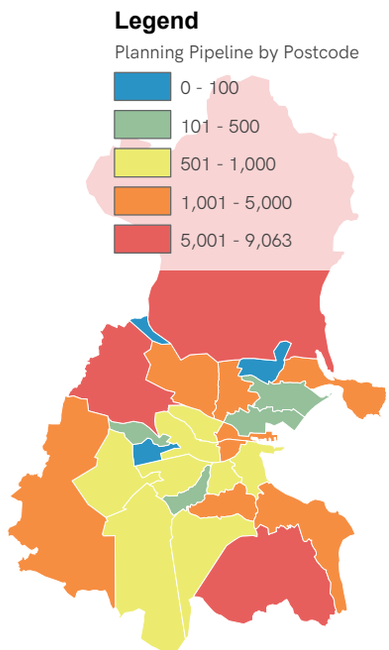


Figure 6: Residential Planning Pipeline in Dublin, Nov 2018

	1 Bed	2 Bed	3 Bed	4 Bed	5 Bed+
DCC	19.8%	50.3%	22.1%	6.9%	0.8%
DLRCC	12.7%	42.7%	26.2%	14.7%	3.6%
SDCC	5.8%	21.3%	50.7%	20.2%	2.1%
FCC	5.1%	29.7%	38.0%	22.9%	4.2%
Overall	11.0%	36.6%	33.5%	16.2%	2.7%

Table 1: Breakdown of Unit Type in Consented Planning Permissions in Dublin

	1 pph	2 pph	3 pph	4 pph	5+ pph
DCC	30.4%	34.3%	16.6%	11.6%	7.0%
DLRCC	24.6%	33.0%	17.2%	15.1%	10.1%
SDCC	19.5%	29.7%	19.1%	18.2%	13.5%
FCC	18.7%	29.6%	19.1%	19.3%	13.3%
Overall	25.1%	32.3%	17.7%	14.9%	10.0%

Table 2: Breakdown of Per Person Household Demand in 2024

Gap Analysis

Research suggests that the supply of new housing being delivered will be insufficient to meet the minimum housing requirement for the five years to 2024, which will total just over 65,000 residential units (cumulative). Data on the pipeline residential planning permission indicates that 35,774 units are currently granted to be developed on lands within Dublin. At a high level this will result in a shortfall of nearly 30,000 units up to 2024 alone.

Additionally, there appears to be a partial mismatch between the units with consent and what the demand requirements will be in the future. While the preference is shifting towards smaller unit sizes (Table 2 and Figure 7), over half of the consented units are for 3-beds or more (Table 1). 1-person unit-demand is going to increase significantly over the next decade and there is a lack of appropriately-sized residential development forthcoming to accommodate it.

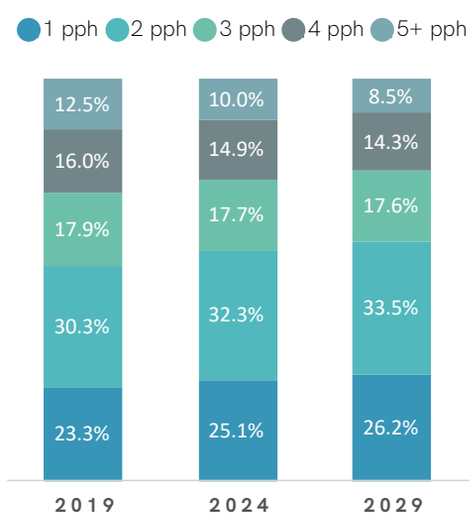


Figure 7: Comparing Per Person Households Changes in Dublin

Key Drivers of Changing Preferences

Taking the Gap Analysis outputs its clear there will be a strong need for a broadening of the unit mix in Dublin, particularly to include more 1-person units.

Over the next 10 years the trends of lower household size and more consolidated household composition will persist in Dublin. This composition will not be the same across all Dublin Local Authorities. For example, Dublin City is likely to experience the largest demand for 1-or 2-person households, while the more suburban locations will still carry a larger demand for 3-and 4-person households.

These trends indicate the need to plan for more homes, but designed to meet the accommodation needs of families and single person households (including older people), both of which are likely to increase in number.

This section presents key drivers behind the changing trends in property.

POPULATION GROWTH AND HOUSING DEMAND

Dublin's population reached 1.35 million at the time of the census in 2016 and it is expected to continue growing robustly to 1.60 million by 2029. This expanding population will generate an ever-increasing housing requirement, which will not likely be sufficiently catered for based on current planning consents.

The result of further housing shortages is an inability to meet a need, which is likely to lead to higher costs of renting, continued growth in shared living arrangements and further increases in homelessness. Furthermore, it will augment the pre-2018 pent up housing demand generated by the lack of completions from 2010-2015, thereby exacerbating the existing pressures in the housing market.

CHANGING NATURE OF OCCUPANCY

The housing market has shifted significantly in the last number of years. The private rented sector has more than doubled in size between 2006 and 2016, with approximately one in five households (24%) now renting their home in the private rented sector in Dublin.

Increasingly the sector is providing housing for a wide range of households, including; those who have postponed house purchase due to a variety of reasons; and others who have lost their homes during the recession; and students, and individuals and households who choose to rent by choice. The sector also provides homes for those whose rents are paid for by the State through the Rent Supplement and Rental Accommodation schemes.

Key Drivers

SHIFTING HOUSEHOLD SIZE AND COMPOSITION

The fertility rate in Ireland, measuring the average number of children per female, is lower amongst the current cohort than it has been in previous generations. This implies families are, on average, smaller households than they have been in the past and also that there may be more households without children.

In Dublin, the proportion of 4-and 5-person households is reducing, while 1-and 2-person households are becoming the norm.

With family households likely to be smaller than in the past, there is a valid contention that such households are likely to demand smaller dwellings.

TRENDS IN HOUSEHOLD FORMATION

Ireland is experiencing social changes identical to that happening globally. Such changes relate to:

- Higher proportions of people living alone;
- Reduced rates of marriage;
- Higher divorce rates;
- An ageing population in a developed economy where life expectancy is increasing;
- Cities having much higher concentrations of young professionals;
- Delayed household formation and less children;
- Increased social mobility (higher income, educational attainment);

All of the above have lead to changing preferences for unit types.

RENT AND PURCHASE AFFORDABILITY

Affordability is a fundamental factor of any housing market, allowing households the choice between either renting in the short-, medium- or long-term or becoming homeowners. There are a number of factors which determine affordability but it is generally accepted that if housing costs exceed 40 per cent of a household's disposable income, the household would be considered unaffordable.

In Dublin, property prices have been increasing since 2012, with the average sale price at €471,900 (2018), 68.2% higher than the bottom of the market and the previous peak.

Rents have also gone through a considerable period of change since the mid-2000s and now exceed peak pre-economic crisis levels. For Dublin, 2018's (YTD) average asking market rent has been €1,827; 83% higher than the lowest point in 2012 and 29% higher than the previous peak in 2008 (Daft).

Section 05

HOUSING SOLUTIONS

Changing demographics and rapidly evolving lifestyles are creating new options in the residential market.

Private Rental Sector (PRS)/Build-to-Rent (BTR)

The housing market has shifted significantly in the last number of years, evidenced by the relative growth of the PRS. The lack of housing supply, limited availability of finance for purchases, fall in property prices and increase in the unemployment rate all combined to see a transition away from the well-established owner-occupier market. In Dublin, the PRS has grown considerably; increasing from 14.5% of households in 2002 to account for 23.9% of households in 2016. Its absolute growth has been from nearly 55,000 to over 114,000; growth of 109% between 2002 and 2016.

BTR describes the practice of delivering purpose-built residential rental accommodation that is designed with the sole purpose of being used as long-term rental accommodation and professionally owned and managed by an institutional landlord. BTR schemes are generally of a very high quality design and with ready access to amenities such as resident lounges, entertainment space, gyms and cinema rooms, while also being located close to good quality public transport.

A large proportion of the Irish population is likely to continue to aspire to home ownership. However, for many of this cohort, this will have to be delayed until such time as they have saved the necessary deposit. Therefore, they will require access to rental accommodation in the interim. For others, such as the millennial generation or the large proportion of transient workers, renting is an increasingly acceptable form of tenure.

In addition to the demands from privately renting individuals and families, over the next few years there will be an increased demand for PRS units from the socially rented sector. The primary instrument local authorities now have to provide social housing support for people who cannot afford to buy their own homes is the Housing Assistance Payment (HAP). The Irish Government's Rebuilding Ireland proposes national targets indicating a 3-to-1 preference for HAP scheme over building new units by 2021 (83,760 HAP Target Vs 33,437 New Build Target) and will account for just over 60% total national social housing allocation over the next 3 years.

Purpose-built student accommodation

The purpose-built student accommodation (PBSA) sector, which was once the preserve of a small cohort of specialist providers and colleges themselves, is now moving mainstream. Third level colleges are increasingly demanding high-quality accommodation near their campuses to complement their educational offer to existing and future students. This is becoming increasingly pertinent in terms of

attracting international students to particular universities; an issue that will become even more evident in the aftermath of Brexit as colleges around Europe attempt to attract higher volumes of international students who are key users of PBSA. Investors are particularly attracted to the sector by virtue of it's relative level of 'immaturity' in Ireland and by the fact that student housing has remained remarkably resilient throughout market downturns as it is not subject to the same cyclical variances experienced by other mainstream investment options.

Due to a severe scarcity of rental accommodation in cities such as Dublin, promoters of PBSA schemes are, therefore, able to achieve higher occupancy rates and command high rents in their schemes. Contemporary PBSA offers students a high-quality of living with rents generally inclusive of bills (electricity, internet, etc.), varying options on tenancy lengths, enhanced internet connectivity and a comfortable, secure environment. For the most part, units are provided furnished.

Downsizing Families and Elder Care

One of the most notable features of Ireland's changing demographics is the pace at which the population is ageing, particularly the rate of growth in the older age cohorts. Age dependency is defined as people outside of the typical working age categories (i.e. 0-14, 65 years+). Data released from the Census 2016 indicates that Ireland's population of older people (defined here as those being 65+) is now 637,567. This is an increase of 36% over the past decade. Older people now account for 13% of the national population (up from 11% in 2006).

The CSO's Population and Labour Force Projections 2016 – 2046 estimate the likely changes to population and this trend over the next two decades. It is projected that the population within the 65+ age cohorts will increase by 223,033 (or 35%) to 860,600 persons over the next 10 years. This will see the age dependency rate rise again from 13% to 16% of the total population.

Driven by this dramatic change in the demographic profile there is a section of the market that, to date, in Ireland is not being considered. The delivery of Elder Care housing that includes provision for local day care services and community based services offers the attraction of higher investment yields than more traditional real estate sectors, and as a result, there has been a notable increase in investors and developers who have seen focussing specifically on this sector in recent years. As has been witnessed in other more mature markets, such as the US and the UK, the healthcare sector tends to be particularly attractive to more sophisticated long-term capital and investors who have experience in this specialist sector.

Section 06

CONCLUSION

The study has considered how different drivers of demographic change have influenced demand over the past decade. The assessment then models the direction in which demand is likely to go in the coming decade. Taken as a whole, the trends indicate we will have to plan for more homes, particularly meeting the accommodation needs of families and single person households including older people, both of which are likely to significantly increase in number.

Key Findings

The research for this report shows that:

Dysfunction within the housing market over the past decade is impacting on the quality of life of large sections of society. This is best illustrated by the fact that for the first time since the foundation of the State, average household size increased in the last census. Many thousands of people can no longer choose their desired living arrangements and must remain living with family for longer than planned or in many cases have no home at all.

Based on the current pipeline for new residential units in Dublin, future housing demand will not meet the minimum forecast requirement. At a high level this will result in a shortfall of nearly 30,000 units up to 2024 alone.

The mix of housing demand is changing dramatically. A much greater share of output will need to cater for one or two-person households and targeted policy interventions will be needed to meet the particular housing needs of an ageing population.

In the Dublin market, there is a particular demand for investment in sectors that are experiencing severe supply demand imbalances including Build to Rent, Student Housing and Elder Care in particular.

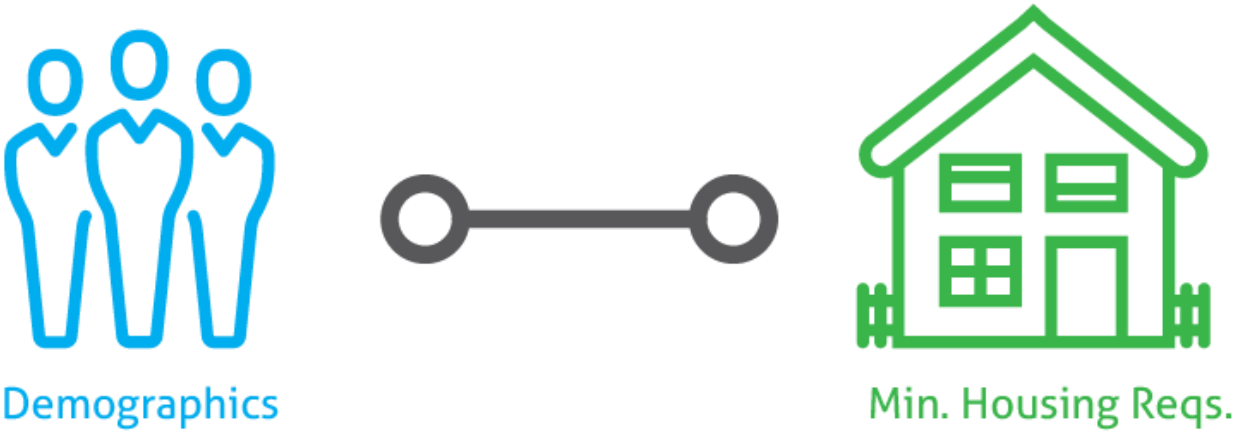
The increased appetite for investment in these new housing solutions is perhaps not surprising considering demographic projections for Ireland's population in the medium to long term. 'Build to Rent' in particular will have an important role to play in helping to address severe supply shortages of rental accommodation in Dublin and other Irish cities. The delivery of much-needed purpose-built student accommodation in Ireland's cities will alleviate pressures in other areas of the housing market and is to be welcomed. Meanwhile, the delivery of new elder care housing throughout Ireland is critical considering the extent to which the Irish population is ageing.

Demographic Drivers and Changing Housing Demands in Dublin over the Coming Decade

A quantitative assessment of changing household composition and occupancy demands in Dublin over the past 10 years and its impact on future needs.

PREPARED BY
Future Analytics FOR
Ardstone Capital

Technical Note: *A description of modelling as undertaken*

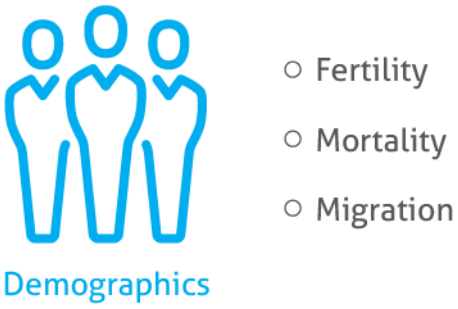


Context

The interplay between demographic change and future housing requirements consist of many individual factors such as the drivers of population change, settlement patterns, migratory flows, changing household composition and the supply of housing. Research undertaken by Future Analytics Consulting (FAC) on behalf of the Ardstone Capital Ltd (in January 2019) assesses population change and its resulting impact on minimum housing requirements in Dublins' urban settlements and rural areas.

The following modelling overviews and specification of input assumptions underpin this research, the scope of which was to develop a projection of population covering the period 2018-2031, informed by Census 2016 data as baseline. The projection of future minimum housing requirements could then be assessed by applying trended changes in household composition to understand how existing supply will accommodate demographic change.

Modelling Overview: Demographics



FAC's projection of population is underpinned by the application of the demographic cohort component methodology (CCM); the same methodology as used by the CSO in preparing the national projections.

CCM is widely used internationally as a best-in-class methodology. It provides a flexible and powerful approach to population projection by using varying comparative scenarios, each tailored around the application of qualified assumptions in mortality, fertility and migration (as aligned with the CSO's assessments).

The methodology applies key assumptions in fertility, mortality and migration year-on-year over the assessment period, at single year of age and gender. In doing so, the population is aged through the model, impacted by migratory inflows and outflows and mortality.

In considering a suitable basis for projection, FAC developed a series of scenarios, each with respect to the most recent national and regional assumptions published by the CSO, but also with specific regard to the latest Census 2016 data and published data (more recently released) on fertility and migratory flows (both internationally and between counties). After assessing different scenarios, M1F1-aRAdj was selected as the preferred option.

A scenario named M1F1a(ligned)-R(ecent)-Adj(usted) or M1F1a-Radj was selected as the preferred option.

M1F1a-Radj relates to assumptions in fertility and migration (principally) which align with the CSO's published M1 and F1 outlooks (see below). It maintains the recent (inter-censally observed) net outward flow from Dublin, which we believe will not decrease towards net neutral by 2022 but is set to increase (as played out during the period 2002-2011).

- Fertility
  Full year fertility data for 2017 (Vital Statistics, CSO May 2018) was used to develop a baseline for each County's birth rate. Age-specific fertility rates were derived (births per thousand for women of child bearing age) and rates then linearly interpolated to achieve a Total Fertility Rate (TFR) of 1.8 by 2026. Therefore, this aligns with CSO F1 over the longer tail, but opts for a gradual reduction to 1.8 TFR so as not to over-adjust counties were fertility is presently above the national average.

- Mortality
  No change was made in using the published life tables from the CSO (Irish Life Tables No. 16, CSO July 2015), though it is recognised that mortality has fallen for men and women since their publication (the CSO have yet to publish updated data). The principal assumption of gains in life expectancy at birth from 77.9 years in 2010 to 85.1 in 2046 for males and 82.7 years in 2010 to 88.5 years in 2046 for females was carried forward.

- Migration
  The M1 CSO outlook for national net migration, assumes a steady continuation of high levels of net inward migration at 30,000 per annum, repeating. When this research was conducted, the latest available indication of net inward migration was 19,800 in 2017 and 34,000 in 2018. Therefore, M1F1aRadj assumes a gradual reduction back to the reoccurring level of 30,000 net inward beyond 2021.

  The continuation of high levels of net inward migration to 2031 is therefore premised on the prevailing trends which can be expected to continue in line with improving economic conditions of the economy at large and the pull of various sectors in attracting outside employees and students to Ireland.

  Migration was assessed at regional and at county level. A migration matrix was developed to simulate future inflows and outflows between counties, informed by inter county and settlement size flows (CSO, 2017). A generalised growth rate per county of 0.25% was applied to both inflow and outflow totals per annum and a specific spatial assumption applied to move migrants towards Dublin and the Mid-East generally. This forms the basis of the 'Recent' assumption as featured in the scenario name.

  This is in keeping with observed trends since 2006 and specifically carries forward the observed change in Dublin's net allocation. Unlike 2006-2011, where Dublin experienced a slight net inward surplus of migrants, Dublin has now returned to almost +4,500 net outward migrants per annum – as people settle in the surrounding counties, and this trend is set to continue.

Cohort Component Method

Utilised as the basis by which each scenario was projected, the cohort component method (CCM) for population projection is widely used internationally as a best-in-class methodology which provides a flexible and powerful approach to population projection.

CCM can incorporate many application techniques, types of data and assumptions regarding future trends. It can also be used at any level of geography (given data suitability) and perhaps most importantly, it provides projections of total population, demographic composition and individual components of population growth by applying key assumptions in fertility rates, mortality rates and migration rates per year of projection across the duration of the period. These assumptions are discussed further in section 2.3.

Future populations are derived from a base population through the projection of population change and its major demographic components, births, deaths and migration. The projection of the demographic components of change is driven by the composition of the population by age, sex and birth rates, and the way these variables determine the propensity to bear children, die and migrate to, from or within Ireland.

Knowledge of the age and sex composition of the population at any point in time is fundamental to the projection of the population. Knowing the age-sex distribution at one date (2011) allows us to impute the age-sex distribution of those still alive at later dates, since sex does not change while age advances with the passage of time. This knowledge also allows the projection of demographic behaviours (above) as differentiated by age based upon past trends and expert opinion in order to introduce confidence and mitigate uncertainty.

In its simplest statement, the component method is expressed by the following equation:

$$P_t = P_{t-1} + B_{t-1,t} - D_{t-1,t} + M_{t-1,t} \qquad (1)$$

where

P_t = population at time t ;
P_{t-1} = population at time t-1 ;
$B_{t-1,t}$ = fertility, in the interval from time t-1 to time t ;
$D_{t-1,t}$ = mortality, in the interval from time t-1 to time t ; and
$M_{t-1,t}$ = net migration, in the interval from time t-1 to time t.

Components of population change are projected separately and applied to equation 1 recursively to produce a series of populations. The measurement unit of time may be of any interval from t-1 to t, however, the impact of each component will vary over time.

This logic is also true for individual age groups, recognising that the source population for a given age group is the population at time t-1 in the adjacent younger age group. For the initial age group, it is births during the interval from t-1 to t, hence the 2011 base figure for under 1's is used. Equation 1 is replaced by two equations, depending on whether the age group is under 1, denoted as 0, or any other age, denoted by a.

$$P_t(0) = B_{t-1,t} - D_{t-1,t}(0) + M_{t-1,t}(0) \qquad (2)$$

$$P_t(a) = P_{t-1}(a-1) - D_{t-1,t}(a) + M_{t-1,t}(a) \qquad (3)$$

Each of the terms in equations 2 or 3 whether defined as a population or a number of events, relates to people born in a particular year. Such a group is known as a birth cohort, hence the term "cohort component method".

Modelling Overview: Minimum Housing Requirements

- Population Projection
- Intercensal Trends
- Vacancy Rates
- Household Composition
- Housing Stock
- Obsolesence

FAC's projection of future minimum housing requirements is a product of evaluating the impact of a changing demographic across each settlement and rural area in Ireland.

This change will have a significant effect on the utilisation of existing housing stock and will give rise, in many places to a deficit should supply lag behind.

A key component is the application of the population projections which are used to assess how each individual settlement and rural area will undergo shifts in their age profile and how people coming into the area, as well as leaving it, impact on the rate of change in that area.

Various intercensal trends in housing characteristics are assessed as well as Census 2016 data being actively utilised as baseline inputs in order to build a profile for each area. Vacancy rates (excluding holiday homes) and an assumed rate of obsolescence are also applied to factor in restrictions and natural depletion of the existing housing stock (this rate varies across Dublin but is in the region of 0.5%)

Household composition plays a key role in understanding the settlement pattern within each area. Specifically, it covers households by number of persons resident and varies greatly between settlements of different sizes, economic roles and geographic locations (for many reasons). Over time this describes how people in the area have chosen to from households of different sizes, for one reason or another, and does so more accurately than average household size (another measure for describing households).

The compositional profile of an area in this regard has a marked bearing on future housing utilisation, should trended patterns continue to apply – essentially shift in compositional occupancy. An assessment has been made in this research of Census data stretching back to 2002 to inform such trends.

As the population changes, the utilisation of existing stock also changes – in line with increases and decreases in person-household size. In this research an area's future population is distributed proportionally in line with its characteristic profile (its projected occupancy pattern), and the resulting quantum of homes required can be determined.

By assessing the existing stock (after depletion) against the number of homes required, a minimum requirement can be identified should a shortfall exist in the existing stock.

In some cases, a settlement's existing housing stock will be adequate to cover future requirements as they arise, even excluding stock held in frictional vacancy. However, since 2011, such surpluses have been rapidly eroded, and many formerly vacant units have come back into use as needed.

In Summary

A *minimum housing requirement* provides an indication as to a potential shortfall in housing supply in an area due to demographic changes primarily. No assumptions are made with respect to capacity, affordability, latent demand or desirability. Furthermore, no assumptions on housing supply (such as planned pipeline developments) are included. In this regard, any identified requirement can largely be offset by such additions.

A principal determinant of the identified minimum requirements is derived from how an urban settlement's occupancy composition is trended to change over time. Celbridge, County Kildare, for instance, is set to continue to experience a shift towards two and one-person households over three and four-person households; mostly at the cost of five or more person-households. This shift is felt incrementally but over an extended period and

in centres of higher population, it can amount to large shifts in the population's selection and preference towards housing-type. Provision must keep this consideration in mind.

The increased pressures on an urban settlement's housing stock as a result of this form of occupancy shift (either from preference or economic necessity) has a marked impact on the depletion of available stock. The decline in average household size (AHS) has been known for many years, but the consideration of AHS alone can mask the reality of how the populace's behaviour has truly been observed to shift towards different household sizes – and not just one size fitting all.

This profile of occupancy shift varies between each urban settlement, with some of those identified showing strong shifts to one and two-person households, whereas others show a resurgence in three-person households far above the growth of one-person households. Further analysis relating to these shifts can be queried from FAC directly.

Further details on both the demographic and housing requirements modelling processes are available upon request from Future Analytics Consulting