# Does densification increase diversity? A quantitative study of the relationship between newbuilt housing and population diversity in inner Oslo

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# Abstract

This thesis will explore the relationship between densification and diversity, specifically focused on the connection between newbuilt housing, divided by size, and population diversity. I aim to investigate if inner Oslo has been able to achieve a more diverse population composition, a goal that has been set since the 1970's and is now a part of the larger sustainability approach to urban planning. In order to do this, I am using a quantitative approach where I will construct a diversity index which will later be used in several regression analyses (OLS). Diversity will be categorised into four; ethnicity, age, education level and income. My results indicate that the densification process in inner Oslo has led to more diversity, but the effect is stronger in the Western parts of the inner city than in the East. This is quite surprising considering the long-time efforts of improving the population composition in the inner East. I further discuss if a focus on population diversity through housing variety is enough, or if other measures have to be considered as well.

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# Table of Contents

# List of tables

# List of figures

# Chapter 1 Introduction

Diversity has become increasingly important in urban planning. Together with densification it has entered the field as some of the leading strategies for creating a socially sustainable city. After decades of strict zoning and rigid master plans set out to organise and sanitize cities, there has been a newfound appreciation for the mixing of uses and the unpredictable element that follows urban diversity. A diverse population has always been considered one of the main features of cities. As Aristotle wrote: "a city is composed of different kinds of men; similar people cannot bring a city into existence" (In Sennett, 2018, p.7). A variety of people has therefore been considered essential to the core definition of cities for a very long time. If difference is a part of the core definition of what a city is, then urban planners can hopefully contribute to sustaining and improving population diversity. However, the changing structures of the urban planning system and the role of the planner, might make this even more difficult today than it was before. In addition to this, globalisation is affecting urban development through the international competition for talent and investment. Some argue that cities are becoming more similar and standardized (Sennett, 2007). How does the increased focus on diversity fit into this development? Is it possible to create diversity intentionally, or is it something that has to occur organically, as Jane Jacobs argued (Jacobs, 2011).

Oslo has set some ambitious sustainability goals, highly focused on environmental and social sustainability. The capital's population of 681 067 is expected to rise to 850 000 until 2040 (Oslo kommune, 2019). As a city surrounded by protected nature, the possibilities for expansion is limited, and it is generally agreed upon that Oslo's main strategy needs to focus on the already built up areas, which mean to increase the land use efficiency. Population growth bring opportunities but it will also bring great challenges. Lowering greenhouse gas emissions, housing issues and economic inequality are just some of the many challenges Oslo faces today. Population diversity has gained more attention as an important goal for Oslo, and the goal is to make the city "a greener, warmer and more innovative city with room for everyone" (Oslo kommune, 2019, p.4).

## 1.1 Diversity and its assumptions

Diversity is a term that can have a number of interpretations depending on the context. The term is generally used to describe people with a variety of different characteristics such as for

example ethnic background, socioeconomic status, age, gender, family composition, or religion. Many researches choose to focus on certain aspects of diversity, with ethnic background traditionally being a very common perspective. My approach will look at a few broad categories that together will provide a general perspective of population diversity. The definition I use is pretty straightforward. Easily explained, diversity is just variety (Wessel, 2009).

Why has diversity become such an important element in urban planning? Many diversity policies are based on three main assumptions. The first is the assumption that diversity leads to more contact between groups, which will lead to less prejudice. The second assumption is regarding neighbourhood effects and the third is that diversity is good for the economy.

This first assumption is to a large extent based on contact theory, which assumes that contact between groups will reduce prejudice (Pettigrew et al, 2011). However, the opposing idea presented in conflict theory assumes that more contact between groups can lead to more conflict. Both aspects have important arguments and a large amount of the research emphasizes that the consequences of the contact will be highly influenced by additional factors. The effect of contact is likely to be larger in settings where friendships can be formed, for example in relation to hobbies, sports or recreational activities. When contact is forced, or if the differences between the groups are very large, it can lead to more conflict and hostility (Putnam 2007). Time is also an important element when discussing contact, as contact over time, seems to reduce prejudice. The overall assumption then becomes that even if diversity leads to conflict in the short term, the long-term consequences will be less prejudice and the differences between groups will eventually become less clear. However, the research on this theory shows that the results are highly dependent on the context and should therefore be further explored. Numerous examples exist where exposure over time do not solve conflicts. Contact between groups might be essential, but also insufficient to reducing prejudice and conflicts (Pettigrew et al, 2011). It is often assumed that tolerance is an aspect of diversity, while in reality it is the extent to which people embrace diversity (Wessel, 2009).

Contact has been, and still is, an important tool to counteract the negative consequences of segregation and inequality. This is closely connected to the second assumption, which assumes that the place we live and the people who surround us also affect our own chances in life. One of the most important arguments for population diversity is related to what is often

called neighbourhood effects, i.e. that certain features related to the environment people grow up in may influence both their current and future chances in life (Brattbakk and Wessel, 2017). Exactly how and how much this affects people in Oslo is a subject too broad to include here, but the main idea is that if different population groups were distributed more evenly, many of the negative consequences could be reduced.

The third assumption is that population diversity will lead to more economic development and innovation. The connection between urban population diversity and economic development is important and has been highly influential. This is to a large extent based on Richard Florida's theory on the creative class. By attracting the creative class, the city will become tolerant and open, which again will attract investment and capital (Florida, 2002). Syrett and Sepulveda (2012) argues that because of the increasing importance of urban economic policy, diversity is now seen as a tool to pursue economic development. Promoting diversity often becomes a way to increase entrepreneurial activity. Diversity has by this been incorporated in the global city perspective and being seen as a diverse city gives associations to a certain "cosmopolitanism" and it is often used as a marketing tool to promote a city to attract tourists, capital and business, in addition to people who wants a certain "urban lifestyle" (Colic-Peisker, 2014; Røe 2015). It is therefore argued by some that the term diversity has become politicized and commodified, where diversity's "contributions" to the economy is somewhat agreed upon, while the policies aimed to promote diversity has become incorporated into business-promoting narratives that benefits a relatively small group of people (Raco and Kesten, 2018). Even though my definition of diversity is easy to understand, it is important to be aware of these underlying assumptions and how they affect political and everyday conversations on diversity. This discussion will be continued in more detail in chapter 2.

The European Union (EU) emphasises that the increased economic inequality and spatial segregation in many European cities poses an enormous challenge for the social sustainability of Europe. The recent increase in non-European migrants, ethnic and socioeconomic segregation and aging populations are causing some undesirable consequences, and to promote and plan for diversity is seen by some as the antidote to these problems (Talen, 2006a). Diversity has therefore become a new guiding principle for city planners, although the connection between physical structures and social diversity is still unclear (Fainstein, 2005). What is clear is that one does not necessarily follow the other, meaning that creating

population diversity is much more complicated than just providing a specific urban development or facilitating contact between different groups.

## 1.2 Density and densification

Dense cities are currently presented both as the more environmentally friendly way to develop urban areas, because it limits the land take and environmental degradation and fragmentation, in addition to disincentivising car dependency. Furthermore, economic growth tends to benefit from agglomeration. A high concentration of people and businesses allows for a diverse labour market as well as the sharing of ideas and knowledge which again can stimulate innovation and future growth. The EU, together with UN Habitat has emphasized the importance of creating dense cities as a strategy to improve both the environmental, economic and social aspects of cities and preventing urban sprawl. Europe is still urbanising, although slowly. Population projections for the EU indicated that cities, and especially capital cities will continue to grow, while the rest of the EU, and especially many rural areas, will have a negative population growth (EU & UN Habitat, 2016).

The Norwegian Ministry of Local Government and Modernisation has adopted a similar vision where they see compactness, mixed-use development and proximity to work places, services and cultural activities as the main strategy forward to make Norwegian cities more sustainable (Regjeringen 2019). The State Planning Guidelines for Coordinated Housing, Land and Transport Planning from 2014 explicitly mentioned that both the building patterns and transportation systems in Norway should promote compact cities and towns, as well as nodal and transport-oriented development. The municipalities are important actors in the implementation of these guidelines and should base their local plans accordingly (Kommunal- og moderniseringsdepartementet, 2014). The municipality of Oslo has adopted its own goals and municipal plan based on these guidelines and the municipality emphasizes sustainability as the reason for the different strategies. Although densification and social sustainability may be considered fairly new concepts and strategies, the municipality of Oslo has for a long time tried to make the inner city more diverse. Diversity has been a goal since the municipal plan from 1976-1985, where it is stated:

"A main goal for the renewal areas is to improve the housing and environmental conditions for those who live in the area today. In the long term, one should have a goal of a more diverse population composition both in terms of age and social structure" (Oslo kommune, 1977, p.5, my translation).

The new municipal plan adopted in 2019 has several similar goals as the plan from 1977, although the current plan has a higher emphasis global trends that are likely to influence the city. Challenges mentioned are climate change, economic inequality, continuing urbanization, immigration and local and global changes in the labour market (Oslo kommune, 2019). Considering the long time period and the number of policies and initiatives dealing with the composition issues, there has been little research done in regards to how the overall levels of diversity has changed in Oslo. With this thesis, I therefore hope to contribute to providing some new knowledge on this theme.

## 1.3 Sustainability as the political framework

The vision of a dense and diverse city fits into the wider sustainability concept and is expressed in the Sustainable Development Goals (SDGs) from 2015. Sustainability has been more and more incorporated into the planning process in Norway during the last two decades. The most relevant of the SDGs in regards to this thesis is goal number 11: "Make cities and human settlements inclusive, safe, resilient and sustainable" (UN, 2019). The focus of urban sustainability has often been on living conditions, but has later also included more subjective experiences of neighbourhoods and social life, in addition to the affordability of housing and services in the city (Hanssen et al. 2015). The municipality of Oslo has specifically mentioned the SDGs and economic, environmental and social sustainability as goals towards 2040 (Oslo kommune, 2019).

The sustainability concept is normally divided into three categories, environmental, economic and social sustainability, in addition to several subcategories. Environmental sustainability focuses on sustaining biological diversity, healthy ecosystems, limit pollution and to ensure a sensible use of resources. Economic sustainability emphasises growth, productivity, innovation and development. Social sustainability highlights accessibility, equity, diversity, poverty reduction, inclusion and social capital (Basiago 1999; Dempsey et al. 2011). The original focus was mainly to pursue a socio-ecological equilibrium, which means a condition

of ecological and economic stability (Vojnovic 2014). The term "sustainability" was fully integrated into mainstream society after the UN World Commission of Environment and Development (WCED) published their report "Our Common Future" in 1987. They described sustainability as: "development that meet the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). The definition in itself has several problems, especially with the formulation "meeting the needs". These "needs" reflect the current consumption patterns of the Global North, and the definition therefore becomes problematic because these needs are directly linked to the highly unsustainable Western consumer society.

Today, sustainability is very often used as a prefix with positive connotations. However, there are several problematic aspects with both the content of the term, and how it is used. What constitutes as most sustainable will, in many cases, depend on the priorities, attitudes and political or ideological perspectives of the decision makers. This makes it very difficult to provide clear answers to when we can confirm if something is or is not sustainable. It is therefore most useful to see this term as a scale than an either/or situation. This is especially true in the context of sustainable urban planning, as Peter Marcuse expressed:

> "While sustainability may be a useful formulation of goals on environmental issues, it is a
> treacherous one for urban policy because it suggests the possibility of a conflict-free
> consensus on policies whereas, in fact, vital interests do conflict" (Marcuse, 1998, p.104).

What is seen as a benefit and as sustainable for one individual, might be unsustainable and hurt another, meaning that sustainability and social justice does not necessarily go hand in hand (Marcuse, 1998). The term has been criticized for becoming a buzzword that just means "business as usual", but despite the problematic aspects, it is still widely used both in research, politics, and everyday language (Hanssen et al, 2015). To sustain something generally means to preserve status quo (Marcuse, 1998). It is therefore more difficult to see how it can be incorporated in the larger debates on systemic change. Although this general debate about sustainability is very interesting, my focus further will be on social sustainability. This is the least theorised and the vaguest concept, according to Shirazi and Keivani (2017). Social sustainability will therefore function as the overarching concept in this thesis, and the main goal for the diversity policies is to achieve this to a higher degree than the current situation.

## 1.4 Research questions

Since densification and diversity has been goals for Oslo for such a long time, I want to explore if the densification process over the period 2000-2015 has contributed to more diversity in inner Oslo. To do this, I have focused on densification by infill and transformation, which is the most relevant methods for the inner city. Oslo still struggles with high economic inequality, divided between an affluent West side and a poorer East side, a divide that has been persistent despite the many changes that has affected the city through the years. Location will therefore be an important perspective in the further analysis.

 RQ1: *Does the densification in the form of infill and transformation contribute to more population diversity in inner Oslo?*

 The second research question will be:

RQ2: *Does the size of the newbuilt housing have an effect on population diversity, and does this effect differ between the inner East and West?*

## 1.5 Theoretical framework

My theoretical framework is divided into five parts with the goal of providing a basis for understanding the connections between density and diversity. My framework is based on a number of sources meant to shed light on how diversity has become a dominating paradigm in urban planning. The first part will provide a more in-depth overview of the underlying assumptions explaining why diversity has become such an important goal in urban planning.

The second part looks at how cities have moved from zoning to mixed use development, in the context of planning history. The shift from ideal cities founded on the wish to control and sanitize cities, to the new appreciation of diversity was largely influenced by Jane Jacobs and her writing. I will then further connect this to the current ideal of urban sustainability.

The third part will discuss the connection between certain physical traits of the city and population diversity. This discussion will be based on Jacobs and her "generators of diversity", in addition to more recent research on elements such as mixed-use development

and a building structure with varying age. I will further add some critique regarding why these structural features does not necessarily lead to population diversity.

Fourth, I will discuss how diversity has become a common urban policy, incorporated into other, mainly economic strategies. On the one hand, diversity has become more recognized, on the other hand, some argues that is has become politicised (Raco and Kesten, 2018). Either way, diversity has become a part of the promotion of cities and I will be discussing the global city aspect, and the cultural city idea. While this can lead to recognition of different groups' contribution to the urban history, it can also become what Jacobs described as "the self-destruction of diversity" (Jacobs, 2011).

In the fifth and final part of my theoretical framework, I will look at the planner's role in the process of taking diversity from policy to practice. I argue that the changes in planning mode in the Nordic countries has given planners less power to work in a way inspired by communicative planning, because the planning system has become more oriented towards a market-based mode of governance. I will therefore discuss Sager's (2009) argument that there is a gap between the planners' personal values and the ideals of the systems they have to work within.

## 1.6 Data and methods

The data used in this thesis is collected from several sources. The data used to express diversity have been provided to me by my advisor, who has access to a database where he extracted relevant data for me to use. To measure densification, I will use a combination of variables that together will constitute the concept density. Densification in the form of infill and transformation and will is identified by separating out newly built housing from two periods: 1990 to 1999 and 2000 to 2011. These will be sorted by size to see if the effect of the different sizes will vary in its influence on population diversity. I will conduct my analysis based on three years, 2000, 2011 and 2015.

I have several variables collected from Statistics Norway and Oslo municipality's statistical database, such as building type, population density and location. These are meant to constitute some of the features that might affect the degree of population diversity in inner Oslo. All the data is registry data and the geographical scale in the analysis will be basic statistical units. I

will define inner Oslo by the municipal limits that lasted until 1948. This means that areas like Bygdøy, Løren and Hasle are not included. This is based on two reasons. Firstly, these areas have not traditionally been a part of the inner city. Secondly, much of the densification in these areas are done by other methods than those I am interested in. My main method of analysing this will be by using linear regression models (OLS) and expand the models by including more variables throughout. The different categories of diversity will be the dependent variables. The variables for newbuilt housing will constitute the key independent variables and lastly, I will include the relevant control variables.

## 1.7 Outline

Chapter 2 will provide an overview of the theoretical foundation for this thesis. The main focus will be on how the diversity concept has developed throughout the last century, specifically the shift from zoning to mixed use development. I will connect this to other relevant trends in urban planning, in addition to discussing the planner's role in the work of making cities more diverse. Chapter 3 will provide the context for the analysis by first focusing on the historical and social development of Oslo, before moving on to the city's urban planning. Chapter 4 explains specifically what data I use, and where it is collected from. I will also explain the entropy score I will use to create the diversity variables, in addition to explaining the regression method. Chapter 5 will provide descriptive statistics for all relevant variables. Chapter 6 shows the regression results, organised by year and theme and presented in tables. Chapter 7 will provide a concluding discussion where I reflect on the results and the consequences they may have for policy, in addition to some suggestions for future research.

# Chapter 2 Diversity: a dominating paradigm in urban planning

As mentioned earlier, I understand population diversity as variety. This simply means variety in different features in a population, and carries no judgement on whether this variety is good or bad (Wessel, 2009). Emily Talen (2006a, p.1) describes diversity as: "the antidote of separation", meaning that to plan for diversity is, at least in the idea, to plan against segregation. Diversity was long understood as differences in social class or ethnicity, but during the 20th century, the understanding widened to include the multidimensionality of people's identities and group connections (Piekut et al. 2012). My conception of diversity in this thesis includes demographic and socioeconomic population diversity, with an assumption that these categories overlap on some accounts.

My theoretical foundation for this thesis is collected from several different authors and is meant to show the previous research on population diversity, and the ambiguity of the research on the connection between population diversity and the physical environment. My starting point will be a short overview of the assumptions underlying political decisions and the common opinion of population diversity. I will then continue with providing a historical perspective on Jane Jacobs and her ideas about cities and diversity. I will follow up by explaining how the 1960's became a turning point in urban planning, which later pushed population diversity to the top of the agenda for city planners. Jacobs "generators of diversity" has greatly influenced planning based on the perceived connection between physical structures and social diversity, and these have been adopted by many cities all over the world.  I will continue by connecting this to the larger planning context of city development based on diversity, creativity and competition. In the last part of this chapter, I will shortly address the planner's role and how these global trends affect urban planning in Norway.

## 2.1 Political background: Contact, tolerance and economic development

Diversity has become a popular theme on the agenda for almost every city committed to the Sustainable Development Goals. As social sustainability has gained more attention, so has the social composition of cities. Three underlying assumptions heavily affect the discussions around diversity policies, namely the assumption of the benefits of contact, the second, that the social composition of the neighbourhood affects a person's own chances in life, and third, that population diversity is good for the economy.

The first assumption advances a common view of the connection between diversity, contact and tolerance. To explain this, we have to look at the meaning of contact between groups. Contact has long been an important aspect when discussing diversity. Sennett (1970, p.194) writes: "If the permeability of cities' neighbourhoods were increased, through zoning changes and the need to share power across comfortable ethnic lines, I believe that working-class families would become more comfortable with people unlike themselves." The perceived benefit with contact is that: "The enemy lose their clear image, because every day one sees so many people who are alien but who are not all alien in the same way" (Sennett, 1970, p.195). The main assumption is that the experience of diversity will over time change the groups' desire to segregate themselves, a desire that stems from a lack of experience with other groups. In short, contact theory proposes that being exposed to diversity gradually wear away the distinction between in-groups and out-groups, and thus enhances out-group solidarity (Pettigrew, 1998; Putnam, 2007). Different aspects of this perspective, however, have been criticized for the assumptions they make about the causal direction, particularly in the early studies. It could be that people chose to enter contact situations because they were already more tolerant before the interracial contact and by that more likely to embrace the new diversity. Contact can reduce prejudice, but prejudice can also reduce contact (Binder et al. 2009). Scholars studying different aspects of contact theory find that the potential creation of friendship can change the attitudes about a group. In addition to this, the attitudes will likely be affected positively if the individuals see each other as group representatives (Pettigrew and Tropp, 2011; Wessel, 2009; Binder et al, 2009). Although many studies have shown that the contact hypothesis is relevant, conflict theory, on the other hand suggests that "the more we are brought into physical proximity with people of another race or ethnic background, the more we stick to 'our own' and the less we trust the 'other'" (Putnam, 2007, p.142). Increased population diversity can create more contact, but it can also create more conflict. Tolerance is a concept closely connected to this, but Wessel (2009, p.6) states that tolerance is "the extent to which people embrace diversity", and not an inevitable result of, or an aspect of diversity.

Historically, diversity policies often involve trying to mix different ethnic, religious or other social groups, or controlling where certain groups are allowed to live. The main idea today is to avoid segregation or other unwanted consequences. A number of such policies has not led to the wanted results and in general, they tend to not work very well. The validity and efficiency of diversity policies have been challenged and criticized for many reasons. Wessel (2009, p. 5) states that this is because "they do not produce a presence of otherness" and

because "diverse individuals and groups fail to interact". Even if an area has a variety of different people living there, there is no guarantee that they will interact with each other. This might create what researchers have called "parallel lives", meaning that even if a neighbourhood is diverse, the people who live there might still have minimal or close to no contact with each other (Wessel, 2009).

The second assumption regarding neighbourhood effects are quite complicated and I will not be able to go in to a detailed discussion here. The main idea can be expressed by White (1983, p.1009): "How far other people live from you and whether they are black or white, rich or poor, is likely to make a difference in the character of your urban social life." There is a certain agreement that the area you grow up in or live in has an effect on you, *how much* it matters is harder to say. The results in the research differs and is largely context based, i.e. that the effects seem to be stronger, or at least easier to document in the US than in Europe where the results are less consistent (Brattbakk and Wessel, 2017). Although the home and family are considered the main source of influence on someone's life chances, other types of influence are also relevant, especially for children. This could for example be through different socialization processes, like social norms and networks, often called internal factors. Other external factors can for example be lack of local institutions and/or resources and stigmatisation of the neighbourhood (Brattbakk and Wessel, 2017). Common ways to counter the negative neighbourhood effects can be area-based upgrading to improve the physical standard, or through different economic redistribution policies where areas with a high share of social problems get more resources. In short, many believe that if the population composition were more diverse, positive neighbourhood effects could occur, and many social problems could be reduced overall.

The third assumption that heavily affect how diversity policies are made is the idea that diversity is good for the economy. Jane Jacobs (2011) expressed her belief in the positive effect both physical and social diversity had on the economy in her book from 1961, "The Death and Life of Great American Cities". She further explored this theme in "The Economies of Cities" where she stated: "Conformity and monotony, even when they are embellished with a froth of novelty, are not attributes of developing and economically vigorous cities" (Jacobs, 1969, p.251). Other influential scholars like Edward Glaeser (2011) has emphasized the importance of cities attracting diverse, creative and smart people to boost their economy. Glaeser (2011, p.224) states: "The best cities have a mix of skills and provide

pathways for those who start with less to end with more". The idea of diversity as a tool for economic development might be most famously presented in Richard Florida's theory of the creative class. He proposed that urban areas should aim to attract the three T's: talent, technology and tolerance (Florida, 2002). Although Florida has been heavily criticized for his narrow view of diversity and creativity, his ideas have been highly influential with cities desperate to boost their economy. The connections between diversity and economic growth are complex, but the general idea is that a diverse mix of people with different knowledge, skills and ideas, will create new economic opportunities and innovations. Studies show that population diversity can have both positive and negative influence on the urban economy, depending on what type of diversity is looked at, for example high-skill or low-skill labour migration, immigration, or diaspora relations (Syrett and Sepulveda, 2011).

These assumptions have to a large degree affected how governments plan for diversity and works as the foundation for diversity policies. Although the results are varying, there seems to be a certain agreement that one should plan for more contact between groups because this will likely create more cooperation and innovation, and less prejudice. But as the short overview above shows, this is not easy and tend to give very different results, depending on a myriad of factors that might affect the relationship between population density and population diversity. There also seems to be little doubt that economically successful cities tend to have a diverse population. Population diversity has strong theoretical support, but when turned in to politics and policies much of the nuances and grey areas in the research tend to be overlooked and the assumptions remain as facts. What often follows are plans that are heavily affected by these assumptions without it necessarily being an active choice in theoretical foundation by those who creates the plans. Diversity policies therefore often become quite superficial and incoherent, without a clear understanding of the complexities.

## 2.2 From ideal cities to urban diversity

Jane Jacobs is likely the most well-known advocate for urban diversity. Her arguments are a direct reaction to the urban planning at the time of her writing, seeing the effects of strict zoning and the modernist planning methods had on New York City. As stated in the introduction of her most famous book: "This book is an attack on current city planning and rebuilding." (Jacobs, 2011, p.5). Jacobs expressed her hostility towards the trends of strict zoning, modernist planning and the current opposition to the natural diversity and

unpredictable element that she saw as necessary for a good city to function. She wrote: "There is a quality even meaner than outright ugliness or disorder, and this meaner quality is the dishonest mask of pretended order, achieved by ignoring or suppressing the real order that is struggling to exist and to be served" (Jacobs, 2011, p.21). Cities in the beginning of the 20th century was heavily affected by overcrowding, poor housing conditions and numerous other social problems. Urban planning and urban design were one of the main tools used to try and solve these problems. Fishman (1982, p. 239) sums up the common urban planning process at that time:

"The harmonious city must first be planned by experts who understand the science of urbanism. They work out their plans in total freedom from partisan pressures and special interests; once their plans are formulated, they must be implemented without opposition."

The time previous to the 1960s was heavily influenced by different models of ideal cities, most notably the Garden City, presented by Ebenezer Howard and the Radiant City, presented by Le Corbusier. Together with the Chicago school and their "concentric zone theory", these ideas heavily affected the development of cities in the 20th century. One common wish at this time was to simplify the city and making it more organised and orderly (Sennett, 2018). This wish to control the city is what created the "pretend order" that Jacobs referred to, which she thought was based on unrealistic utopian ideas about cities from people with anti-urban attitudes (Jacobs, 2011, p. 28). The wish to control urban disorder was also present in the architecture, and most notably in Le Corbusier's Radiant City, with its geometrical shapes and wide avenues. In addition to the streamlined design, his ideal city would also be completely segregated by class (Hall, 2014). There was no room for diversity or mixed use in Le Corbusier's planning ideas, and little mention of anyone other than the middle and upper class. The focus was on efficiency and not equity. Furthermore, his ideas were not possible to connect with already existing inner cities and were therefore very demolition friendly, usually in the name of "urban renewal" or "beautification" (Hall, 2014; Fainstein, 2005). These utopic goals of order and efficiency, in addition to the disregard for much of the older housing stock, was the foundation for Jacobs' protests against the planned highway and the demolition of her Greenwich Village neighbourhood. The demonstration by "ordinary people" against the master planners' top-down approach triggered a reconsideration of the ideas and assumptions underlying the modernist planning methods (Hall, 2014). The people who, together with

Jacobs, opposed this kind of development was a mix of historic preservationists, community preservationists, activists, socially conscious intellectuals and gentrifiers (Zukin, 2010).

Opposition to the strictly planned and designed city also came from voices within the architectural field. Some, such as Robert Venturi attacked modern architecture for its functionalistic expression and stated: "I like complexity and contradiction in architecture… I am for richness of meaning rather than clarity of meaning." (in Sennett, 2018, p.6). He saw complexity in architecture as something that makes the overall experience better and more interesting, compared to the stripped-down style of modern architecture (Sennett, 2018). Venturi is well-known for labelling his own work "ugly and ordinary" (Calder, 2018), while also stating "less is a bore" (Wainwright, 2018). His approach of complexity and simplicity at the same time represented a new perspective of the appreciation of the complicated, ordinary and ugly. Despite some newfound recognition for complexity in both architects and urbanism, the visions of a sanitized and orderly city still stood strong in the field of urban planning for many years, or even decades after Jacobs published her now famous book.

Urban renewal continued to define urban development in large parts of the 20th century. Le Corbusier was not directly involved in many of the urban renewal programs, but his underlying philosophy of efficiency and order was very influential long after his passing. Many cities in Europe and the US still carries the Corbusian legacy in for example the design of much of its public housing. The need to control the urban disorder and enforce a strict categorisation of people and functions led to displacement and evictions of the poor, the disadvantaged and ethnic minorities. Displacement was usually justified with some argument of improved housing conditions or living environment for the poor, and this was indeed the result in many cases. The problem was that many people lost their community and neighbourhood connections, in addition to their historical connection to the area (Fainstein, 2005). Furthermore, the strong hostility toward any mixing of urban uses and functions, helped fuel massive suburbanization and urban sprawl (Moroni 2016).

Jacobs' and other protests against urban renewal fuelled a shift towards a newfound appreciation for physical and social diversity, at least among ordinary people and in many academic circles (Fainstein 2005). Both Jacobs, and later Richard Sennett, argued that the urban renewal of poor and working-class neighbourhoods destroyed local gathering spots, both in the form of neighbourhood bars and cafes, but also in places outside, like street

corners, ideal for more unplanned socializing (Sennett, 1992; Jacobs, 2011). Sennett states that we can understand this decline in gathering spots as: "a result of neighbourhoods becoming much more definable and homogenous in the modern city" (Sennett, 1992, p.77). We can therefore argue that the urban renewal process during parts of the 20th century seems to have made many neighbourhoods less diverse and more segregated. Jacobs argued that: "Intricate minglings of different uses in cities are not a form of chaos. On the contrary, they represent a complex and highly developed form of order" (Jacobs, 2011, p.290). An element of orderly disorder is the real-life component that the urban renewal and Corbusian planning did not include. Areas that are too orderly and strictly designed will not have the "sidewalk ballet" with room for a variety of people and functions which, according to Jacobs, was essential to a good city (Jacobs, 2011).

The end of the 1960's and 70's saw an increase in urban uprisings in American cities (Hall, 2014). Protesting police brutality, racial injustice, discrimination in the housing market and inadequate public services, led to an increased focus on how urban inequality affects people differently. This was closely linked to anti-urban attitudes causing years of disinvestment and disregard for urban dwellers, and especially marginalised groups in the inner city. Post-war cities therefore became associated with the term "urban jungle", or as a frontier that needed to be controlled and tamed (Smith, 1992). Crime and poverty in many Western cities were increasing and urban planning did not seem to be able to provide any answers to solve the pressing social problems (Hall, 2014). Combined with an increased focus on civil rights, and later women's rights, LGTBQ- rights and other social rights movements, scholars writing about cities started to include more perspectives on justice and inequality. This changed the view of urban space from a container of buildings, population and production, to "a constituent of the relations of production and reproduction and a contributing source of inequality and by implication injustice" (Fainstein, 2014, p.1-2). With the increased focus on justice and equity, diversity became an important expression of these ideas. Fainstein (2014) further adds that the development of the concept of justice incorporated goals of material equity and recognition of difference, which again increased the focus on who was being included and excluded in urban space. She also emphasized that all these concepts need to be combined, and the goal should be to aim for a just city, meaning: "A city in which public investment and regulation would produce equitable outcomes rather than support those already well off" (Fainstein, 2010, p.3). Despite increased focus on inclusion of different groups in society, Fainstein (2010) states that there is not necessarily a link between greater

inclusiveness and a commitment to a just society. A commitment to diversity would therefore need to be complimented further to fully contribute to overcoming social problems.

The defining element in planning by the early 1990s and further into the 2000s was that of sustainable development. Diversity and other concepts used to address the social dimension of the built environment became incorporated under the social sustainability umbrella. This part of the concept has been deemed the least developed of the three and has been called a concept in chaos by Vallance (et.al, 2011), in part because it is under-theorised and oversimplified and lacks a proper conceptual understanding (Shirazi and Keivani, 2017).

According to Dempsey et al. (2011) social sustainability should say something about the social goals of sustainability and they emphasize several physical and non-physical factors. Of non-physical factors they highlight diversity, social justice, social inclusion, fair distribution of income, sense of community and belonging, mixed tenure, social interaction and community cohesion, amongst other factors. Physical factors listed are accessibility, walkable neighbourhood, decent housing, urbanity and local environmental quality and amenity. Dempsey et al. base these factors on two overarching concepts that represent the core of social sustainability, namely social equity issues and the sustainability of community itself. By social equity they mean: "fairness in the apportionment of resources, and equality of condition" (Dempsey et al. 2011, p. 292). This also means that a society should be inclusive and make sure that people can participate economically, politically and socially in society. Social equity is often measured in terms of accessibility to key services and facilities and transport options. Challenges regarding social equity are often geographically concentrated in areas of deprivation, where poverty, poor housing conditions and reduced access to public services are common. The second concept mentioned was sustainability of community. This means that a society or community should have the ability to sustain and reproduce itself, while functioning in a healthy way. A sustainable community is dependent on social interaction and social networks and keeping the relative stability of the community, meaning that the turnover rate should not be too high.

The main problem with sustainable urban development is that even though all might agree that is should be a goal, nobody really knows how to transform it into actual policy and decisions in a specific urban context (Hall, 2014). The general guidelines of social sustainability are often easy enough to understand alone, but they become extremely

complicated when connected to the larger urban systems. Some are more sceptical to how social sustainability is supposed to include so many complex dimensions of social life. Marcuse (1998) has argued that sustainability and social justice do not necessarily go hand in hand, and that the term has clear limitations in relation to social issues. When it comes to social issues, sustainability in its literal meaning, to uphold something, can camouflage the true efforts needed to create a more socially just society, because the sustainability rhetoric can be used for justifying and legitimising market-oriented and unjust development programmes, as Loretta Lees suggests has happened in London. (Lees et al., 2014). Some are arguing for "degrowth" as a new strategy for reaching sustainability, where the overall argument is to downsize both the global and national economies to a more sustainable level which is less exploitative of people and nature (Khmara and Kronenberg, 2020). A great number of strategies have already been developed to address different aspects of sustainable urban development. Jabareen (2006) sums up some of the most popular strategies as: compactness, sustainable transport, density, mixed land uses, diversity, passive solar design and greening. These tend to overlap, and are by no means brand new strategies, but most of them seem to agree on the assumption that physical design can improve social sustainability. In the next part of this chapter, I will present some of the common design elements, illustrated with Jane Jacob's "generators of diversity", that is currently being used to promote social sustainability, focusing on population diversity.

## 2.3 Urban design and population diversity

The idea that it is possible to create population diversity through urban design has been a very common assumption. Jacobs listed the "generators of diversity" as mixed primary uses, small, short blocks with many corners, aged buildings, plus a dense concentration of people, both permanent residents and out on the streets (Jacobs 2011, p.196-197). Although Jacobs stressed the element of spontaneity in creating diversity, it is clear that she assumes great positive benefits from a certain type of urban design, even though she emphasizes that diversity is mainly an organic and natural process.

Jacob's first generator of diversity is mixed primary uses. By mixed primary uses, she means a combination of mainly offices, dwellings, factories, in addition to places for entertainment, education and recreation. By having a combination of different uses, the area will also attract different groups of the population at different times of the day. Mixed primary use will

because of this give positive economic effects on the area because businesses and stores can utilize a range of potential customers. Areas with one main function, for example, offices open during normal work hours, will be largely deserted from the afternoon to the evening, and will therefore struggle to create the sidewalk ballet Jacobs saw as essential for city life (Jacobs, 2011). By having mixed uses with places to use both day and night, the area will be livelier and by that again attract more people. Mixed-use has become a very common way to develop urban areas since the time of Jacobs writings. The current way of developing for mixed use is largely based on the model of the traditional European city centre with small and dense neighbourhoods, and social and cultural diversity (Rowley, 1996). Before the 1920's, neighbourhoods were naturally mixed with both dwellings, jobs and facilities because of less transportation options (Talen 2006). Having the essential shops, jobs and services nearby was therefore natural because people were largely dependent on being able to walk. These elements are now starting to return to the principles of urban planning.

The concept of mixed use has become more complicated today and has gained several dimensions. Rowley (1996) emphasizes that there needs to be a mix of commercial and residential tenure. In terms of housing, this means properties designed for renting, home ownership and shared ownership. There also needs to be a mix of housing units to accommodate different family structures, in addition to units of different sizes and prices to allow for variety in socioeconomic backgrounds (Talen, 2006a). In terms of the commercial properties, there should be a variety of leasing agreements to facilitate a mixture of commercial activity (Rowley, 1996). There is one obvious problem with Jacobs' idea of mixed use as a generator for diversity, and that is the current way the property market and land ownership is organized, which has changed tremendously since the time of her writing. The affordability of the mixed-use development will heavily affect who can live there, and by this also affect the population diversity in an area. As Rowley (1996, p.93) writes: "Developers and investors desire maximum value, at minimum risk and at maximum convenience to themselves." Creating a truly mixed-use development that has both mixed-housing and commerce, in addition to being mixed in terms of affordability, size and population, seems difficult in the current market economy because other ways of building might create more profit and therefore be more desirable for the developers.

In addition to wanting small, short blocks, Jacobs also emphasized "the need for aged buildings", which she referred to as: "a good lot of plain, ordinary, low-value old buildings,

including some rundown old buildings" (Jacobs, 2011, p.244). Her argument is that new buildings will have a high cost of construction and by that a higher level of rent, meaning that only either subsidized operators, like high-end art or other cultural institutions, or well-established businesses like chain stores, chain restaurants or banks can afford to establish themselves there. Essentially, older buildings will be cheaper to rent and will have less competition among renters, thereby opening up for more uses from people of a variety of income groups, in addition to possible start-ups and newly established, small businesses. Jacobs also stated that the development of new houses in an area should be gradual, rather than by large scale redevelopment schemes (Jacobs, 2011).

Jacobs' claims have been investigated by for example King (2013) in an article which saw significant links between the historical development pace, meaning the diversity in housing age in an area, and neighbourly social relations, controlled for other neighbourhood features like social composition and individual social and demographic composition. She suggests that a gradual development process might better maintain the community ties, although she does not rule out other mechanisms or factors that might explain more of this relationship. King (2013, p.2422) further suggests that "large-area zoning frameworks that discourage transitions may be even more problematic than previously thought, and infill development even more promising". Because Jacobs believed that older buildings and shorter blocks were cheaper and would make better neighbourhoods, she also assumed that preservation and restricting building height would be tools to safeguard affordability (Glaeser, 2011). Later developments, however, have not moved in that direction. While Jacobs has a valid point regarding the attractiveness of old, run-down buildings, the implication of this attractiveness has often been gentrification, i.e. increasing presence of middle-class people and subsequent increases in cost of living. When housing prices increase dramatically, this can challenge the diversity in an area by displacing long-term residents who can no longer afford to live there, at the same time as it can become an exclusive space limited to those who can afford to pay the high housing prices, usually the middle-class or upper-class (Zukin, 2010).

The relationship between density and diversity is also something Jacobs explored in her writings. Density had a bad reputation at the time of her writing. It was often seen as a symptom of poverty and slum areas, and a synonym to overcrowding, even though overcrowding generally describes a high number of persons per dwelling, while density usually refers to the number of people in a specific area. This means that a dense area does

not need to be overcrowded, and an overcrowded area does not necessarily need to be extremely dense, because it depends on the distribution of people. When Jacobs talks about density, she focuses on the number of dwellings in an area. If this is too high, standardization of buildings may set in and this will remove some of the diversity in age and types of buildings, which again will be negative for diversity. She therefore emphasizes that density also needs to be combined with variety in buildings (Jacobs, 2011). With enough people and enough dwellings: "the diversity can be generated and people can develop attachment and loyalty to their unique neighbourhood mixture of things" (Jacobs, 2011, p. 271).

When looking at these generators of diversity, we see that they do not explain fully why some areas are diverse and others are not, and there is absolutely no guarantee that this will create a diverse population. Jacobs connects physical diversity to population diversity, and although she sees the latter as something that has to happen naturally, she does put a lot of faith in the physical structures of buildings and streets. She received critique for having a romanticized view on old neighbourhoods and traditional urban communities (Taylor, 2006). Some of her well-known examples were becoming obsolete already at the time of her writing. Local shops were being replaced by chain stores, housewives who had "eyes on the street" were entering the workforce, landlords were abandoning low-rent properties and gentrification was in process (Zukin, 2010). In addition to this, she has also been accused of being naive in her view on how we can create diversity. This critique is mainly based on the fact that she does not talk much about scale in her writings. This is important because it is extremely difficult to maximise diversity on all geographical levels. Her view of "true diversity" is very difficult to find in actual cities. As David Hill (1988, p.312) states: "It is quite rare in urban history to find new work, corridor streets, close-grain urban form, high density, and sociological mix in the same place at the same time. If diversity is so central, why is it so rare?". Implementation becomes a problem for those who want to follow the teachings of Jacobs because it is hard to foresee how much of what she suggests could be enforced and turned into policy. By using an ethnographic approach, Jacobs has provided urban studies with many insightful perspectives, but her lack of empirical documentation becomes a weakness when others want to follow her principles. Hill (1988, p.312) has also pointed out that Jacobs "provides little guidance regarding what interest groups would support her position, or what voting blocs would benefit from diversity in cities." Hill (1988) further adds that it is not automatic that her principles will reduce the gap between rich and poor or improve equity.

Talen (2006b, p.240) argues that despite the strong theoretical backing of multidimensional diversity, "the translation to principles of physical planning and design has been underdeveloped". One interesting example is the design movement called New Urbanism. This idea is based on traditional neighbourhoods and neo-traditional architecture with elements easily recognized from Jacobs writings, like mixed land uses, an emphasis on public gathering spaces and streets adapted for pedestrians (Talen, 1999). New Urbanists have been thoroughly criticized for their spatial determinism, meaning that they rely on the physical environment to affect social behaviour. Another element of critique is the use of the typical American small town as their ideal type for a good community (Talen, 1999). This model has been criticized for promoting social fragmentation and elitism, and since these developments are often designed with a specific type of people in mind, they also carry values related to class, ethnicity and lifestyle. As Talen (1999, p. 1373) points out: "Since new urbanist development is, to date, dominated by affluence, it is possible that this status rather than town design creates an economically based sense of community." While the physical structures might be appealing to a diverse set of people, social norms might be a negative influence in such areas. It is therefore important to notice that many other factors than the design can influence the sense of community and also the diversity in these areas, and it is not simply down to the architecture and design. This example is most relevant for an American context, as gated communities, or neighbourhoods that require a membership are less common in Norway.

## 2.4 Diversity as urban policy

Contemporary urban development involves many components, and I will in the following paragraphs give a short overview of how diversity has become "the new guiding principle for city planners", according to Fainstein (2005, p.3). Current urban policies are heavily affected by entrepreneurialism, city marketing, the wish to produce urban rent and territorially targeted social policies. Furthermore, we have seen a shift from distributive policies and the classic welfare state towards more market-oriented approaches (Swyngedouw et al., 2002). The population diversity debate is illustrated in two contradicting images. On the one hand population diversity is seen as a positive impact on the urban economic development, while on the other, it can create conflict between different groups, especially when related to immigration and religion (Syrett and Sepulveda, 2012). This has led to what Raco and Kesten (2018, pp.893-894) call "the politicisation of diversity", where they state: "diversity has taken

on a chaotic form and been used to justify a variety of ambiguous, and at time contradictory, social and economic policy rationalities".

The idea of the global city has become increasingly important and it functions as a framework for understanding why diversity has become a guiding principle in urban planning. Diversity is a key element in the global city, together with cosmopolitanism and the increasing importance of culture. Sennett (2007) draws a parallel to the new system of flexible capitalism to the standardization and impersonality of the new forms of businesses and architecture in the global city. Architectural expressions are an important part of the idea of the global city, as it is closely linked to dominant political and economic interests and not just an artistic practice or expression (Jones, 2009). The problematic aspect of global architecture is that the projects produced are not always adapted to the local context and local identity, and if they are, it is often in a superficial way. Inclusiveness can therefore become a problem. The built environment also becomes a product of the creators will (Sennett, 2018). One clear contradiction between the increased focus on diversity and inclusiveness in urban development is the increase of "hostile architecture" in many cities (Petty, 2016). In general, this type of architecture is meant to limit who can use the space, and for how long they can use it, and functions as a way to control urban space.

The growing importance of diversity as a promotional tool, has blurred the lines between policies meant to promote diversity and those meant to promote economic development. As Syrett and Sepulveda (2012, p.241) states:

"This has led to the development of a range of policy interventions over recent years in which cultural and population diversity are actively used as means to improve the skills and knowledge of the workforce, promote entrepreneurial activity, creativity and innovation, develop trade and business networks through diaspora relations, as well as exploit the presence of diverse urban environments and populations to attract skilled workers, visitors, investment and events."

This combination of economic development, diversity and culture has led to the creation of the concept "the cultural city", which heavily relies on the use of population diversity as a way to distinguish themselves from other cities, and by that getting a competitive advantage (Syrett and Sepulveda, 2011). The marketing tools used to promote the cultural city varies,

but some of the most commonly used are some form of "hard branding", involving flagship development, such as the building of an opera house, museums, theatres, stadia or other similar developments meant for the consumption of culture. Branding commonly involves some form of cultural happenings, either by arranging festivals or events that brings attention to a specific cultural aspect of that particular city, or the people in it.

The focus on experiences, heritage and entertainment represents a process where culture has become a commodity (Evans, 2003). This branding can create a link between individual and collective identities and provide a sense of belonging to a city or neighbourhood. As cities seek to promote their multicultural identity and inclusiveness, many re-label their ethnic quarters, former ghettos and immigrant neighbourhoods to names that can be associated to a certain cultural expression, see for example Banglatown in East London (Evans, 2003, p.421). Sharon Zukin (1995) writes that the power to create an image of the city has become more important as the traditional identities connected to social class or political parties have become less relevant for expressing identity. This means that the branding of cities and neighbourhoods can be a part of creating new common identities, while also disconnect areas from certain parts of their previous identities. Historical areas often gain popularity because of the promotion of distinct architecture and the element of "authenticity" or a "local" neighbourhood feeling, making them distinct and unique and something worth experiencing. Zukin (2010) further explains that authenticity has become a tool of power which is used by certain groups to impose its own tastes on urban space and make claim to that space, which again can displace long-time residents. As these areas become known for being inclusive, diverse, authentic and local, gentrification often follows, and the people who at least first is presented as essential for the culture and history of an area often tend to disappear after the area becomes a "cultural destination". Novy (2012, p. 21), writing about New York City, argues that the "revalorization of multiculturalism and diversity" was an important factor in the city's economic recovery after the troublesome 1970's and 1980's. The same places that once were seen as dangerous and persistently avoided by the general public, such as for example Harlem and parts of Brooklyn, are now being recognized and promoted as economic and symbolic resources, which is seen as positive by many because of the increased investment in the areas. However, not everyone shares the enthusiasm, as many fears that a "touristification" of their neighbourhoods will destroy the features that made them attractive in the first place. Some residents fear that if the Harlem heritage is treated only as a device to make profit it could weaken the whole identity and culture of the place. This kind of

development could be especially challenging if they happen in low-income or minority-group areas where people have less power to influence the decision-making process (Zukin, 1998).

Creating a commodity out of culture and identity is not a new phenomenon, but many communities are being incorporated into the urban economy with a much higher intensity than before, which could be worrisome for vulnerable people who might not be included in the new economy and identity of the community (Novy, 2012). Zukin (1998) exemplifies this by the "Disney World's consumption regime" which "creates a safe, clean, public space in which strangers apparently trust each other and just 'have fun'". This has again fuelled city governments to "Disneyfy" by "sponsoring urban 'festivals' and themed shopping district, cleaning up public space, by installing private agents of surveillance and control and by turning over the management of public spaces to private associations of commercial property owners." (Zukin, 1998, p.832). This type of development can challenge the accessibility, which again can challenge the possibility of a socially diverse place.

It seems quite ironic that trying to plan according to Jacobs' principles, often leads to what she called "the self-destruction of diversity". She describes the process like this:

> "A diversified mixture of uses at some place in the city becomes outstandingly popular and successful as a whole. Because of the location's success, which is invariably based on flourishing and magnetic diversity, ardent competition for space in this locality develops."
> (Jacobs, 2011, p.317).

This competition for space, fuelled by the hard branding and promotion of the cultural and global city, creates winners that represent a small segment of the uses that made the space a success in the first place. This then goes from being a diverse to a monotonous space (Jacobs, 2011). Diversity is used as a tool to revitalize areas with more economic potential. By attracting more investment and high skilled people, the local economy often sees a boost, but the crisis of success can contribute to the later decline in population diversity. It might be reasonable of us to question the true commitment to population diversity in these plans and policies when economic development, regardless of its effect on the population, so often seems to be the end goal anyway.

## 2.5 Planning - From policy to practice

As presented above, there is a variety of approaches to creating more population diversity within different fields like architecture, urban planning and economics. Planners still struggle to turn diversity policies into practice, and I will in the following paragraphs present some of the challenges that affect the planner's role in planning for diversity. In the planning modes that developed during the 1950's, often known as synoptic planning, planners were seen as objective and apolitical, with clear goals and a step by step vision of how to implement them. This mode of planning was influenced by masculine perspectives with a top-down view on society. Since planners were seen as neutral experts, there were not much room for participation from the public or other non-experts (Fainstein, 2000). Several new modes of planning have been developed after this. I will not go into details on this development, but the shift in the Nordic countries has mainly been towards more inclusion of the people who live in the relevant areas set out for urban development, in addition to an increased focus on sustainability.

Even though diversity has become more and more incorporated in urban planning, there is still few documented examples internationally of planners taking diversity into account in the practice of their profession (Pestieau and Wallace, 2003). These changes in planning modes might have made the idea of planning for diversity more accepted, but in practice, the planners often have a limited amount of power to actually influence the planning process. The changes in planning mode has affected the Nordic countries as Mäntysalo et al. (2015) illustrates in their study of the legitimacy of informal strategic urban planning in Norway, Sweden and Finland. They notice how informality has entered urban planning in the Nordic countries. They explain: "By informality we mean that the new strategic means of urban planning have been investigated from outside the statutory land-use planning system" (Mäntysalo et al. 2015, p.350). The planning system has become more informal in two main ways. The first is the inclusion of planning consultancy firms, think tanks, living labs, competitions, and the use of new techniques to visualise urban structures and dynamics in the planning process (Mäntysalo et al. 2015). The planning process is therefore more layered than before, with more players involved in developing the plans. The second way is the increased use of informal plans. Creating legally binding statutory plans needs to fulfil several demands that makes this process time consuming and expensive. Creating informal plans can be done much faster and usually cheaper because of fewer technical demands, in addition to less demands for public involvement. According to Mäntysalo et al. (2015, p. 351) the problem

comes: "When strategic urban plans are prepared outside the statutory planning system, these processes also lack the legal guarantee for inclusiveness, fairness and accountability. This is a serious legitimacy problem". The risk here is that the informal planning becomes a parallel planning system outside the existing one, instead of the process being cooperative. This is not currently the case in the Nordic countries, but Mäntysalo et al (2015) points out that this is the direction we seem to be moving towards.

Sager (2009) expresses his concern about the planner's role in the Nordic countries as being: "torn between dialogical ideals and neoliberal realities". By this he means that urban planners in the current system often find themselves having to act contrary to their values in a system with an increasingly economistic and efficiency-oriented ideology. Sager (2009, p.74) further argues that: "the typical attitude of Nordic planners corresponds to the ideals and values embedded in communicative planning". His study found that Norwegian planners were most likely to experience hard trade-offs between their own values and their agency or administration's values and perspectives. This is grounded in Norwegian planners' strong commitment to involving citizens in the planning process, in addition to the planner's opinion of affected groups, which often leads to disagreements between their recommendation and the policies and recommendations of the agency.

This chapter has been focusing mostly on Anglo-American literature, and I consider the themes as relevant for Oslo and Norway in general. The Nordic management tradition has changed in many ways, but is still strong compared to the situation in many American cities. The municipality of Oslo is for example a strong voice in providing the overall goal of the city's urban development. Sirowy (2015) states that it is the *gap* between the overall plans and reality that poses the challenge in planning for population diversity in Norway. Changing power structures between city governments and private developers has put much of the specifics of planning into the hands of private developers. This means that even though planning by the city government might have become more inclusive, the increase of privatization and outsourcing of the planning process has made the process overall less inclusive. The space in which planners can navigate and relate their work to values or communicative planning might therefore be fairly limited because the current planning process is so influenced by the global trends of managerial governance and market-oriented planning practices. It is therefore quite difficult to create plans for diversity within a system that has such a narrow focus on planning authorities being flexible, efficient and service

minded. Diversity therefore risks becoming another buzzword in urban planning without much actual substance or concrete practices or results to show to.

## 2.6 Summary

Urban diversity seems to have become the new leading ideal for cities. It carries along assumptions like more economic development and more tolerance, but we also see that diversity can cause conflict between groups. Governmental plans have been heavily affected by these assumptions and changes in the physical environment are currently seen as the number one way to influence the mixture of people in an urban area. But as Sennett (2018, p.1) said: "The built environment is one thing, how people dwell in it another", and as this chapter hopefully has shown, the relationship between these two are complicated and contradicting. On one hand, we see that diversity is celebrated with cultural events and advertising campaigns, focusing on the local and authentic life. On the other hand, we see an increase in hostile architecture, reflecting the trends of more segregation and polarization connected to the entrepreneurial and market-oriented modes of urban planning. There seems to be a clear mismatch between population diversity as a paradigm and the tools that governments have to realise the goals. Local governments have less power than before to steer the development in the direction they want because market driven actors have become more powerful. This trend is also present in the Nordic countries, although the change is not as dramatic here as in many other countries and cities. Population diversity has become a term often used superficially in the planning process and the plans does not necessarily have much positive effect on population diversity since there is no legal demands to accommodate this. Ideas inspired by Jane Jacobs writings have become self-evident truths in urban planning but most of them are still extremely difficult to turn into actual plans and policies.

# Chapter 3 Historical development and the planning of Oslo

Oslo after 1945 was characterised by the industry and railroads around the harbours and rivers. The city has grown substantially since then, and now faces new challenges, especially related to social and environmental issues. The inner city has gone through many stages, from neglect to renewal, and later gentrification. This chapter will provide a short overview of relevant developments in the inner city. It will be divided into two parts. The first will present the demographic and social development of Inner Oslo after 1945. The focus here will be how the urban planning and policies affected the population in the inner city. The second part will focus on the central trends in the planning of Oslo at this time and until today, with an additional focus on how the planner and the municipality's role has changed.

## 3.1 Demographic and social development

Pre-1945, Oslo was affected by a population increase which fuelled the need for housing. At the same time, the ideals of a good life were affected by ideas inspired by the rural life, meaning that a high number of single-family housing were built, causing a sprawling city. The size and location of these houses was to a large extent determined by how much money the builder had, what transportation possibilities existed and the status of the area. This meant that the East/West pattern that already existed in Oslo was becoming clearer already before 1945, with the wealthier inhabitants locating to the West and the lower-middle class and the working class locating in the East (Myhre, 2017). Oslo's population grew, and in 1948 Aker was merged with Oslo municipality (Myhre, 2017). Hard economic times during the war meant that little new building was done, and by 1945 Oslo was rugged and grey after years of lacking maintenance (Benum, 1994).

The period after 1945 saw drastic changes in the city, both in terms of people and structure. The post-war baby boom and urbanization meant that there was a shortage of housing (Benum, 1994). One of the main changes in this period was that the municipality got much more involved in the housing development, and by that, also the urban development. This happened especially through the housing cooperative organisation, and through the building of the suburbs (Myhre, 2017). The suburbs attracted a lot of people from the inner city, the surrounding areas, and newcomers from other parts of the country. Even though single-family housing was still built, the main addition to the housing stock was the building of apartment blocks. The new suburbs were based on the idea of community, where the population ideally

should reflect the general urban population composition. The municipality did not have many tools to actually make this happen, but they provided some variation in apartment size to accommodate people without children and the elderly (Benum, 1994). Although these areas had a lower standard than the villa housing and single-family housing, the people who first moved here usually saw an increase in the standard of living compared to before. The move to a larger apartment with better sanitation, which was located close to green areas represented for some the change to a "modern society". For others, the new areas were grey and boring, with fewer facilities than first promised, in addition to being located too far from the city (Myhre, 2017, p.45).

This positive development in the outer city was in stark contrast to the situation in the inner city, and especially in the inner East. The population in the inner city declined from 302 000 in 1948 to 133 000 in 1986 (Myhre, 2017). The housing stock in the inner city had particularly low standard compared to the rest of the city, with the tenement buildings and the old wooden houses even worse off than the rest. This did not fit into the picture of Oslo as a modern city as they were seen as both a health risk and a safety hazard. Redevelopment was the agreed upon strategy for the inner city already in 1937, but by 1950, only a few of the 17 designated redevelopment areas had been demolished. The three areas, Vestre Vika, Vaterland and Enerhaugen were fully removed and mostly replaced with commercial properties and modern apartment blocks. The 14 others remained under the threat of full redevelopment which caused insecurity and further lack of maintenance and investment among the residents (Benum, 1994). Both the municipality and the developers' focus was directed towards the suburb development which was considered to be cheaper and more efficient than redevelopment (Bergkvist, 2011) The complete disregard for the inner city likely saved the older areas from demolition.

The redevelopment strategy faced opposition from the beginning from people who lived in the areas. One of the most notable redevelopments that sparked public debate was the demolition of the old, wooden houses in Enerhaugen, deemed "housing not worthy for humans" (Benum, 1994, p.150, my translation). Some had designated Enerhaugen as a slum, while others were much more positive and considered it a "village within Oslo" (Benum, 1994, p.150, my translation). Despite much protests by local residents and others, the area was demolished and OBOS received the honour of rebuilding, resulting in modern high-rise apartment blocks. This process fuelled the debate on redevelopment, and many became more

openly critical to the demolitions. Regardless of the opposition towards the renewal of areas like Enerhaugen, people in the inner city were in general quite keen to leave. Why was it so? According to Lund (2000) the main motivations for leaving were working conditions and living conditions, with the latter being especially important. The poor living conditions meant that those who could afford to leave usually did. This was especially younger people, and families with children, which in reality meant that those who stayed behind was generally old, poor, unmarried and with little or no social network or family nearby. This led to an accumulation of social problems, as mostly poor and marginalised people stayed behind (Benum, 1994).

The foreign migration that started during the 1960's also contributed to the changing social composition in the inner city. While the first wave of immigrants in the 1960's consisted mostly of young men, family reunions later made the immigrant population more diverse, in addition to adding more children. The inner East was run-down and struggled with pollution and noise, and the location was in proximity to the workplace or to public transport. This meant that the rents were low which made it easier for immigrant groups to locate here. The municipality also played a part in allocating housing units to migrant workers in the inner East (Benum, 1994). These groups filled some of the void left in the inner city, but the overall population decline still continued. As we can see in Table 3.1, the population in the inner city declined from 301 708 in 1949 to 132 652 in 1989. In the same period, the outer city population increased from 121 190 to 319 197. These numbers clearly represent the priority in housing developments in the outer city and the deterioration in the remaining housing stock in the inner city.

Table 3.1 Population change in Oslo, 1949-2019

| Year | 1949 | 1979 | 1989 | 1999 | 2009 | 2019 |
| --- | --- | --- | --- | --- | --- | --- |
| Inner Oslo | 301 708 | 153 497 | 132 652 | 150 350 | 180 384 | 223 928 |
| Outer Oslo | 121 190 | 300 174 | 319 197 | 351 656 | 393 980 | 454 744 |
| Oslo total | 428 994 | 456 128 | 456 001 | 502 867 | 575 475 | 681 071 |

Source: Oslo Municipality, 2019. Absolute numbers.

Many apartments in the inner city did not have modern sanitation like toilets and hot water before the widespread upgrading in the 1970's and 1980's. Moving to the outer city therefore could mean a quite substantial upgrading in the standard of living for many people. To fund the renewal, the city adopted a principle of self-financing, which meant that the residents in the renewal areas had to pay for the upgrades, causing many in the lower social groups to go into large debts or being forced to move. Since the inner East was had an overrepresentation of older people and people with social issues, there was a wish to attract other social groups. Many smaller apartments were therefore combined to make room for families with children in the hope of at least making the area more diverse in terms of age and family structure (Bergkvist, 2011; Lund, 2000). At the end of the 1980's, the municipality developed a criteria-based allocation system to better provide resources for the areas with the largest share of the social challenges (Benum, 1994). A similar system is still in place today.

The urban renewal of the inner city had positive influence on the standard of living. In addition to physical improvements, particularly of the tenement buildings from the 1800's. Oslo also had "a goal of a more diverse population composition both in terms of age and social structure" (Oslo kommune 1977, my translation). The renewal was part of a larger process of creating more social mix and more stable neighbourhoods, and as it progressed, the social composition in the inner city changed, but not necessarily exactly as the Municipality had hoped. The goal was originally that the same people would live in the area and that increased population diversity would happen gradually by increasing the share of young people and families with children (Benum, 1994). A study published already in 1984 by Bysveen and Wessel pointed to several changes that had affected the social composition of the inner city. The first major change was that around 40 % of the households moved during or after the renewal process. Most of these were old and unmarried. The second change was that the degree of improvement affected the rent, which again affected the stability of the neighbourhoods. In general, high-income people tended to live or move into apartments with a high degree of improvement. A third change was that the renewal drastically reduced the number of rental units because many apartments were combined to make them larger and more appropriate for families. Many apartment blocks were also turned into cooperatives, which could be problematic to afford for low income people. In terms of age, these areas did get more diverse, but less so in terms of social structure.

Despite some improvement following the renewal process, the trend of Oslo as a socially divided city continued (Myhre, 2017). The urban renewal helped to improve the image of the inner city and many of these areas are considered highly attractive areas today. It also led to a replacement of low-income people with higher-income people, which means that we can see a tendency of gentrification already at the earlier points in the renewal process (Bysveen and Wessel, 1984). One indication of this major change in population structure is illustrated by the changes in overall education level in the inner city.

Table 3.2 shows that of the ages 30-39, 34,2 % of the population had higher education on a bachelor's level in the inner city. If we compare this with the numbers of the city in total, we see that the number was 30,1 %. Higher education on a master's/PhD level was about the same in the inner city and in Oslo in total. This supports Bysveen and Wessel's (1984) conclusion of a relatively substantial change in population structure during the 1980's, where the inner was highly educated already at this point. The increase of high-income groups in the inner city is likely connected to the increase in education levels, as these two tend to be correlated.

Table 3.2 Percentage of the population, aged 30-39 with higher education. Oslo total and inner Oslo 1990-2015.

|  | Year 1990 | | Year 2000 | | Year 2015 | |
|---|---|---|---|---|---|---|
|  | Oslo total | Inner Oslo | Oslo total | Inner Oslo | Oslo total | Inner Oslo |
| Bachelor's degree | 30,5 | 34,2 | 33,3 | 37,5 | 34,8 | 36,7 |
| Master's degree/PhD | 11,3 | 12,6 | 15,7 | 19,3 | 29,4 | 34,6 |

As table 3.2 shows, the education in both the inner city and the city as a whole has increased quite drastically from 1990-2015. When looking at the percentage of the population that had a bachelor's degree, the level rises to 37,5 % in year 2000, but then falls to 36,7 % in 2015. However, when looking at the percentage for master's degree or PhD, the development in the inner city is even more drastic. The table shows that even though education on bachelor's level have decreased slightly between 2000 and 2015, higher levels have increased from 19,3 % to 34,6 %. Studies have confirmed that the both the new-built areas and the working-class areas of the inner city experienced substantial gentrification in the 1990's and 2000's (Magnusson Turner and Wessel, 2013; Hjorthol and Bjørnskau, 2005). The change in population structure that began in the 1980's seems therefore to have continued, based on the increase in education levels and the established gentrification process. Other reasons that

likely influence the increased education levels is are the obvious increase in women in higher education, in addition to the overall increase in education levels in Norway in general (SSB, 2018). This also gives support to the notion of increased attractiveness and housing standard in many areas in the inner East.

Despite the changes in population structure, some trends are still persistent in the inner East. The districts in the inner East still have a larger proportion of single person households than both the inner west and the outer areas of the city. This is likely related to the presence of a large share of young adults who live alone, often students and others who have not yet established a family. The large share of single person households is also related to the average usable floor space of newbuilt housing in the inner city, which between 2000 and 2018, were on average smaller than in the other parts of the city (Byrådsavdeling for finans, 2019). With a large share of small apartments, overcrowding becomes an additional problem. The districts in the inner East, especially Gamle Oslo, Grünerløkka and Sagene has some of the highest rates in the city when it comes to children living in overcrowded housing (Byrådsavdeling for finans, 2019).

The inner East is overwhelmingly dominated by apartments smaller than 80m2 (Byrådsavdeling for finans, 2019). Efforts have been made to change this trend, mainly through the "apartment distribution norm" primarily aimed to diversify the housing stock in St. Hanshaugen, Sagene, Grünerløkka, and Gamle Oslo by increasing the share of large apartments. Furthermore, according to the norm, maximum 35 % of the apartments in a new project can be between 35 and 50 $m^2$ and at least 40 % needs to be apartments of at least 80 $m^2$. The Planning and Building Authority has concluded that the apartment norm has influenced the demographic development in Oslo by facilitating a diversification of the housing stock in the inner city, based on the increase in families with children in the inner city (Plan- og bygningsetaten, 2016). Attracting families has therefore become an important goal for the city in the last two decades. Other factors than apartment size will also of course affect the stability in the inner city, like access to green spaces, safe play areas for children, and a sense of community.

The apartment norm is essential in understanding how housing is being built in the inner city. It is mainly focused on the inner East and is therefore one concrete tool the municipality has to influence the population structure in this area. However, there has been a reduction in the

production of dwellings less than 35 m$^2$ in both in Frogner, and the outer city, in addition to the norm area. The norm might therefore have had an effect in the city as a whole, by providing some guidance to the minimum acceptable size for a new dwelling (Plan- og bygningsetaten, 2016). The Planning and Building Authorities (2016) states that between 2004 and 2016, 40 000 dwellings were built and 60 % of these were in the inner city, mainly in the area of the apartment distribution norm. They also find that the average size of newbuilt housing in the norm area has increased from 60 m$^2$ to just under 70 m$^2$ since 2004. This means that the housing in the inner city has increased in both average size and in total number. Research shows that there are currently more families and children in the inner city than it used to be, but they still tend to move out to the outer areas and suburbs. This means that local governments have not been able to create stability among families in the inner city just yet (Wessel and Lunke, 2019). The inner city is a place of large contrasts and it is difficult to say how the developments over the last decades has affected the overall population diversity, as there is not much research done on this subject. One thing remains clear, the inner city has seen a major change in its population structure. Whether this means that it has become more or less diverse remain to be seen.

## 3.2 The planning of Oslo

The urban development in Oslo after 1945 was heavily affected by the ideas of modernisation both in society in general and in architecture and urban planning. The urban development in Oslo in the last century has to a large extent been determined by the pressing need for housing. After Aker was incorporated into Oslo municipality in 1948, Oslo had the option of expanding the city into the unbuilt areas surrounding the city core (Kolstø and Kronborg, 2017). As the city grew, this strategy became less used, both because there was less space to build on and because it became expensive to provide social services and transport over such a large area. This subchapter will briefly explain some important historical considerations to be aware of when discussing the relationship between density and diversity in inner Oslo.

The new general plan for Oslo from 1950 had a fairly anti-urban perspective, reflected in the ideas of decentralisation, with little attention given to the inner city. The land-use plan was divided into four main zones, housing, industrial areas, parks and green areas and last, the surrounding forest. In addition to this, more detailed plans were developed for the new suburb development (Grønvold, 2011). This zoning and the current law gave Oslo municipality the

right to acquire or expropriate private properties located in areas with great interest for planning authorities and developers, usually farmland in former Aker municipality, as this was seen as the most efficient ways to construct new housing on a large scale (Grønvold, 2011). Two actors became important in this process, and by that also important in the overall planning of the city, namely Oslo Bolig- og Sparelag (OBOS) and The Norwegian State Housing Bank (Lund, 2000). The municipality cooperated with both actors to speed up the building and allocation of housing to keep up the building speed, while also keeping the ideal of high-quality housing. Other private firms later developed and together with the housing cooperatives they formed a productive relationship with the municipality (Lund, 2000). By organising the housing construction in this way, the municipality could leave parts of the responsibility to other actors, at the same time as they could be able to influence the process. Oslo has a long tradition of planning, or at least controlling the urban development in some way, but from the 1950's and onwards planning became more and more incorporated into laws. One of the milestones in Norwegian urban planning was the introduction of the first National Building Act in 1965. From now on, all municipalities had to develop land-use plans. This change reflected the optimism regarding modernist planning methods (Kolstø and Kronborg, 2017). During this time, the power structures slowly began to change, which in time led to less power to the professionals and more to the politicians.

A new zoning plan for the inner city was beginning to develop in 1953. The plan was never officially finished but continued to influence planners as it functioned as a starting point for more detailed planning (Jensen, 2016). A revised version of the zoning plan was presented in 1973, which still suggested separating functions into different zones, despite the fact that single-use zoning had become increasingly outdated. Both the zoning plan and the transport analysis of 1965 was considered to be two important tools to bring Oslo into the age of modernity. The idea of zoning generally stood strong in Oslo into the 1980's and 1990's, because of a lack of updated plans (Wessel and Lunke, 2019).

By the 1970's, the consequences of increasing car use were apparent with increased noise, pollution and accidents. In addition to this, parking and traffic jams became pressing issues (Jensen, 2016). As mentioned, redevelopment was the preferred strategy to deal with the deteriorating housing stock in the inner city. The market forces were the main driver for this change in the West, and the municipality pushed for the redevelopment in the inner East. Together, this exacerbated the population decline in the inner city (Benum, 1994). The latter

part of the 1970's established renewal as the main strategy to improve both the physical and social conditions in the inner city. In 1976, the law of urban renewal was established, which officially marked the shift from redevelopment to renewal. Following this, Oslo city council in 1977 and 1978 adopted urban renewal programs that largely defined the planning of the 1980's (Bergkvist, 2011; Lund, 2000). At the head of the development was Oslo Byfornyelse AS which was a company with Oslo municipality as the largest shareholder, making them the main organizer behind the renewal. The main goal was to update the existing housing stock to improve the standard of living in the inner city. Shortly after this municipal plan was approved, the planning paradigm shifted. Now, the market was the main actor and the strong principles of public planning by the municipality was set aside for a more efficient and flexible planning process, strongly influenced by politicians and the new role of private developers (Jensen, 2016).

As already mentioned, the 1980's became a difficult time for both the national and municipal economy. The decentralisation and building of the suburbs had greatly expanded Oslo's urban area. One pressing consequence of this was that the distances made it very expensive for the municipality to keep up with the maintenance of the new housing and infrastructure. Additionally, the increase in welfare spending and the general tasks of the city, made the situation very demanding both economically and socially. This situation, both locally and nationally, in addition to the current trend in other Western-European countries and the US to turn towards a market-based approach, laid the foundation for organizational changes within the public sector of Oslo. One of the main changes that affected the city was the deregulation of the Norwegian housing market. The municipality who up until now had strongly controlled and influenced the local housing market together with The Norwegian State Housing Bank. The Housing Bank's role, and the municipality in general, changed from actively funding housing construction to a more welfare-oriented role in allocating housing for the disadvantaged (Kolstø and Kronborg, 2017). From this point on, the Norwegian housing policy shifted from having many social democratic traits to largely liberal traits. Private companies became the main drivers for housing production and allocation of housing is now only directed towards specific groups eligible for municipal housing (Stamsø, 2008). This further enhanced the Norwegian tradition of homeownership, with a current percentage of 77 % (SSB, 2020a).

The introduction of the Planning and Building Act in 1986 further altered the municipality's role in the general planning process of the city. Two major changes happened. The first was that the state was more actively involved in the planning, for example with the inclusion of national policy guidelines (Kolstø and Kronborg, 2017). The second change was that the new Act ended the municipal planning monopoly, and now allowed private actors to submit development plans for political approval. This was originally meant to be a way to provide more democratic and civil involvement but has now turned into a planning instrument for market actors (Falleth and Saglie, 2011). Together, this changed the municipality's role from an active developer to a facilitator of development (Kolstø and Kronborg, 2017). Now, politicians were supposed to initiate goals and ideas, and the planners would not be involved before city hall ordered a plan from them. This meant that the planners' role was to transform the political goals into feasible plans, focusing on the overall objectives and ideas and the compliance to the land-use plan, while the private developers created the plans on a lower scale and with more specific details of how a project should be executed (Kolstø and Kronborg, 2017). The Norwegian planning system now changed to become more bottom-up and project based, which poses the risk of a fragmented urban development. One of the new tasks of the municipality is therefore to ensure that all the project-based planning also contributes to the overall goals of a cohesive urban area (Kolstø and Kronborg, 2017). Since 2004, 80% of all development plans in Norway came from the private sector (Falleth and Saglie, 2011). This poses a problem: "As higher-level plans, that is municipal plans, are not binding on development plans, approved development plans can easily go against municipal plans." (Falleth and Saglie, 2011, p.58). The problematic aspect here is that since the private plans are project based, and not necessarily bounded by the higher goals of municipal plans, aspects like population diversity might get lost between the levels of planning and the lack of legal demands for planners to facilitate for diversity. Private developers want an efficient and streamlined planning process and it is therefore a risk that population diversity, and other goals related to social sustainability are only involved in a superficial way with no legal demands or practical plans of how to actually work towards, let alone achieve them.

In 1992, The Agency for Planning and Building Services was established, consisting of the old City Planning Authority, the Buildings Inspectorate and the Land Surveying Agency. The responsibility for the general land use and transport planning in Oslo was now in their hands. The new agency illustrates the municipalities' new role in urban planning, as in between, and in cooperation with the politicians, private developers, professional stakeholders and local

inhabitants (Kolstø and Kronborg, 2017). The urban planning vision for Oslo in the 1990's was without doubt influenced by the global debates about cities' negative environmental impact, and the need for sustainable urban development. The key answer to these challenges has been to increase the land use within the city limits, with densification as the most important tool, according to Hanssen et al. (2015). Densification in Oslo is usually done either by transformation, intensification or expansion (Hanssen et al. 2015). The first method is expansion, meaning to build on undeveloped land or greenfields, which was the strategy in Oslo before the renewal period. The second method, transformation, involves turning industrial structures into new areas containing a mix of housing, services and small businesses. This has become a very important urban development strategy in Oslo, especially in the areas surrounding the Aker river and along the seaside. The third method is intensification. This can be done by infill, meaning to build between already existing dense structures, like for example between tenement buildings, or by utilizing already built structures by increasing the height or depth of a building. In addition to this, intensification can be done in areas with single-family housing by splitting up large plots into smaller ones and build more housing, often small apartment buildings, townhouses or additional single-family housing. Oslo has been able to break the long-lasting trend of urban expansion, and are now focusing on urban containment (Hanssen et al. 2015). All of the strategies above are used in Oslo, but transformation and infill are the most relevant developments when discussing the inner city, as these areas are already quite dense.

The last decades have drastically increased the standard of living in the inner city, but the contrasts between different areas can be enormous in many cases. The Municipal plan for Oslo from 2019 states that by 2040 Oslo will be a city with very small differences in living conditions, which is tolerant and open to a diverse set of people. The plan emphasizes that certain areas of the city experience an accumulation of social problems, and that issues relating to housing affordability plays a major part in why this is happening (Oslo kommune, 2019). An important goal is therefore that all new developments in the inner city should not contribute further to segregation, but help to create a more varied population composition, in addition to contributing to making the city more sustainable. Oslo's main focus forward regarding urban development is heavily influenced by visions of sustainability and to make the city "a capital of culture" (Andersen and Skrede, 2017, p.585). This resonates with Florida's writings (2003), meaning that competitiveness and attracting the creative class has become an important aspect of the city's urban strategy. Despite Oslo being located in one of

the world's most equal countries, which ideally should be the perfect place to achieve social sustainability, the goals of creating a socially just and sustainable city has still not been achieved (Andersen and Skrede, 2017).

Efforts are being made to try and improve the inner city trough different strategies. The current development of the Fjord City is a long-lasting project means to increase the share of housing and open up the waterfront to the public. The method has to a large degree been to build new structures, but also to transform some of the former industrial areas to new uses. The Fjord City project started with the transformation of Aker Mekaniske Verksted in the 1990's and now includes a goal of a continuous promenade from Frognerstranda and past Sørenga. The main goals of the project are to open up the seafront and make it available to the public by turning the old structures of the harbour into public space, housing, recreational areas, offices and places of entertainment and culture. The goal is that both the housing, activities and services should be available and accessible to the entire population and create socially mixed spaces. Areas in the Fjord City have achieved a good variety in the new housing stock, with around 40 % of the apartments being over 80m2, in line with the apartment distribution norm (Plan og Bygningsetaten, 2018). Some are sceptical to the accessibility and affordability of the new Fjord City. As Andersen and Røe (2017, p.305) writes: "there are reasons for claiming that the Fjord City is becoming an area designed for well-off inhabitants, tourists, visitors and investors, and to a lesser degree the lower classes of the city and socially marginalized groups." Although the housing stock in the Fjord City is varied in size, with a high share of large apartments, the housing prices are in general very high. This is reflected in the population where the average resident in the area is overall considered as wealthy, more so in Tjuvholmen and Aker Brygge, than in Sørenga and Barcode (Plan- og Bygningsetaten, 2018).

The other project, centred in the Tøyen/Grønland area, takes on a different approach, more similar to the classic area-based development project meant to both upgrade the physical area, in addition to improving the social problems in the inner East. Both are only a short walk from the Barcode area of the Fjord City, but the contrast is quite dramatic. Grønland and Tøyen are described as "Oslo's most diverse areas" and both face challenges like high crime rates, poverty and overcrowding (Oslo kommune, 2020, p.7). The area plan also points to both Grønland and Tøyen as transit areas where 1/3 of the inhabitants are moving each year (Oslo kommune, 2020). A goal is therefore to make the areas more stable, which will likely

have a positive influence on the overall living environment over time, in addition to providing a physical upgrade of the infrastructures in the area. As mentioned earlier, areas in the inner East has already experienced gentrification and several more areas are at risk. Both the Fjord City development and the plan for Grønland and Tøyen will likely influence the population composition in the inner city, but exactly how it will change is harder to say.

These two examples illustrate the different ways Oslo is being developed currently. Both projects have some element of social sustainability present, although in different ways. The area plan for Grønland and Tøyen mentions the current population diversity as a resource, and one should aim to "activate the inhabitants' resources, knowledge, experiences and talent" (Oslo kommune, 2020, p.6. My translation). Social sustainability should be improved by creating safe local communities with a high focus on marginalised groups. Important elements are higher standard of living, reducing crime, and creating a safer local environment stands out as some of the main goals. The key challenge in this area is therefore to improve social sustainability by *reducing* the current social problems and the high turnover rate. The Fjord City area, has fewer social problems to deal with and the approach to social sustainability is therefore quite different. One of the main factors is that large parts of these areas are used as recreational areas for people who do not necessarily live in there (or in Oslo at all). The challenge for many of these areas, especially Sørenga and Barcode is that they are newbuilt areas which means that people have less associations with them as neighbourhoods. Key challenges in regards to social sustainability is therefore to make the areas good and safe local environments for those who live there, in addition to keeping them open to the public as recreational areas. Both of these aspects are dependent on the area being able to *attract* people. This has to be done both by attracting a varied population structure who will live there permanently, but also other people who will contribute to creating life on the streets. Population diversity is central in both locations to increase the social sustainability, although in different ways. By using these two examples, I have tried to show how the urban development in Oslo has a certain duality to it. The housing in the Fjord City development are expensive and constitutes a good amount of luxury housing. The Grønland/Tøyen development are more focused on improving the current problems. Both are focused on sustaining and improving diversity but the challenge is that facilitating for one diversity category can make it more difficult for another category.

## 3.3 Summary

The inner Oslo needs to be understood in the light of its history as a transit area. The historical neglect of the inner city and particularly the inner East caused a population decline, which again contributed to the accumulation of social problems for those who chose to stay, or simply could not afford to leave. After the goal of improving the living conditions and the population composition in the inner city was established, large changes happened. The redevelopment strategies improved much of the physical standards, but it also caused a change in population structure. The inner-city population increased and so did the education levels. In addition to this, younger people now wanted to live in the inner city and these developments were part of the overall trend of gentrification.

Much of the urban development in Oslo in the last decades has been fuelled by the need for housing. Although the preferences might have changed from the suburban ideal to the cosmopolitan inner city, many parts of the inner city still lack stability. Measures such as the apartment distribution norm have tried to counteract the instability, but especially the inner East, still has ha high turnover rate. The reasons for this are a combination of physical aspect with the housing stock, such as small apartments and high prices. Additionally, many of the social problems in the inner city has not been dealt with in a sufficient way. The municipality of Oslo has ambitions plans for both the physical development of the inner city, in addition to a vision of sustaining and promoting the diversity that the inner East is known for. The challenge is to promote a diverse population composition, without promoting gentrification and displacement in the inner city. While the urban envelopment in Oslo has traditionally been fuelled by more local needs, the city's current plans and visions are also affected by the global competition for both people and capital. The examples of the Fjord City development and the area plan for Tøyen/Grønland shows how these developments focus on diversity and social sustainability in different ways. Facilitating both high status areas and for families with children, in addition to improving the social problems might be contrary to each other even though they are all somewhat based on increasing social sustainability.

# Chapter 4 Research design and data

Oslo has a goal of becoming a more socially sustainable city, with population diversity being a central component. While diversity previously has often been investigated in terms of specific aspects of the concept, it is now often understood as a multidimensional phenomenon. This creates several types of challenges, in relation to measurement and estimation as well as interpretation of differences and changes. As mentioned earlier, the city has had long term goals of increasing the population diversity, but little research has been done to see how the levels of diversity has developed. By choosing a quantitative approach to look at this development over time, I can hopefully establish a general trend or pattern between density and diversity in inner Oslo.

To answer my research questions, I first have to make the concept concrete and applicable for my thesis. It can be defined and used in many different ways, and the chosen definition is closely linked to the methodological approach. By understanding diversity as variety, I have chosen a definition that works well when looking at this from a quantitative perspective. By this definition, diversity can be measured by determining the degree of variety between different groups in an area. The goal is to establish a trend, relationship or pattern. Once a trend or pattern is established; qualitative methods could later be used to illuminate some of the more subjective aspects of this theme. However, this is out of the scope of my thesis as my focus will mainly be to try and establish if there is a relationship between increased density and increased population diversity.

I will start by presenting my study area and discuss the scale I will be working on in my analysis. I will continue by presenting my data and variables that will constitute the diversity measures, which are collected from registrations in 2000, 2011 and 2015. In addition to this, I will discuss some of the challenges of quantifying diversity, with a particular focus on the entropy-based diversity index. I will then continue with explaining the density variables and the additional control variables measuring different housing features. The next subsections will give an overview of the methodology, focusing on Ordinary Least Squares and the linear regression model. Lastly, I will discuss some ethical challenges with my data and method.

## 4.1 Study area and scale

The study area in this thesis is the inner city of Oslo, following the municipal limits lasting up until 1948. The definition of the inner-city is divided between the inner East and the inner West. The inner East consists of the districts Gamle Oslo, Grünerløkka and Sagene. The inner West include St. Hanshaugen and Frogner. I have excluded Kvernerbyen, Ensjø, Etterstad, Helsfyr, Hasle, Løren, as densification in these areas are largely done by other means than what I am focusing on. In addition to this, Bygdøy is also excluded, since it represents a more suburban type of landscape. The reason for using this definition is that some of the areas included in the current definition are not functionally a part of the inner city, and have traditionally been a part of the outer city. My definition is the same as the Planning and Building Authorities (2005) used in their development plan of the inner city from 2005-2020, where "sociocultural diversity" is explicitly mentioned as a goal to secure the urbanity of the inner city. Furthermore, the inner city has a characteristic structure of streets and urban spaces that makes it structurally distinct from the outer city.

The indexes I will use will be constructed on a low scale, meaning that I have used the level "basic statistical unit" (census tracts) as the chosen level of analysis. Oslo is currently divided into 589 such units (Oslo kommune, 2017). About 209-214 of these are included in my definition of the inner city. According to Statistics Norway the goal of the division is to create a stable and flexible foundation for statistical analysis. Furthermore, the units should also be geographically coherent, in addition to fairly homogenous in terms of the basis for economic activities, building structure and communication conditions (SSB, 2020b). They therefore roughly correspond to what is considered neighbourhoods. Performing the analysis on this detailed scale is an advantage, since cruder scales might conceal important distinctions. The number of statistical units used in the analyses varies as bit as these tend to change quite often, for example if a large amount of housing gets built in an area. The units are then often changed to better reflect the neighbourhood structure.

Figure 1: Study area, Inner Oslo. Source: Kartverket

## 4.2 Data

All the data used in this thesis are collected from national registries, either downloaded through Statistics Norway by me, or by my advisor's database. The data I am using for my diversity variables are extracted from a larger database that my advisor has access to in relation to his participation in the research project "Social inequality and housing over the life course: good choices or lucky outcomes?", which was financed by the Research Council of Norway. The data itself are owned by several public institutions (e.g. the Norwegian Tax Administration), and are produced and managed at Statistics Norway. The data have been aggregated from individual level to the basic unit level, which means that I only have data on a collection on individuals in the basic unit levels. The density variables are downloaded from Oslo Municipality's Statistics database, which is based on Statistics Norway's data, or directly through Statistics Norway. The reason I have used both is that certain data was only available in the basic unit level through Oslo municipality's database.

Having this kind of data has both positive and negative sides to it. The data are drawn from reliable sources, which will generate data with a higher quality than what an investigation conducted by myself would have. Collecting quantitative data often takes a lot of time so for a thesis with limited time such as this, using data already collected will often be a better choice. At the same time, this means that I do not have control of the specific details of how the data has been organized. Data from Statistics Norway is used by government departments like for example the Norwegian Tax Administration, and I am therefore confident that the data I use have been collected and organised in a precise and professional way. Since the purpose of the study my advisor was involved with was social inequality, I believe this type of data is appropriate for investigating population diversity, as these two concepts are related in that they focus on the distribution of different social features.

### 4.2.1 Representativeness

One of the main strategies in quantitative methods is to generalize by using a large number of cases or observations (Ragin and Amoroso, 2011).  While quantitative research is usually dependent on investigating a sample, I have data for the whole population in the chosen basic statistical units. This means that everyone is included, as long as they are registered in the official statistical registries that the data is collected from.

In terms of representativeness, the registries are very reliable and it is safe to assume that very few people are missing from these. However, those without a formal address in the study area are not included. This could for example be students who live in Oslo, but have not reported a change of address to the city, illegal immigrants or homeless people. Statistics Norway states that asylum seekers are not included in any of their statistics, which means people who have applied for asylum in Norway but are waiting for their application to be processed are not included, although they technically might live in Oslo (SSB, 2019). Although I have mentioned several groups that are not included in the data, these groups no not consist of a large amount of people and the lack of inclusion would likely not make much different in the overall picture and results. Some missing values or errors will always occur when working with data, but if so it is reasonable to assume that it will, in this case, likely not make any difference on the results.

## 4.3 Diversity variables

To measure diversity, I have used variables describing age, education level, income quartile and ethnicity. These are fairly broad categories and can be seen in full in table 4.1. All are measured in the years 2000, 2011 and 2015. When choosing variables in a quantitative analysis, it is important to be aware of the term parsimony, which means to use "as few variables as possible to explain as much as possible" (Ragin and Amoroso, 2011, p.170). This means that we only want to include variables that influence the patterns we want to investigate. I am using broad categories to measure population diversity, but I think that this will give me a good and overarching view of the levels of diversity in the inner city.

The first variable, *age* is measured on an ordinal and categorical level, meaning that we have mutually exclusive categories that can be meaningfully ranked from low to high age (Ringdal, 2013). The first three categories reflect natural life stages of children and teenagers, and roughly corresponds to the educational stages of preschool, primary school and secondary school, and upper secondary school.

The second variable, *ethnicity,* is measured on a categorical and nominal level. This means that all categories are mutually exclusive and cannot be ranked. This categorisation of ethnicity is obviously very general and is roughly continent-based. As Statistics Norway (2019) states, there are certain countries in a region or continent that have a large share of the immigration to Norway. For example, immigrants from Pakistan are a large and well-known group in Oslo, but will fall under the "Asia" category together with for example, people from Vietnam. This means that in terms of people's exact area of origin, I will not know the nuances in the data, for example if some regions or countries are overrepresented in a category. One other aspect of this variable is the categorisation of people with a very mixed or multicultural background. The categorisation is made by Statistics Norway and in this case, people can only be in one category, meaning that they can only be from one area/continent. I am aware that this categorisation might not be fully consistent to a person's own interpretation of their ethnic background and identity. In the further analysis and discussion, I will refer to this as "ethnic diversity", while keeping the problematic aspects of this definition in mind. This choice is based on practical reasons, mainly so that the understanding of the analysis and results will be intuitive for the reader.

Table 4.1 Diversity variables

| Diversity variables | Categories |
|---|---|
| Age | Age group 0-5 years |
| | Age group 6-14 years |
| | Age group 15-19 years |
| | Age group 20-29 years |
| | Age group 30-39 years |
| | Age group 40-49 years |
| | Age group 50-59 years |
| | Age group 60 + years |
| | |
| Ethnicity | Norway |
| | Western Europe (except Norway) |
| | Eastern Europe |
| | Africa |
| | Asia |
| | Latin-America |
| | North America and Oceania |
| | |
| Education | Secondary school or lower |
| | Upper secondary school |
| | University, lower level (bachelor) |
| | University higher level (master, PhD) |
| | Unknown education |
| | |
| Income quartile | Income level: quartile 1 |
| | Income level: quartile 2 |
| | Income level: quartile 3 |
| | Income level: quartile 4 |

Similarly, to the previous variable, *education* is measured on an ordinal and categorical level, relating to the highest level of education achieved. With this variable, it is worth noticing that *unknown education* is not included in the data from 2015. One reason for this could be that the registry usually has a complete overview of education levels, and most people have completed some education. However, it is possible that a few people have not attended any school at all. If so, this will likely be a very low number. The last variable is *income quartile.* This is measured as a categorical variable on an interval scale. This means that the population is divided into four subgroups, where the first group/quartile is the 25 % of the population with the lowest income, and the fourth is the 25 % with the highest income.

## 4.4 Quantifying diversity

The choice of a quantitative research strategy brings along certain perspectives and assumptions it is important to be aware of. Traditionally, a quantitative approach is to look at the social world in an objective way, where the researcher puts themselves in a neutral role (Ringdal, 2013). This view has been challenged both within and outside the social sciences, and it is now common to have a more pragmatic understanding of both the choice of method and the researcher's role. Quantitative and qualitative methods are today seen as complimentary to each other, rather than opposites (Ringdal, 2013).

Quantifying the variety of social factors in a population can be done in many different ways, depending on what aspect we are interested to look at. As the diversity concept has grown in importance, an increased interest has followed on how to quantify population diversity in a way that provides a useful representation of a real community. By looking at diversity as variety in a multidimensional perspective which assumes that categories overlap, it can be fruitful to use quantitative measures to try and find the general trends of how diversity has developed over time.

To quantify something means that we are looking to understand patterns, trends and relationships between social phenomena. The three main goals of quantitative research are (1) to identify general patterns and relationships, (2) to test theories and (3) to make predictions (Ragin and Amoroso, 2011). To identify general patterns and relationships means that we are looking for associations between different phenomena. Once a relationship is established, research looking at the many nuances can be conducted with both quantitative and qualitative methods, to understand how or why something happens. The second goal of testing theories means that a researcher uses theories or theoretically based images to create hypotheses to test whether the evidence supports the theory or not. The third goal is to make predictions, as knowledge of patterns and relationships helps us potentially forecast future behaviour. (Ragin and Amoroso, 2011). However, prediction is generally not the most common goal in the social sciences today.

When quantifying complex social phenomena, it is always sacrifices to make in terms of nuances. This provides a few points of discussion on what we gain and lose when using statistical analysis to investigate population diversity and when choosing the research method. First, I do not weigh one or another aspect of diversity as more important than others. Since my understanding of diversity is more related to the total variety, I do not consider diversity

in ethnicity to be more or less important than for example diversity in income. This mean that some of the details in the diversity within the four categories I am using will not be visible in this analysis. Secondly, concepts and aspects related to population diversity, like social contact, will not be directly investigated here, although the empirical outcomes (entropy scores and index values) give a weak indication of *potential* for contact. In addition to this, the concept of tolerance will not be investigated here, as this is even more complex and would require a completely different approach and theoretical background. I hope that my results can provide a starting point for more detailed studies of the relationship between population diversity and density in Oslo, as there are many interesting issues to investigate in this field of study.

## 4.4 Diversity indexes

Different elements must be considered when choosing which index is the best fit for this particular use. Many different measurements and indexes have been developed to capture the variety of features in a population. Three common categories to measure are segregation, inequality and diversity (Roberto, 2016). The measurements of these phenomena are often conceptually quite similar. Diversity measures are different from the two other categories in that they are only concerned with the relative quantity or variety of groups. The two other ones focus on which groups are under- and over-represented in the distribution, e.g. in specific areas (Roberto, 2016).

Many diversity indexes derive from biology and ecology, and were originally developed to measure the diversity of species in a particular area. One common feature is that they mainly measure either richness or evenness, or both at the same time. Well-known examples from ecology is the Simpson's Index and the Shannon Index (White, 1986; Somerfield et al. 2008).

Diversity indexes are often quite similar mathematically, and usually measure the relative heterogeneity of the population (White, 1986). Many desirable traits of diversity measures have been developed to assure beneficious properties. The first is that "diversity should be maximised when all groups are present in equal proportions" (White, 1986, p.200). The second trait is that in two populations with equal representation of all groups, the one with the largest number of groups will be more diverse. The third is that when we have three or more independent classifications, the total diversity should equal the sum of the respective individual diversities (White, 1986). With so many choices of diversity measurements, we have to consider the benefits and limitations carefully before choosing which tool to use. The

choice of index will determine how we interpret the results and it will also matter for comparability to other research, as many of the indexes cannot be directly compared to each other.

The entropy index complies with all three criteria and can therefore be said to be a prominent measure of diversity (White, 1986). This will be the index I am going to use in this thesis to express the degree of diversity in the inner city of Oslo. One important aspect of diversity measurements concerns the number of categories, as some measures can be sensitive to this. Entropy-based measures have an advantage, according to White (1986), in that they can better handle polytomies, meaning more than three groups or categories, in addition to treating the groups symmetrically. Furthermore, the entropy index is decomposable which can be very useful.

## 4.5 Entropy

Entropy has long been used in physics and information theory to measure disorder or randomness in a system. Henri Theil used this concept to establish a number of related statistical tools, among them the Information Theory Index (Roberto, 2016). Theil described this index as "a measure of the average difference between a unit's group proportions and that of the system as a whole" (Iceland, 2004). We can by this understand entropy as a measure of multigroup diversity in a chosen area (White, 1986). The exact number of the entropy index can be calculated in several different ways. I have chosen a step-by-step approach where I first calculate the *entropy score* and then calculate the *entropy index* by using the results from the first calculation. This is to make sure that I better understand the process. Statistical packages, like Stata can do this calculation easily and I did it both ways to double check my results. My calculation corresponds to Stata's calculation, so I am confident that the entropy score is done correctly.

Entropy score measures diversity in each unit, while the entropy index is a measure of the distribution of groups across several areas or neighbourhoods (Iceland, 2004). The entropy score for one unit within a metropolitan area can be expressed as:

$$Ei = \sum_{r=1}^{r} (\Pi_{ri}) ln[1/\Pi_{ri}]$$

where *IIri* refers to a specific group's proportion of the population in area *i*. I then have to find the natural logarithm (ln) of 1 divided by the group proportion, before multiplying the group proportion with the natural logarithm. By doing this I will find the entropy score for each unit, which can then be sum to find the score of the whole area. The latter value will result in a number between 0 and the maximum number of groups (Iceland, 2004). This means that if I for example have four groups, the maximum value will be the natural logarithm of four, which is 1,39. The score will then vary between 0 and 1,39. Since this makes interpretation and comparison difficult, we will use this to calculate the entropy index, which is easier to interpret. The entropy index is:

$$H = \sum_{i=1}^{n} \left[ \frac{t_i \, (E - E_i)}{ET} \right]$$

where *T* is the population in the whole metropolitan area, *ti* refers to the population in tract *i*, *n* refers to the number of tracts. *E* represent the diversity (entropy) in the metropolitan area and *Ei* represents area *i*'s diversity (entropy). The entropy index will vary between 0, where all areas have an identical composition, and 1, when all areas consist of *one* group, which in reality implies no diversity (Iceland, 2004; Roberto, 2016).

## 4.6 Defining density

Densification has become a common term to describe the process of building taller and more compact, with a goal of increasing the population density. One of the main reasons for this strategy is the perceived environmental benefits that a dense city will have, such as less car dependency, lower climate change emissions, urban containment, and a better foundation for efficient and cheaper public transport (Westerink et al. 2013). Density can be divided into two subconcepts, the first being "measured density" meaning: "a ration of the number of people per unit area or the number of dwellings per hectare of acre" (Nematollahi, et al. 2016). The second concept is "perceived density" meaning "an individual's estimate of the number of people present in a given area" (Nematollahi, et al. 2016). It is important to remember that density is also a socio-cultural concept, which also involves people's subjective thoughts and feelings around the experience of density. This means that how people perceive density will vary based on a range of cultural and social characteristics of a society. In this thesis, I will focus on density as a quantitative and measurable concept. To do this, I have a number of

different variables that together will illustrate the densification process in Oslo measured in the years 2000, 2011 and 2015.

## 4.7 Density variables

The variables presented in the following section will together constitute the density concept. A more detailed overview will be presented in chapter 5. The first variables I will focus on are the independent variables. First, I have some measuring the number of newbuilt housing between 1990-1999. They are called: *newbuilt housing 1990-1999 (1 room)*, *newbuilt housing 1990-1999 (2-3 rooms)*, and *newbuilt housing 1990-1999 (4 or more rooms)*. By categorizing the housing variables like this, I will have three categories of small, medium and large housing. The main assumption is that as the number of rooms increases, the size of the dwelling also increases. This is of course very generalising, but I think it is safe to assume that number of rooms and apartment size in newbuilt housing are closely connected. The later period, 2000-2011 has the same categorization with variables named, *newbuilt housing 1990-2011 (1 room)*, *newbuilt housing 1990-2011 (2-3 rooms)*, and *newbuilt housing 1999-2011 (4 or more rooms)*. The period from 2011 to 2015 is not included as the numbers in The Norwegian Mapping Authority's Cadastre and Land Registry are insufficient with a defection rate of up to 40%, and I therefore chose to omit newbuilt dwellings from that period.

Since location is such a large part of this analysis I have *East* as the key independent variable. I use the variable *West* as the reference category. Location will be included both as a variable on its own, and in addition to this, I will create an interaction term between location and newbuilt large housing. Considering Oslo's history of being a divided city, location is an interesting perspective to include. The apartment distribution norm is largely focused on the inner East and by using an interaction term, I will be able to investigate if the newbuilt housing has had an increased effect on the diversity in this area.

Next, I will present the control variables. I include control variables because of the possibility that something might disturb the measuring of the relationship between newbuilt housing and the diversity categories. I chose to include a variable for housing type, called *apartment block/tenement building*. Originally, I planned to include other housing types as well but since my focus is on newbuilt housing, I decided to include only one variable for housing type as apartment blocks/tenement building is by far the most common housing type in the inner city,

both in the existing housing stock and the newbuilt housing. The total number of single family housing in the inner city has not changed much over the period I am looking at, as this type of housing rarely gets built here. Having a very detailed categorisation of housing types could possibly disturb the analysis. For example, if the newbuilt large apartments are located in a unit with a high number of single family dwellings this area also likely a high income/high education area, which could hide some of the effect. In addition to this, I have a variable called *population density per acre*, which I assume can affect my results. For example, high density can hide the effect of newbuilt housing on ethnic diversity if immigrants are attracted to typical urban areas. Including these control variables will help me to be more certain of my results.

## 4.8 Validity and reliability

Validity and reliability are two important methodological concepts. Validity is a quite general term that that looks to see if we are measuring what we actually set out to measure (Ringdal, 2013). Questions to ask ourselves in relation to validity are if the data and methods we are using are appropriate for our specific research questions. Validity can be divided into many subcategories, depending on what aspect we are interested to look at. Content validity will be most relevant for this thesis, meaning to consider if the chosen variables capture the intended content of the term investigated (Ringdal, 2013).

Reliability asks if consistent and repeating measuring with the same instrument or tool will provide the same results, and high reliability is a prerequisite for high validity (Ringdal, 2013). A general way to get an indication of the reliability of one's research could therefore be to compare it to previous research to see if the results indicates a similar conclusion.
At the time of writing, there is no studies on the relationship between density and diversity in Oslo, but research on inequality and segregation can be helpful since the concepts are related both in theory and methodology. In terms of the validity and reliability of the data, this will likely be a marginal problem, as they are very accurate and contains few missing values. Some of the variables related to newbuilt housing had, as I mentioned, many missing values and a low coverage. Using these would have affected the reliability, so I chose to exclude them.

## 4.9 Methodology

As mentioned, I will use the entropy scores and the density variables to establish whether densification influences population diversity. To do this, I will have to use a statistical method that allows me to analyse the relationship between diversity and density. I will use regression analysis, which is one of the most commonly used statistical methods in social science, which is linked to the application of hypotheses. Testing hypotheses is a process used to find quantitative evidence to support the suspected relationship between two or multiple phenomena. This is based on the strength of the relationship and if the relationship is statistically significant or not. A regression analysis will, strictly speaking, not establish causality, but we can find correlations (Mehmetoglu and Jakobsen, 2017).

### 4.9.1 Multiple Linear Regression

Several different versions of regression analyses exist, but in this thesis, I will focus on the multiple linear regression. The prefix "multiple" refers to the inclusion of two or more independent and dependent variables. Social phenomena often require complex explanations that take many aspects into account. The simple reason for using a multiple instead of a bivariate regression is to get a more complete understanding of what we are investigating, by controlling for aspects we think might influence our phenomena (Mehmetoglu and Jakobsen, 2017). We can express the multiple linear regression as such:

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \beta_4 X_{4i} + \beta_5 X_{5i} + \beta_6 X_{6i} + \varepsilon_i$$

where $\beta_0$, called the constant or intercept, represent the mean $Y$ value when all independent variables are equal to zero. This is also the regression lines' point of crossing on the Y-axis. The next, $\beta_1$ is called the regression coefficient. This shows the amount of change in the mean $Y$ for each unit change in $X_1$, while the value of the other independent variables stays constant. It also decides the slope of the regression line. $\varepsilon_i$ is an error term, which represents other variables that might influence $Y$ but that are not included in our estimates (Mehmetoglu and Jakobsen, 2017; Midtbø, 2013). This means that we can look at the effects one variable have on $Y$ independent from the other effects and thereby get a more nuanced picture of what is being investigated.

Mehmetoglu and Jakobsen (2017) point to several reasons for the common use of linear regression. First, many relationships investigated in social sciences can be expressed in a linear fashion. Second, if there is no strong theoretical suggestion to use a different functional form, the linear form is usually used as default. Third, some nonlinear relationships can be examined using a linear model since the results tend to be comprehensible and fairly reliable. For example, Hellevik (2009) has argued that using linear models for analysing a dichotomous dependent variable can be just as good as a logistic model, despite that this is considered to be against the arguments of linear regression. He believes that the choice of technique should be more guided by what is fitting to the research problem and that the foundational arguments for the choice of model is not always as decisive as often projected. Multiple linear regression is therefore often a good choice as it is fairly simple to understand both for the researcher and the reader.

### 4.9.2 Interpretation of a regression analysis

The data will be run by using a multiple linear regression and the output we get will provide us with much interesting information. The main focus of the output is the regression coefficient which will show us the exact change per unit, and whether this change is positive or negative. In addition to this, we want to look at the p-value(s) which will tell us if our results are significant or not. I will come back to this later when I discuss statistical significance. This is mainly what we use to answer our research question. Furthermore, the standard error will tell us something about the insecurity of the coefficient(s). If the variation around the coefficient is too large it can indicate uncertainty in the distribution pattern (Tjønndal, 2018).

### 4.9.3 Ordinary Least Squares

Ordinary Least Squares (OLS) is a very common approach used to calculate the value of the slope and intercept of the regression line. The method finds the values of the intercept and slope that provides us with the regression line that is closest to all *Y*-values on average. OLS calculates the distance between the observed value of the dependent variable and the estimated conditional means, while minimizing the sum of the squared errors. The sum of squared errors is the distance between the regression line and the observed values (Gordon, 2015; Mehmetoglu and Jakobsen, 2017).

OLS is based on three main assumptions (Mehmetoglu and Jakobsen, 2017). The first assumption is that it the model we use needs to be correctly specified. This means that we only include relevant variables that have a theoretical and logical reason to be included. Using a linear regression means that a one-unit change in $X$ equals a constant amount of change in mean-$Y$, keeping all other $X$-variables constant. We have to carefully consider if this model specification is the best fitting for us, or if we might have a curvilinear relationship. If so, a different model might be a better fit.

The second assumption is that we have an absence of multicollinearity. If we have multicollinearity, it means that some of our $X$-variables measure the exact same phenomenon. This can be a problem if the variables end up with stealing explanatory power from each other which makes it difficult for us to assess their importance accurately. However, sometimes the independent variables correlate without it being a problem for the analysis (Mehmetoglu and Jakobsen, 2017. This assumption circles back to the principle on parsimony in quantitative research, mentioned in the beginning of this chapter.

Third, some assumptions regarding the residuals. Firstly, it is assumed that the residuals are normally distributed, if not, it might lead to invalid $t$-statistics. In addition to this, the error term should have a conditional mean of zero. The second assumption is that homoscedasticity is present, meaning that the error terms have constant variance despite of the predicted values. If the variables are heteroscedastic, this will likely create a bias in the estimates of the standard errors. This can be tested for in Stata and if heteroscedasticity is present, robust standard errors can be used to solve this problem. Lastly, we assume that our errors are uncorrelated, meaning that they are not dependent on each other, for example by the data being nested. If the assumptions of OLS are met, I will likely get the best linear unbiased estimates, also known as BLUE (Mehmetoglu and Jakobsen, 2017. Considering that I have a fairly small number of observations, I decided to test for this in Stata to see if I needed to make some adjustments to the model. I used the Breusch-Pagan/Cook-Weisberg test on all models from 2000 and found heteroskedasticity in six of them. I therefore decided to use robust standard errors in all regressions for all years. Heteroskedasticity will not change the value of the coefficients but it could provide standard errors that are too low and t-values that are too high. The risk is that I could have interpreted results as significant when they in reality were not significant. The main reason for using robust standard errors is therefore that the models will be better overall (Gordon, 2015).

### 4.9.4 Interaction effects

Interaction effects occur when a third variable affects the relationship between a dependent variable and an independent variable (Mehmetoglu and Jakobsen, 2017). This means that the relationship we are investigating might for example be dependent on a third variable to reach a certain value. To look for these connections and interactions can help us provide more nuance to our research and help us find a more realistic picture of what we are investigating. For example, if I want to investigate if the effect of newbuilt housing/densification is the same in the inner East and West, since much of the focus and efforts have been in East. In addition to this, the historical divide of Oslo might also influence this relationship. Considering that the analysis in being done by using the basic statistical units, I have a limited number of observations and this might influence the use of an interaction term. I first wanted to include two interaction terms, one for medium sized housing and East and one for large housing and East. However, when I did this very few of the variables came out significant, likely due to the small number of units, causing the effects to be split up. I therefore chose to include only the interaction term between large housing and East. The regression results with both interaction terms can be seen in the appendix.

## 4.10 Statistical significance

A central theme in quantitative methods is the question of statistical significance. Shortly speaking, this means that we check if our correlations are real or if they could have resulted by chance. A common way to do this is to test a hypothesis. This means that a concrete hypothesis is formulated and will either be accepted or rejected based on the regression results. My hypothesis for the regression analysis will be:

*H1: Increasing population density increases the level of population diversity*

To find out if I keep or reject the hypothesis, I have to establish the significance level. The most common levels in social sciences are 1%, 5% and 10%. For example, a 5% significance level, this means that we accept a 5% chance of rejecting a true hypothesis. The p-value is used to determine this, and is presented automatically in the Stata output. If the p-value is lower than the chosen level of significance, the null hypothesis is rejected (Midtbø, 2013).

### 4.10.1 Goodness of fit and explanatory power

In addition to a good understanding of each coefficient, we also need to understand the overall explanatory power of our model. $R^2$ is based on Pearson's R, which is a standardized measure based on covariance and indicates the direction, but not the strength of the relationship. In a multiple regression, $R^2$ is commonly used to assess the goodness of fit of the model as a whole, and is simply Pearson's R squared. $R^2$ tells us something about explained variance, meaning how much of the variation in the dependent variable we can attribute to the explanatory variable(s) (Midtbø, 2013). $R^2$ is expressed by a number between 0 and 1, where results close to 0 imply that X explains very little, and results close to 1 imply that X explains all variation in Y. $R^2$ multiplied by 100 represents the percentage of the variation explained by the regression equation. For example, if we see in our regression output that we have a $R^2$ value of 0,35, it means that our explanatory variable explains 35% of the variation in Y.

While $R^2$ is fairly easy to interpret and use, it is also very easy to misuse. Midtbø (2013) points to a problematic aspect regarding $R^2$ and what data we use. For example, $R^2$ tends to be higher in aggregated data than in survey data. Our data may therefore influence $R^2$ which is important to be aware of. One other aspect of $R^2$ that can create problems for us, according to Mehmetoglu and Jakobsen (2017), is the evaluation of our $R^2$ value. How high does $R^2$ need to be for us to interpret it as a large effect? The answer is that there is really no agreement of what values are high or low based on pure statistical quantity. What constitutes a high or low $R^2$ will vary between different academic fields, and we should therefore look at our results in context to previous research to get an indication of how our research might coincide or differ. If we base our interpretation on previous research, in addition to a good dose of common sense, we are likely to not over- or undersell our results. Furthermore, Gordon (2015) points to a problem with $R^2$ and the number of variables used in the regression. She states: "$R^2$ is problematic in that it always increases as we add additional predictor variables to our model." This means that if we ignore our principle of parsimony and include many (irrelevant) variables, we might still get a very high $R^2$. Creating unnecessarily complicated models just for a high $R^2$ would decrease the validity of our research. If we construct a model with few predicting variables and get a high $R^2$, we can usually assume that it is a good model, overall (Mehmetoglu and Jakobsen, 2017). To avoid the problems of $R^2$, adjusted $R^2$ is often used. However, since I am using robust standard errors, I will just use $R^2$ since the adjusted version is not appropriate in this case.

The F-test can be used to supplement $R^2$. According to Mehmetoglu and Jakobsen (2017), this will test "whether the amount of explained variation ($R^2$) is statistically significantly different from zero." The F-test looks at explanatory power and significance together, with the underlying idea that new independent variables should only be included if they contribute to a distinct increase in the explained variance. Therefore, since $R^2$ increases when we add more variables, we can use the F-test to decide if the increase is significantly different from zero (Midtbø, 2013). An F-test in Stata, will provide an F-value in addition to a p-value. If the p-value, connected to the F-value is within our level of significance, we can assume that the regression model has a good overall explanatory power. If the p-value of the F-test is not significant it could be because many variables included in the model do not contribute to explaining our dependent variable (Tjønndal, 2018).

## 4.11 Ethical challenges

Every scholar will always face ethical challenges to some degree or another in the research process. Quantitative research has traditionally seen the researcher as objective and neutral. This is of course impossible to be in all respects, but it is important to interpret the data and construct the conclusion in regards to what the results says, and not from a wish to promote a certain perspective, political view or ideology.

One of the most important parts of ethics in social science is that individuals should have received information and voluntarily consented to participate in the study. This applies when dealing with personal information or data that can potentially identify individuals, directly or indirectly (Ringdal, 2014). This is most relevant when information has been collected by for example surveys or interviews. Since my data is organised by statistical units, the ethical challenges are much smaller than when dealing with individuals, and I do not need to apply for approval at the Norwegian Centre for Research Data. In terms of representativeness, I do not face the same challenges as if I had used a sample of the population. Using a sample always involve the question of transferring the results to the population in general. Since my data is collected from different public registries, the representativeness will likely be as good as it gets. Some measuring errors will always exist, but those types of registries tend to be quite complete. I would therefore argue that the ethical challenges in this thesis are minimal.

# Chapter 5 Descriptive results

Descriptive statistics are useful to get a full picture of our data, and can help us to identify missing or extreme values and to understand how our data is distributed. This information is essential to apprehend in order to have a solid starting point for the further regression analysis (Tjønndal, 2018). In this chapter, I will present an overview of my data focusing on the distribution and general trends of the variables. I will first present the dependent variables, and the development of these through time. As mentioned, I have constructed the entropy scores for each basic statistical unit in inner Oslo for three separate years, 2000, 2011, and 2015. These will constitute the dependent variables for each diversity category.

## 5.1 Ethnic diversity

In table 5.1 we can see the general information on the entropy score from the years 2000, 2011 and 2015 for the variable *ethnic diversity*. The entropy scores are calculated into one separate score for each of the statistical units and in this chapter, I will present an overview of the entropy scores for each of the diversity variables. Since the entropy score varies from zero and the natural logarithm of the number of groups, the scale is different for most of the variables. This makes comparison between the different variables a bit difficult, but we can still see the change in entropy in the three different years. The maximum score indicates equal representation for all groups in the geographic area, meaning the higher the score, the more diverse the area is (Iceland, 2004).

Table 5.1 Entropy scores summary for ethnic diversity

| Variable | Mean | SD | Min | Max | N |
|---|---|---|---|---|---|
| Entropyethnicity2000 | 0,164 | 0,080 | 0,000 | 0,433 | 214 |
| Entropyethnicity2011 | 0,142 | 0,073 | 0,000 | 0,498 | 213 |
| Entropyethnicity2015 | 0,168 | 0,079 | 0,000 | 0,567 | 211 |

The entropy score for *ethnic diversity* varies from 0 to a maximum value of 1,95. The mean score value was reduced from 2000 to 2011, from 0,192 to 0,142, before an increase to 0,168 in 2015. The maximum value has increased which suggest that some units have become more diverse in terms of ethnic diversity. The maximum value for each year are all from the same statistical unit, 2501, which is located in Grønland. The area is known as the most

multicultural in the entire city and it therefore seems like a reasonable result that the entropy is high there, compared to other units. Unit 2501 was divided into three smaller units in 2017, and no longer exists. In newer data it can be found as unit 2507, 2508 and 2509.

## 5.2 Age diversity

Table 5.2 Entropy scores summary for age diversity

| Variable | Mean | SD | Min | Max | N |
|---|---|---|---|---|---|
| Entropyage2000 | 0,192 | 0,081 | 0,002 | 0,459 | 214 |
| Entropyage2011 | 0,193 | 0,089 | 0,000 | 0,533 | 213 |
| Entropyage2015 | 0,196 | 0,833 | 0,002 | 0,528 | 211 |

The entropy score for *age* varies from 0 to 2,08. As we can see in table 5.2, the mean values for these entropy scores are quite low but have increased some in the time period I am looking at. The maximum value from 2000 are from Vålerenga, unit 2703, while the values from 2011 and 2015 are from Grønland, the same unit as mentioned above.

## 5.3 Education

Table 5.4 Entropy scores summary for education diversity

| Variable | Mean | SD | Min | Max | N |
|---|---|---|---|---|---|
| Entropyeduc2000 | 0,121 | 0,051 | 0,000 | 0,251 | 214 |
| Entropyeduc2011 | 0,122 | 0,053 | 0,000 | 0,347 | 213 |
| Entropyeduc2015 | 0,098 | 0,041 | 0,000 | 0,258 | 211 |

The entropy score for education varies on a scale from 0 to 1,39. The maximum value in 2000 were found in unit 2703, Vålerenga. The value for 2011 and 2015 were again unit 2501 in Grønland. The category for "unknown education" was not included in the data from 2015 and this could be a part of the reason why education level diversity is different from 2011 to 2015.

## 5.4 Income

The entropy score for income varies from 0 to 1,39. The entropy scores for *income* were low, in addition to having the lowest maximum value of all variables. All of the maximum values were from unit 2501 in Grønland.

Table 5.3 Entropy scores summary for income diversity

| Variable | Mean | SD | Min | Max | N |
| --- | --- | --- | --- | --- | --- |
| Entropyincome2000 | 0,097 | 0,040 | 0,000 | 0,197 | 214 |
| Entropyincome2011 | 0,098 | 0,042 | 0,000 | 0,270 | 213 |
| Entropyincome2015 | 0,098 | 0,041 | 0,000 | 0,261 | 211 |

Based on my entropy scores, unit 2501, Grønland is therefore the most diverse in the inner city in 2015, both in terms of ethnicity, age, income and education level. As mentioned in chapter 3, the inner East, and especially areas like Grønland has long been considered transit areas with high turnover rates and instability in the neighbourhoods (Oslo kommune, 2020). The current degree of population diversity might be difficult to keep or improve if people see Grønland as a temporary living space before for example moving to a home that better fit one's preferences. Furthermore, the current area plan for Grønland will likely affect both the physical and social structures of the area. Whether this will have a positive or negative effect on the population diversity remains to be seen.

## 5.6 Entropy index results

The entropy index is calculated for the entire inner Oslo with one index for each of the diversity variable in each of the three years investigated. As mentioned, the entropy index varies between 0 and 1 where 0 is maximum diversity and 1 is no diversity (Iceland, 2004). The indexes can be seen in table 5.5. The variable measuring ethnicity had a value of 0,735 in 2000, a number which increased to 0,892 in 2015. This means that in terms of ethnic diversity, the inner city got less diverse from 2000-2015. When looking at the index values for age there is just a small decrease, illustrating a very small increase in diversity. Both variables education and income show marginal changes, meaning that the level of diversity in these variables have not changed significantly.

Table 5.5 Entropy index for inner Oslo

| Year | Ethnicity | Age | Education | Income |
|------|-----------|-------|-----------|--------|
| 2000 | 0,735 | 0,878 | 0,907 | 0,916 |
| 2011 | 0,805 | 0,872 | 0,906 | 0,914 |
| 2015 | 0,892 | 0,873 | 0,913 | 0,915 |

## 5.7 Density trends 2000-2015

The variables that constitutes density for the year 2000 can be seen in full in table 5.6. The first variable *newbuilt housing 1990-1999 (1 room)* will function as the reference category in the further analysis. The table shows that the mean value of newbuilt one room apartments is quite low, at just 3.5. The maximum value for newbuilt small apartments can be found in unit 2308 in Grünerløkka. The next variable, *newbuilt housing 1990-1999 (2-3 rooms)* has a mean value of 39.5 and is varying quite drastically. The maximum value of 737 can be found in unit 2501 in Grønland. It is also worth noticing that 497 of these apartments have two rooms, so the main portion of these newbuilt apartments is likely quite small even though I have categorized them as medium sized. The next variable is *newbuilt housing 1990-1999 (4 or more rooms)* has a mean value of 10.3 and a maximum value of 147. The maximum value can be found in unit 2703 located in Vålerenga. This area has a large amount of old wooden houses in addition to some newer apartment blocks. Both *East* and *West* measures the number of inhabitants in each unit, divided by location. The average number of people is highest in the East, with a mean of 403,2, while the mean value in the West is 312,9. The highest value in the East is in Grønland and the highest in the West is in St. Hanshaugen. The average number of housing in apartment blocks or tenement buildings is 440,4. The highest number can be found in unit 2406, Tøyen, located in Sofienberg, with a value of 1044 dwellings. This is also the unit with the most dwellings, totalling in a number of 1055. The average number of housing units in the inner city in 2000/2001 was 471 per statistical unit.

Table 5.6 Density variables, 2000

| Variable | Mean | SD | Min | Max | N |
|---|---|---|---|---|---|
| Newbuilt housing 1990-1999 (1 room) | 3.5 | 8.9 | 0 | 61 | 214 |
| Newbuilt housing 1990-1999 (2-3 rooms) | 39.5 | 71.7 | 0 | 737 | 214 |
| Newbuilt housing 1990-1999 (4 or more rooms) | 10.3 | 17.1 | 0 | 147 | 214 |
| East | 403.2 | 455.5 | 0 | 1726 | 214 |
| West | 312.9 | 404.7 | 0 | 1390 | 214 |
| Apartment block/ tenement building* | 440.4 | 213.2 | 0 | 1044 | 214 |

*Apartment block/tenement building was measured in 2001, as this was not available for the year 2000.

The density variables for 2011 can be found in table 5.7. The variables for newbuilt housing now consist of the period from 1990-2011. *Newbuilt housing 1990-2011 (1 room)* will also be the reference category for this year. The mean value has increased for this period to 9.5, with a maximum value of 198. This was measured in unit 1704, Bjølsen. The next variable *newbuilt housing 1990-2011 (2-3 rooms)* has now a mean of 91.5 which is substantially higher than what it was for only 1990-1999. This likely reflect the increased focus on using large dwellings as a tool to attract more families to the inner city. The maximum number of newbuilt housing of medium size is located in the same unit as before, namely 2501, Grønland and is now 1375. The mean value for *newbuilt housing 1990-2011 (4 or more rooms)* is 10.3, while the maximum number of newbuilt large apartments for this period is 308. The area with the highest number of large apartments is unit 0203, which was divided into two in 2016 and is now named unity 0212 and 0213. This area includes Pilestredet Park, which has a large amount of both large and medium apartments. The average number of inhabitants in both East and West has increased, and the highest number of people in the West

can be found in unit 0203, which indicates that the Pilestredet Park area has both a high number of people and a high share of large apartments. The highest number of people in the East is still unit 2501 in Grønland, meaning that this unit has increased in both the number of people and the number of medium size apartments. Both the average number and the maximum value of apartment blocks/tenement buildings has increased quite drastically. The highest number can be found in unit 0203, and shows that the Pilestredet Park project has added a large amount of housing in this period. The last variable measures population density per acre, with a mean of 15,9. The densest area is in unit 2605, located in the Tøyen area. Unfortunately, I could not find data to create a variable for population density for this year.

Table 5.7 Density variables, 2011

| Variable | Mean | SD | Min | Max | N |
|---|---|---|---|---|---|
| Newbuilt housing 1990-2011 (1 room) | 9.6 | 22.4 | 0 | 198 | 213 |
| Newbuilt housing 1990-2011 (2-3 rooms) | 91.5 | 143.2 | 0 | 1375 | 213 |
| Newbuilt housing 1990-2011 (4 or more rooms) | 29.5 | 40.2 | 0 | 308 | 213 |
| East | 514.5 | 594.8 | 0 | 3177 | 213 |
| West | 379.2 | 498.1 | 0 | 2721 | 213 |
| Apartment block/ tenement building | 570.8 | 308.7 | 0 | 2226 | 212 |
| Population density (per acre) | 15.9 | 9.2 | 0 | 39,5 | 213 |

As mentioned earlier, the variables for newbuilt housing in 2015 is the same as in 2011 because of insufficient data. The max values are therefore the same. The mean values have changed slightly but this is due to a change in the number of units. When looking at the location variables, it is clear that the mean number of inhabitants in each unit has increased to

580,1 in the inner East and 419,3 in the inner West. The highest value for East is still in the same area of Grønland, and the highest value in West is in the same area as before, where Pilestredet Park is located. The mean value for apartment blocks/tenement buildings has increased, but the highest value can be found in the same unit as before. The population density has also increased to a mean value of 17,5 and a maximum value of 41.1 can be found in the same unit as in 2011, in the Tøyen area.

Table 5.8 Density variables 2015

| Variable | Mean | SD | Min | Max | N |
|---|---|---|---|---|---|
| Newbuilt housing 1990-1999 (1 room) | 9.7 | 22.5 | 0 | 198 | 211 |
| Newbuilt housing 1990-1999 (2-3 rooms) | 92.4 | 143.6 | 0 | 1375 | 211 |
| Newbuilt housing (4 or more rooms) | 29.8 | 20.3 | 0 | 308 | 211 |
| East | 580.1 | 661.9 | 0 | 3403 | 211 |
| West | 419.3 | 544.1 | 0 | 3048 | 211 |
| Apartment block/ tenement building | 598.1 | 312.3 | 0 | 2225 | 210 |
| Population density (per acre) | 17.5 | 9.6 | 0 | 41.125 | 210 |

The descriptive statistics I have presented clearly illustrates the physical densification in the inner city, with and increasing number of newbuilt housing of all sizes. Together, these variables show that the inner city now has more housing overall, with a following increase in population, both in total numbers and in the average number for each unit. People in the inner city also live denser in 2015 than in 2011 and although I do not have the exact numbers, the density has likely increased from 2000 to 2011 as well.

## 5.8 Analytical structure

This chapter has introduced the reader to the variables that will constitute the dependent, independent and control variables for the analysis presented in chapter 6. The next chapter will answer the research questions, in addition to the hypothesis presented in chapter 4. The method used is multiple regression analysis, with a summary of the results presented by year and theme.

# Chapter 6 Analysis

As I have discussed in the previous chapters, the connection between population diversity and population density are complicated and not clear cut. To narrow down the density concept, I will focus the analysis on newbuilt housing. The goal is to investigate how newbuilt housing, divided by size, affects different categories of population diversity, in addition to looking at how it is affected by location. To make sure that my interpretation of the results is correct, I will also add control variables which I believe might affect the results. The analysis will be conducted with the two research questions in mind:

RQ1: *Does the densification in the form of infill and transformation contribute to more population diversity in inner Oslo?*

RQ2: *Does the size of the newbuilt housing have an effect on population diversity, and does this effect differ in the inner East and West?*

The analysis will be organized by year and theme. The first part will show the results for the year 2000, with subchapters discussing the results of the diversity categories: ethnicity, age, education and income. The results for 2011 and 2015 will be organised in the same way. The analysis will consist of four regression models in 2000 and five in 2011 and 2015. My approach to the regression analyses has been to start with a fairly simple model where I gradually include more variables. By doing this, I get to see how the results vary when I add more control variables, which gives me a better foundation for interpretation. The general structure of the models is similar for all years and starts with the variables measuring newbuilt housing, divided by number of rooms. I will then add location, building structure, population density and lastly, an interaction term that combines newbuilt housing 4 rooms or more with East. As mentioned earlier, the municipality of Oslo has a vision of increasing the total number of housing, and of building more large apartments to keep families from moving out of the inner city. Restricting the building of new small apartments and encouraging building of larger ones is therefore seen as a tool to promote a varied population structure. Since the highest prevalence of small apartments have traditionally been in the inner East, it is interesting to see if I can find an interaction between the newbuilt housing and location, which will be a part of my concluding discussion. To make sure that the data was normally distributed, I used a quantile-quantile plot in Stata, which shows close to perfect normal

distribution of the residuals in all of the regressions. Keeping a linear regression form is therefore a good choice for this analysis.

## 6.1 Regression results 2000

The regression analysis for year 2000 consists of four models in each diversity category. The dependent variables in each of the subsections are the entropy scores for the different diversity categories. The first independent variables are *newbuilt housing 1990-1999 (2-3 rooms)* and *newbuilt housing 1990-1999 (4 or more rooms)*. This means that *newbuilt housing 1990-1999 (1 room)* is the reference category. I chose to divide the variable like this, to have the general categories of small (1 room), medium (2-3 rooms) and large (4 or more rooms) apartments which is a helpful categorisation for further discussion. Secondly, I added *East*, making *West* my reference category. The third model measures the presence of apartment blocks or tenement buildings, while the fourth model includes an interaction term between newbuilt housing of four rooms or more and East. The variable for population density was not available for this year and is therefore only included in the models from 2011 and 2015.

### 6.1.1 Ethnic diversity

Table 6.1 shows the results for the regression of ethnic diversity on newbuilt housing in the period 1990-1999, in addition to location, apartment blocks and the interaction terms. Model 1 shows a significant result on newbuilt 2-3 room apartments. This means that this variable has a significant larger effect on ethnic diversity than newbuilt one room apartments. Newbuilt apartments of 4 rooms or larger are not significant in any of the models. Model 2 and 3 includes location and apartment blocks, which both are significant. These results show that being located in the East and having apartment blocks or tenement buildings present gives a significant larger influence on diversity than being located West and not having apartment blocks present. Model 4 includes the interaction term. One thing to be aware of is that when the interaction terms are included, the meaning of the variable used to make the interaction term also changes. This means that in model 4 *newbuilt housing 1990-1999 (4 rooms or more)* functions as the reference category for the interaction term *newbuilt housing 1990-1999 (4 or more rooms) East*. The first variable then shows the results for the effect in *West*. The interaction term is not significant in this case. Further down in table 6.1, $R^2$ shows a steady increase throughout the models from 25,8 % in the first model to 72 % in the fourth

model. The F-test is significant in all models, which indicates that the overall explanatory power of the models is good.

Table 6.1 Regression of ethnic diversity[1] on housing characteristics and location. OLS estimates with robust standard errors in parenthesis.

|  | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Newbuilt housing 1990-1999 (2-3 rooms) | 0.58436*** (0.14734) | 0.37813*** (0.11245) | 0.20943** (0.07303) | 0.21747*** (0.07371) |
| Newbuilt housing 1990-1999 (4 or more rooms) | -0.11388 (0.48872) | 0.36573 (0.39729) | -0.09941 (0.25688) | 0.20353 (0.32510) |
| East |  | 0.07987*** (0.00930) | 0.04118*** (0.00787) | 0.04767*** (0.00901) |
| Apartment block/tenement building |  |  | 0.23334*** (0.000014) | 0.22993*** (0.01421) |
| Newbuild housing 1990-1999 (4 or more rooms) East[2] |  |  |  | -0.00040 (0.00026) |
| Constant | 142.18780*** (5.88996) | 116.57570*** (6.30704) | 37.46053*** (6.11112) | 35.10810*** (6.14608) |
| $R^2$ | 0.258 | 0.436 | 0.716 | 0.720 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 214 | 214 | 214 | 214 |

Ethnic diversity measured as the entropy score for ethnicity at the census tract level.
[2]Interaction term for newbuilt housing (4 or more rooms) and East.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

## 6.1.2 Age diversity

Table 6.2 shows the regression results when using age diversity as the dependent variable. Model 1 shows similar results as with the previous theme, where newbuilt housing (2-3 rooms) is significant, while 4 or more rooms is not. Model 2 shows *East* as significant, meaning that there is a significant difference between the diversity in age in the East and West part of the inner city for this year. When including the variable for apartment block/tenement building, newbuilt housing 2-3 rooms is no longer significant, but newbuilt housing with 4 or more rooms is significant ($p<0.05$). This indicates that the building of medium and larger dwellings may have affected the diversity in age at this point, but that the relationship is weak

and easily affected by the other variables. $R^2$ increases from 20 % in model 1 to 76,2 % in model 5, suggesting that the models show good explanatory power.

Table 6.2 Regression of age diversity[1] on housing characteristics and location. OLS estimates with robust standard errors in parenthesis.

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Newbuilt housing 1990-1999 (2-3 rooms) | 0.41614*** (0.12931) | 0.19636** (0.09179) | 0.00264 (0.04695) | 0.00029 (0.04716) |
| Newbuilt housing 1990-1999 (4 or more rooms) | 0.53337 (0.53155) | 0.69371* (0.36844) | 0.53756** (0.23204) | 0.44875 (0.27646) |
| East | | 0.08512*** (0.00976) | 0.04069*** (0.00745) | 0.03879*** (0.00841) |
| Apartment block/tenement building | | | 0.26795*** (0.01489) | 0.26895*** (0.01510) |
| Newbuild housing 1990-2011 (4 or more rooms) East[2] | | | | 0.00012 (0.00020) |
| Constant | 170.50590*** (6.45524) | 143.21170*** (7.13590) | 52.36261*** (6.40259) | 53.05231*** (6.52405) |
| $R^2$ | 0.200 | 0.398 | 0.761 | 0.762 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 214 | 214 | 214 | 214 |

[1]Diversity in age measured as the entropy score for age at the census tract level.
[2]Interaction term for newbuilt housing (4 or more rooms) and East.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

### 6.1.3 Education diversity

Table 6.3 presents the regression results for diversity in education levels as the dependent variable. Model 1 shows that the newbuilt 2-3 room apartments have a greater effect on the diversity in education levels than the newbuilt one room apartments with a significance level of $p<0.001$. Model 2 shows that the location variable is significant and stays significant in all models. In model 3, newbuilt housing of 4 rooms or more are significant ($p<0.05$), meaning that when controlling for location and the presence of apartment blocks, newbuilt large apartments have a greater effect on the diversity in education levels than small apartments.

Model 4 shows a significant interaction term for newbuilt large apartments in the West. $R^2$ increases from 19,3 % in model 1 to 88,4 % in model 4. According to these results the building of large apartments has had a statistically significant effect on the education level diversity and the interaction term shows that this effect has been greater in the West.

Table 6.3 Regression of diversity in education levels[1] on housing characteristics and location. OLS with robust standard errors in parenthesis.

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Newbuilt housing 1990-1999 (2-3 rooms) | 0.25804*** (0.06412) | 0.15079*** (0.04857) | -0.00153 (0.000017) | -0.00185 (0.01694) |
| Newbuilt housing 1990-1999 (4 or more rooms) | 0.32008 (0.30200) | 0.39832 (0.24561) | 0.27555** (0.10765) | 0.26334* (0.14770) |
| East | | 0.04154*** (0.00666) | 0.00661** (0.00330) | 0.00634* (0.00364) |
| Apartment block/tenement building | | | 0.21068*** (0.00681) | 0.21082*** (0.00697) |
| Newbuild housing 1990-2011 (4 or more rooms) East[2] | | | | 0.00002 (0.00011) |
| Constant | 107.18840*** (4.08564) | 93.86870*** (0.004969) | 22.43667*** (2.97411) | 22.53148*** (3.01776) |
| $R^2$ | 0.193 | 0.313 | 0.883 | 0.884 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 214 | 214 | 214 | 214 |

[1]Diversity in education levels measured as the entropy score for education at the census tract level.
[2]Interaction term for newbuilt housing (4 or more rooms) and East.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$

## 6.1.4 Income diversity

The regression results in table 6.4 shows similar results as with the previous themes with model 1 showing significant results for newbuilt 2-3 room apartments but not for the larger apartments. Model 2 shows that East is significant, although this disappears in model 3. When including the variable for apartment blocks in model 3, newbuilt 4 or more room apartments becomes significant ($p<0.01$), meaning that the newbuilt large apartments have a significantly greater effect on income diversity than small apartments. As in the previous category, the

interaction term for newbuilt large housing in the West is significant (p<0.10). $R^2$ increases from 17,5 % in model 1 to 92,4 % in model 3, and stays the same in model 4, showing a high degree of explanatory power in the models.

Table 6.4 Regression of income diversity[1] on housing characteristics and location. OLS estimates with robust standard errors in parenthesis.

| | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Newbuilt housing 1990-1999 (2-3 rooms) | 0.19175*** (0.04529) | 0.11192*** (0.03620) | -0.01677 (0.01378) | -0.01654 (0.01388) |
| Newbuilt housing 1990-1999 (4 or more rooms) | 0.26458 (0.23499) | 0.32282 (0.20183) | 0.21909*** (0.08083) | 0.22760* (0.11744) |
| East | | 0.03092*** (0.00572) | 0.00141 (0.00217) | 0.00159* (0.00236) |
| Apartment block/tenement building | | | 0.17799*** (0.00475) | 0.17790*** (0.00490) |
| Newbuild housing 1990-2011 (4 or more rooms) East[2] | | | | -0.00001 (0.00008) |
| Constant | 86.87070*** (3.29231) | 76.95620*** (4.06079) | 16.60760*** (2.03814) | 16.54154*** (2.04592) |
| $R^2$ | 0.175 | 0.280 | 0.924 | 0.924 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 214 | 214 | 214 | 214 |

[1]Diversity in income measured as the entropy score for income quartiles at the census tract level.
[2]Interaction term for newbuilt housing (4 or more rooms) and East.
 * p<0.10, ** p<0.05, *** p<0.01.

## 6.1.5 Result summary 2000

It seems like the newbuilt large apartments are influencing the diversity in age, education and income, when controlling for apartment blocks and location. The densification in this period therefore seems to have had a positive effect on all diversity categories except ethnic diversity. Overall, large housing has the most effect on diversity when including the control variables, since the variable for medium size housing tends to lose its effect when the controls are included. The exception is in ethnic diversity where newbuilt medium sized housing shows significant results and not the large apartments.

## 6.2 Regression results 2011

The regressions for 2011 is divided into themes as the previous subchapter, in addition to tables showing the results for all models. The two first variables now measures newbuilt housing (2-3 rooms) and newbuilt housing (4 or more rooms) in the period 1990-2011. Newbuilt one room apartments is still the reference category for these variables. Model 2 includes a variable for *East* and model 3 for *apartment block/tenement building*. Model 4 includes a control for population density, and lastly model 5 includes an interaction term between newbuilt housing 1999-2011 (4 or more rooms) and East.

### 6.2.1 Ethnic diversity

Model 1 in table 6.5 shows that newbuild housing (2-3 rooms) is significant, while the variable for newbuilt larger apartments is not. Model 3 shows that both newbuilt 2-3 rooms and newbuilt 4 room is now significant, with the latter showing a negative correlation to ethnic diversity compared to newbuilt one room apartments. When controlling for population density in model 4, both variables are still significant. The interaction term is not significant in for this year either. The results from model 4 indicates that the newbuilt medium size apartments in this period has a significant positive effect on ethnic diversity in the inner city. This is similar to the results from 2000. In addition to this, large apartments now show a significant negative effect. When looking at the $R^2$ values, there is an increase from 39, 7 % in model 1 to 75,8 % in model 5. The F-test is significant in all models and together this indicates that the models have good explanatory power.

Table 6.5 Regression of ethnic diversity[1] on housing characteristics, location and population density. OLS estimates with robust standard errors in parenthesis.

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Newbuilt housing 1990-2011 (2-3 rooms) | 0.34245*** (0.04694) | 0.23576*** (0.04491) | 0.06967* (0.03729) | 0.07709** (0.03469) | 0.09092** (0.04029) |
| Newbuilt housing 1990-2011 (4 or more rooms) | -0.09726 (0.14879) | -0.10398 (0.12734) | -0.27917** (0.13832) | -0.23040* (0.13414) | -0.17774 (0.14312) |
| East | | 0.05115*** (0.00672) | 0.04197*** (0.00579) | 0.03968*** (0.00536) | 0.04469*** (0.00661) |
| Apartment block/ tenement building | | | 0.15289*** (0.01195) | 0.13958*** (0.01622) | 0.13728*** (0.01687) |
| Population density (per acre) | | | | 0.84539** (0.39835) | 0.80996** (0.39184) |
| Newbuild housing 1990-2011 (4 or more rooms) East[2] | | | | | -0.00010 (0.00010) |
| Constant | 113.77030*** (4.99635) | 97.40835*** (5.10757) | 35.77480*** (5.50934) | 28.91301*** (5.27984) | 27.81394*** (5.50170) |
| $R^2$ | 0.397 | 0.526 | 0.748 | 0.757 | 0.758 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 213 | 213 | 212 | 212 | 212 |

[1]Ethnic diversity measured as the entropy score for ethnicity at the census tract level.
[2]Interaction term for newbuilt housing (4 or more rooms) and East.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

## 6.2.2. Age diversity

Table 6.6 contains the results from the regression of age diversity on the newbuilt housing variables. The results look quite different from the results from 2000, and we now clearly see that apartment size has been influencing the age diversity when looking at a longer time period. Model 1 shows significant results for both variables, meaning that both newbuilt 2-3 and 4 room apartments has a significant greater effect on the diversity in age than one room apartments. Model 2 and 3 shows that similarly to the previous results for age diversity, the presence of apartment blocks and being located in the East are both significant in all models.

Model 4 includes all relevant controls. The results have shifted, and now newbuilt 2-3 room apartments show a significant negative correlation to age diversity compared to newbuilt one room apartments, while the effect for the larger apartments stays positive. Model 5 now shows some interesting results. By including the interaction term *newbuilt housing 1990-2011 (4 or more rooms) East*, the other variable for newbuilt 4 room apartments now shows the results for newbuilt 4 or more room apartments in *West*. This variable is significant ($p<0.05$), meaning that the newbuilt large apartments, located in the West part of the city has a significant larger effect on the diversity in age compared to newbuilt one room apartments. Throughout the development of the models, $R^2$ increases from 37,7 % in model 1 to 72,5 % in model 5, in addition to significant F-tests which together indicates high explanatory power.

Table 6.6 Regression of age diversity[1] on housing characteristics, location and population density. OLS estimates with robust standard errors in parenthesis.

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Newbuilt housing 1990-2011 (2-3 rooms) | 0.23533*** (0.04062) | 0.12438*** (0.03905) | -0.08526*** (0.03139) | -0.07443** (0.03071) | -0.08854** (0.04187) |
| Newbuilt housing 1990-2011 (4 or more rooms) | 0.59032*** (0.19342) | 0.58333*** (0.14484) | 0.36217** (0.14909) | 0.43333*** (0.14926) | 0.37958** (0.04182) |
| East | | 0.05321*** (0.00806) | 0.04161*** (0.00821) | 0.38266*** (0.00804) | 0.03315*** (0.00850) |
| Apartment block/ tenement building | | | 0.19300*** (0.01796) | 0.17356*** (0.01906) | 0.17591*** (0.01868) |
| Population density (per acre) | | | | 1.23347*** (0.42421) | 1.26964** (0.42507) |
| Newbuild housing 1990-2011 (4 or more rooms) East[2] | | | | | 0.00010 (0.00014) |
| Constant | 154.01680*** (6.44816) | 136.99960*** (6.99702) | 59.19778*** (8.73900) | 49.18606*** (8.76325) | 50.30803*** (9.07515) |
| $R^2$ | 0.377 | 0.471 | 0.711 | 0.723 | 0.725 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 213 | 213 | 212 | 212 | 212 |

[1]Age diversity measured as the entropy score for age at the census tract level.
[2]Interaction term for newbuilt housing (4 or more rooms) and East. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

### 6.2.3 Education diversity

Table 6.7 show the results for the regressions of diversity in education levels. Just like the results for age diversity, we can see that these have changed quite a lot from the year 2000. Model 1-4 shows significant results for all variables. Newbuilt housing 2-3 rooms shows a significant negative effect on diversity in education levels, compared to newbuilt housing of one room. Newbuilt housing 4 or more rooms shows a significant positive effect on education level diversity compared to the same reference category. The results for education level diversity is therefore quite similar to the results for age diversity, with a positive effect for large housing and a negative effect for medium size housing. $R^2$ is quite high in all models, rising from 44,7 % in model 1 to 87,4 in model 5, suggesting high explanatory power.

Table 6.7 Regression of diversity in education levels[1] on housing characteristics, location and population density. OLS estimates with robust standard errors in parenthesis.

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Newbuilt housing 1990-2011 (2-3 rooms) | 0.17679*** (0.000030) | 0.11361*** (0.03098) | -0.03307** (0.01453) | -0.02774** (0.01326) | -0.03068 (0.01907) |
| Newbuilt housing 1990-2011 (4 or more rooms) | 0.29389*** (0.11147) | 0.28991*** (0.10009) | 0.13500** (0.06225) | 0.16998*** (0.06229) | 0.15880** (0.07973) |
| East | | 0.03029*** (0.00463) | 0.02300*** (0.00354) | 0.02055*** (0.03482) | 0.01949*** (0.00334) |
| Apartment block/ tenement building | | | 0.13508*** (0.00788) | 0.12554*** (0.00783) | 0.12602*** (0.00769) |
| Population density (per acre) | | | | 0.60636*** (0.16023) | 0.61388*** (0.16106) |
| Newbuild housing 1990-2011 (4 or more rooms) East[2] | | | | | 0.00002 (0.00007) |
| Constant | 96.77014*** (3.56724) | 87.08042*** (4.07175) | 32.59305*** (3.91780) | 27.67141*** (3.95202) | 27.90469*** (4.16293) |
| $R^2$ | 0.447 | 0.533 | 0.865 | 0.874 | 0.874 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 213 | 213 | 212 | 212 | 212 |

[1]Diversity in education levels measured as the entropy score for education at the census tract level.
[2]Interaction term for newbuilt housing (4 or more rooms) and East. * p<0.10, ** p<0.05, *** p<0.01.

### 6.2.4 Income diversity

The results for the regression of income diversity on newbuilt housing can be seen in table 6.8. Model 1-4 shows significant results for all variables. In model 4, the variable for newbuilt housing 2-3 rooms has a significant negative effect on diversity in income, compared to newbuilt one room housing. Newbuilt 4 or more room housing shows a significant positive effect on diversity in income, compared to newbuilt one room housing. Model 5 shows that the interaction term is significant for West, meaning that the newbuilt large apartments have contributed to increased income diversity in West, compared to newbuilt one room housing. The $R^2$ value steadily increases from 44,8 % in model 1 to 89,1 % in model 5.

Table 6.8 Regression of income diversity[1] on housing characteristics, location and population density. OLS estimates with robust standard errors in parenthesis.

|  | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Newbuilt housing 1990-2011 (2-3 rooms) | 0.13731*** (0.24758) | 0.09749*** (0.02774) | -0.02737** (0.01145) | -0.02365** (0.01071) | -0.02641* (0.01536) |
| Newbuilt housing 1990-2011 (4 or more rooms) | 0.24758*** (0.09211) | 0.24507*** (0.08945) | 0.11321** (0.04812) | 0.13765*** (0.04935) | 0.12717* (0.06632) |
| East |  | 0.01909*** (0.00392) | 0.01220*** (0.00276) | 0.01105*** (0.00277) | 0.01005*** (0.00244) |
| Apartment block/ tenement building |  |  | 0.11500*** (0.00628) | 0.10832*** (0.00645) | 0.10878*** (0.00632) |
| Population density (per acre) |  |  |  | 0.42366*** (0.12562) | 0.43072*** (0.12649) |
| Newbuild housing 1990-2011 (4 or more rooms) East[2] |  |  |  |  | 0.00002 (0.00005) |
| Constant | 77.64013*** (2.81859) | 71.53355*** (3.35668) | 25.15416*** (3.03729) | 21.71542*** (3.03272) | 21.93426*** (3.21431) |
| $R^2$ | 0.448 | 0.502 | 0.884 | 0.891 | 0.891 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 213 | 213 | 212 | 212 | 212 |

[1]Diversity in income measured as the entropy score for income quartiles at the census tract level.
[2]Interaction term for newbuilt housing (4 or more rooms) and East.
* p<0.10, ** p<0.05, *** p<0.01.

### 6.2.5 Result summary 2011

Like in the results for 2000, the results for ethnic diversity still stands out compared to the other categories. Newbuilt medium size housing still shows a significant positive effect, while large housing shows a negative effect. The newbuilt large housing has contributed to more diversity in terms of age, education and income, while medium size housing shows a negative effect on all these categories. Some of the increase in diversity in the inner city can likely be explained in the increased popularity of urban living, especially among younger adults. The increase in age diversity has been an important goal for the municipality of Oslo. However, apartment size do seem to affect the diversity in all categories.

### 6.3 Regression results 2015

Since the data on newbuilt housing for 2012- 2015 did were insufficient, I am using the data on newbuilt housing from 2011 in these regressions as well. This will hopefully show if any of the relationships so far has changed, or if some new effects have occurred during the longer time period. The regressions for 2015 are built up in the same way as in 2011 with model 1 showing the variables for newbuilt housing, divided by number of rooms, and with newbuilt one room housing as the reference category. Model 2 adds the location variable, while model 3 includes the apartment block/tenement building variable. Model 4 includes population density (per km2) and lastly, model 5 includes two interaction terms, constructed in the same way as in the previous subchapter.

### 6.3.1 Ethnic diversity

The results for the regressions of ethnic diversity in 2015 gives roughly the same conclusion as the results for 2011. Table 6.9 shows that newbuilt housing of 2-3 rooms is significant in all models and have now a value of $p<0.01$ in model 4 and 5, which strengthens the conclusion that newbuilt medium size apartments have a positive relationship with ethnic diversity. Newbuilt housing of 4 or more room is still just significant in model 3, showing a negative relationship to ethnic diversity. However, like in the previous year, this effect disappears when controlling for population density in model 4. The variables measuring location and presence of apartment blocks are all significant in all models. None of the interaction terms shows any significant results for this year either, and the effect of newbuilt housing on ethnic diversity can therefore not be said to have a higher effect in the East or

West. The $R^2$ value increases from 42,4 % in model 1 to 75,6 % in model 5, suggesting good explanatory power for the models.

Table 6.9 Regression of ethnic diversity[1] on housing characteristics, location and population density. OLS estimates with robust standard errors in parenthesis.

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Newbuilt housing 1990-2011 (2-3 rooms) | 0.33616*** (0.03939) | 0.26880*** (0.03785) | 0.09679*** (0.03346) | 0.09948*** (0.03029) | 0.10436*** (0.03595) |
| Newbuilt housing 1990-2011 (4 or more rooms) | 0.09144 (0.14757) | 0.04158 (0.12657) | -0.27098** (0.13162) | -0.22164* (0.12712) | -0.18629 (0.13303) |
| East | | 0.03385*** (0.00657) | 0.02215*** (0.00559) | 0.02029*** (0.00544) | 0.02285*** (0.00693) |
| Apartment block/ tenement building | | | 0.17944*** (0.013108) | 0.16832*** (0.01549) | 0.16730*** (0.01564) |
| Population density (per acre) | | | | 0.92089*** (0.34750) | 0.91053*** (0.34544) |
| Newbuild housing 1990-2011 (4 or more rooms) East[2] | | | | | -0.00005 (0.00009) |
| Constant | 134.33340*** (5.22638) | 122.40220*** (5.67216) | 47.75222*** (6.75716) | 37.36761*** (6.50426) | 36.48969*** (6.87436) |
| $R^2$ | 0.424 | 0.484 | 0.743 | 0.755 | 0.756 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 211 | 211 | 210 | 209 | 209 |

Diversity in area of origin measured as the entropy score for area of origin at the census tract level.
[2]Interaction term for newbuilt housing (4 or more rooms) and East.
* p<0.05, ** p<0.01, *** p<0.001.

### 6.3.2 Age diversity

Table 6.10 shows the regression results for age diversity on newbuilt housing from 1990-2011. Model 3 and 4 shows similar results to the regressions from 2011, with a significant negative relationship between newbuilt 2-3 room housing, and a significant positive relationship between newbuilt 4 or more room housing, with 1 room housing as the reference category. This further strengthens the conclusion that age diversity has increased in the inner

city since 2000. Interestingly, both interaction terms for West are now significant, meaning that the effect of newbuilt housing on age diversity is stronger in the inner West.

Table 6.10 Regression of age diversity[1] on housing characteristics, location and population density. OLS estimates with robust standard errors in parenthesis.

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Newbuilt housing 1990-2011 (2-3 rooms) | 0.18832*** (0.03078) | 0.10628*** (0.02784) | -0.06278** (0.02773) | -0.06136** (0.02859) | -0.07052** (0.02907) |
| Newbuilt housing 1990-2011 (4 or more rooms) | 0.75128*** (0.17641) | 0.69055*** (0.11970) | 0.38361*** (0.13339) | 0.000425*** (0.13756) | 0.35886** (0.15613) |
| East | | 0.04123*** (0.00656) | 0.02971*** (0.00655) | 0.02771*** (0.00657) | 0.02290*** (0.00716) |
| Apartment block/ tenement building | | | 0.17629*** (0.01645) | 0.16786*** (0.01650) | 0.16977*** (0.01612) |
| Population density (per acre) | | | | 0.78942** (0.34540) | 0.80886** (0.34571) |
| Newbuild housing 1990-2011 (4 or more rooms) East[2] | | | | | 0.00009 (0.00010) |
| Constant | 155.88950*** (5.89306) | 141.35880*** (6.26506) | 68.05078*** (8.26693) | 58.62988*** (8.73390) | 60.2771*** (9.24740) |
| R² | 0.424 | 0.504 | 0.726 | 0.737 | 0.739 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 211 | 211 | 210 | 209 | 209 |

[1] Age diversity measured as the entropy score for age at the census tract level.
[2] Interaction term for newbuilt housing (4 or more rooms) and East.
* p<0.10, ** p<0.05, *** p<0.01.

### 6.3.3 Education diversity

Table 6.11 shows the results for the regression regarding diversity in education levels. These models show similar tendencies as the ones from 2011, with a significant negative relationship for newbuilt 2-3 room housing, and a significant positive relationship for newbuilt housing of 4 or more rooms, both compared to newbuilt one room housing. The variables East, apartment block/tenement building and population density are all significant and therefore correlates with increased diversity in education level. Model 5 shows no significant results for the interaction terms. R² rises quite drastically in these models, from

48.4 % in model 1 to 90,4 % in model 5. Together with the F-test, this suggests that the models have good explanatory power.

Table 6.11 Regression of diversity in education levels[1] on housing characteristics, location and population density. OLS estimates with robust standard errors in parenthesis.

| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Newbuilt housing 1990-2011 (2-3 rooms) | 0.11288*** (0.0000231) | 0.07657*** (0.02413) | -0.02634** (0.01040) | -0.02575*** (0.00961) | -0.02673** (0.01154) |
| Newbuilt housing 1990-2011 (4 or more rooms) | 0.34206*** (0.08401) | 0.31518*** (0.07445) | 0.12793*** (0.04245) | 0.14378*** (0.04366) | 0.13670** (0.06248) |
| East | | 0.01825*** (0.00323) | 0.01126*** (0.00221) | 0.01052*** (0.00221) | 0.01001*** (0.00214) |
| Apartment block/ tenement building | | | 0.10743*** (0.00567) | 0.10416*** (0.00561) | 0.10436*** (0.00553) |
| Population density (per acre) | | | | 0.30034*** (0.10391) | 0.30242*** (0.10395) |
| Newbuild housing 1990-2011 (4 or more rooms) East[2] | | | | | 0.00001 (0.00004) |
| Constant | 77.79068*** (2.63605) | 71.35815*** (3.0300) | 26.63810*** (2.77276) | 23.08267*** (2.86037) | 23.25846*** (3.11734) |
| $R^2$ | 0.484 | 0.550 | 0.897 | 0.904 | 0.904 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 211 | 211 | 210 | 209 | 209 |

[1]Diversity in education levels measured as the entropy score for age at the census tract level.
[2]Interaction term for newbuilt housing (4 or more rooms) and East.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

## 6.3.4 Income diversity

Table 6.12 shows that newbuilt housing of 2-3 rooms have a significant negative relationship with income diversity, while newbuilt housing of 4 or more rooms have a significant positive relationship with income diversity. Both compared to the reference category, newbuilt one room housing. The other control variables show similar results as in the previous regressions for 2011, with significant results for location, apartment buildings and population density in all models. Model 5 shows no significant results for the interaction terms. One point worth

considering is that income diversity is closely connected to the housing prices. The newbuilt housing in certain areas will likely have a very positive price development, which will likely affect the diversity in income levels.

Table 6.12 Regression of income diversity[1] on housing characteristics, location and population density. OLS estimates with robust standard errors in parenthesis.

|  | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|---|---|---|---|---|---|
| Newbuilt housing 1990-2011 (2-3 rooms) | 0.11557*** (0.02272) | 0.08412*** (0.02370) | -0.02112** (0.00995) | -0.02045** (0.00911) | -0.02159* (0.01122) |
| Newbuilt housing 1990-2011 (4 or more rooms) | 0.33205*** (0.08123) | 0.30876*** (0.07482) | 0.11723*** (0.04247) | 0.13325*** (0.04318) | 0.12500** (0.06139) |
| East |  | 0.01581*** (0.00326) | 0.00866*** (0.00214) | 0.00795*** (0.00215) | 0.00735*** (0.00201) |
| Apartment block/ tenement building |  |  | 0.10987*** (0.00541) | 0.10649*** (0.00532) | 0.10673*** (0.00523) |
| Population density (per acre) |  |  |  | 0.30207*** (0.09677) | 0.30448*** (0.09697) |
| Newbuild housing 1990-2011 (4 or more rooms) East[2] |  |  |  |  | 0.00001 (0.00004) |
| Constant | 77.92841*** (2.58152) | 72.35731*** (3.03445) | 26.61495*** (2.68918) | 23.08466*** (2.75137) | 23.28931*** (2.99672) |
| $R^2$ | 0.489 | 0.539 | 0.907 | 0.913 | 0.913 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 211 | 211 | 210 | 209 | 209 |

[1]Diversity in income measured as the entropy score for income quartiles at the census tract level.
[2]Interaction term for newbuilt housing (4 or more rooms) and East.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

## 6.4 Summary of all results

The results from 2000, 2011 and 2015 shows that there have definitely been some changes in the effect that newbuilt housing has had on the different aspects of diversity. The recent results from 2015, shows similar trends as the previous years. Based on these results, I can say that the newbuilt housing from 1990-2011 has affected the diversity in inner Oslo, but this

varies between the different categories. Ethnic diversity seems to be less affected where the results from all three years shows very similar results. Both diversity in age, education level and income show a positive relationship between newbuilt large housing and a negative relationship with the newbuilt medium sized housing. It is therefore clear that the size of the newbuilt housing matters, and the building of larger apartments have contributed to more diversity in age, income and education. This also means that having varied housing sized can function as a tool to improve these types of diversity

Ethnic diversity stands out compared to the other categories. The result of the medium sized apartments might be influenced by the fact that this is a quite broad category which likely contains large differences in housing prices. Large apartments in the inner city tend to be quite expensive, which might explain why they have a negative relationship to ethnic diversity. In addition to this, it is also possible that housing size has less influence on ethnic diversity because other factors are more important in deciding where to live. As the descriptive statistics in chapter 5 shows, Grønland is the most ethnically diverse area in Oslo, but is also has a high degree of small apartments. Factors such as being located close to family, work, places of worship, and the presence of other immigrants might be considered more important than housing size. Ethnic diversity could therefore be difficult to influence with housing size and structure.

The results for the interaction terms shows that the effect of the newbuilt housing is stronger in the western part of the inner city, despite the heavy focus on increasing diversity in the East. Many of the new neighbourhoods in the Fjord City project are located in the East, and not all of them were finished in 2015. It would be interesting for future research to investigate how the new developments here have affected the diversity levels in general, and if housing sizes have a positive effect on the same categories of diversity when its located in such an expensive area.

# Chapter 7 Concluding discussion

The results from this analysis shows that population density has increased the population diversity in inner Oslo since 2000; further that building large apartments have contributed to this development. While this is a positive change for the inner city, the future progress is dependent on continuous efforts to sustain the levels of diversity that already exist, and to further work for improvement.

The first point I would like to discuss is the importance of a varied size of newbuilt housing as a tool to create more diversity. An important note of discussion is that many different interests affect the distribution of small, medium and large apartments in newbuilt housing. As I mentioned earlier, the apartment distribution norm has been an important tool in promoting a mix of housing units, where varied sizes can attract people with different needs and preferences. My results show that housing size does in fact influence diversity, and that the increase in large apartments has mainly had a positive effect. The housing distribution norm should therefore be prioritized and further continued by the municipality since it has likely been a part of increasing the diversity in the inner city since 1990. This coincides with the Planning and Building Authority's (2016) own evaluation of the norm. Despite the promising results of the apartment distribution norm, many call for the norm to be softened. Some developers see the norm as an obstruction that makes the building of new housing slow and overly complicated. They believe that if the norm is changed to allow a share of 50 % apartments between 35-50m² usable floor space, it could be built at a faster speed, which they argue would lower the price of housing in the inner city (Boligvekstutvalget, 2016). Others, such as architecture associations, have expressed concerns regarding loosening the restrictions. They make a similar statement as the Planning and Building Authorities (2016), where they state that the apartment distribution norm is an important tool to ensure a varied housing composition in the inner city. They also emphasise the importance of other norms meant to ensure the overall quality of the newbuilt housing and the norm regarding outdoor space (Oslo Arkitektforening, 2017). The Planning and Building Authorities (2016) found a strong effect of the norm after 2008-2009, which coincides with my results from 2011 and 2015 where large apartments mainly seem to have a positive effect on socioeconomic diversity.

According to my results, the building of more large apartments has not had a greater effect in the East, despite that this is the focus area of the norm. It was quite unexpected that the newbuilt large apartments has a stronger effect in West in regards to both diversity in age, education and income. The building of areas such as Pilestredet Park might have contributed to the effect between West and newbuilt large apartments as this area has a large amount of housing of 4 rooms or more. Based on the results in this thesis, I would argue that varied housing sizes do in fact work as a tool to create more diversity. The apartment distribution norm should therefore be maintained further, since the municipality's goals of population diversity has not yet been met. Moreover, this strengthens the argument by Rowley (1996) and Talen (2006a) that the concept of mixed-use development needs to emphasise a mix of housing sizes and prices as well as functions.

Furthermore, I want to argue that in today's cities, such tools, norms and regulations that influence the building process might be even more important than before. As the economy has become more globalised, housing has become a part of the international finance markets. Saskia Sassen (2015) argues that as housing is no longer about securing people a place to live, but has instead become investment objects connected to the global geographies of extraction, where urban land is being bought and sold by global corporations. The result has been that urban space is becoming increasingly privatized and much of the building of new housing is often decided by people who will never live in the area themselves. This can be challenging for the population diversity in the city. Sassen (2015) further states:

"(…) today's large-scale corporate buying of urban space in its diverse instantiations introduces a de-urbanising dynamic. It is not adding to mixity and diversity. Instead it implants a whole new formation in our cities – in the shape of a tedious multiplications of high-rise luxury buildings."

As urban space becomes more privatized a trend of standardization has followed where architecture, consumption patterns and businesses become more similar (Sennett, 2007). These new trends of standardization and privatization can often be expressed in the development of gated communities, either by literal, physical gates or by a general unwelcomeness to those who differs from this standard. Ensuring that the newbuilt housing reflects the needs of local realities can therefore be an essential tool to maintain and improve local diversity, despite the global trends. It therefore seems less likely that diversity will

happen "organically", as Jacobs (2011) wanted, in today's cities. We might be overly hopeful if we expect that population diversity will just appear out of nowhere. It is more realistic to think that the process needs to be pushed politically and further facilitated by policies.

Despite diversity being the new paradigm for urban planning, the reality of how cities are currently developed tend to be quite different. I would therefore argue, in agreement with Fainstein (2010), that a focus on diversity is not enough and that a social justice perspective should be equally present. The United Nations Human Rights Council names the financialization of housing as a driver of inequality and exclusion and calls for the recognition of the social function of housing as a social good to achieve the Sustainable Development Goal of making cities inclusive and sustainable (Human Rights Council, 2017). Creating and sustaining population diversity in cities should therefore be a priority in a social justice perspective, and not just as a marketing tool. It seems unlikely that physical structures alone can both create more diversity and solve the problems related to segregation.

Furthermore, housing size is not the only factor influencing population diversity. Affordability is an important factor that I do not specifically measure here, although the diversity in income gives an indication, since a segregated area is often either very cheap or very expensive. The affordability of the newbuilt housing in areas of inner Oslo is likely to affect the population diversity, as large apartments in the inner city tends to be very expensive. One current example is Sørenga and the Barcode area. As mentioned in chapter 3, these areas have a high share of large apartments, but the housing prices are also very high. Per 2017, the Fjord City area has a high share of older adults and a low share of children and youths, and the inhabitants are in general wealthier than the average inner-city inhabitant, which sets it apart from the common population structure in the rest of the inner city (Plan- og bygningsetaten, 2017). In this case, having a high share of large apartments could therefore be negative for some aspects of diversity, such as income.

Urban development and area plans can be used to influence the population composition in an area, both for better or worse. Holgersen (2020) states: "Lift the class, not the place", which is an important perspective when discussing urban policies in Oslo. Area based programmes, and urban development in general, needs to focus more on improving the conditions of those who live in the area, and not simply move the problems (or problematic people) elsewhere, in an attempt to create an area more attractive for "the creative class".

Although the population diversity in the inner city of Oslo has increased, many social problems still prevail. One clear issue is that the increased diversity in the inner city has not led to increased stability in the inner city neighbourhoods (Wessel and Lunke, 2019), which is an important part of the social sustainability concept. This means that despite the increase in diversity, families still tend to leave, although for other reasons than in the 1970's and 1980's. The inner city is a much more popular location than before, which especially can be seen in the increased age diversity. However, it is clear that increased diversity does not automatically solve the social problems that the inner city has struggled with for decades. Housing size and structure is only one of many factors that affect population diversity and needs to be accompanied by other tools and policies to secure multidimensional diversity. Planners should therefore advocate for a holistic view of urban planning, where the overall goals should be to avoid placing more burden on those who are already marginalized, in addition to promoting development that increases the quality of life for the general public.

In conclusion, population diversity *can* be improved by building a more varied housing stock. This means that diversity is one of the aspects of social sustainability that can be affected by the physical structures in the city. However, the effect varies between different categories of diversity, where income, age and education levels seem to be positively influenced by the building of more varied housing, i.e. large housing in this case of inner Oslo. Ethnic diversity was negatively influenced by the building of large housing, maybe due to high housing prices. These results illustrate how difficult it is to plan for diversity in all categories at the same time, as something that works to improve one aspect might worsen the diversity in another category. In terms of working towards goal 11 in the SDGs, Oslo has improved the overall diversity in the inner city, but still struggles with creating stable neighbourhoods and improving the living conditions for marginalised groups. I will wrap up this thesis by saying that it is very positive that the inner city has become more diverse, but much more efforts are needed to make Oslo a more socially just city.

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# Appendix

Table 1 shows the regression results when including interaction term for newbuilt housing 1990-1999 (2-3 rooms) and East, and for newbuilt housing 1990-1999 (4 or more rooms) and East. All results in table 1 are from year 2000.

Table 1 Regression of all diversity categories[1] on housing characteristics and location. OLS estimates with robust standard errors in parenthesis.

|  | Ethnicity | Age | Education | Income |
|---|---|---|---|---|
| Newbuilt housing 1990-1999 (2-3 rooms) | 0.24294*<br>(0.13115) | -0.01892<br>(0.10404) | -0.05610<br>(0.04501) | -0.05401*<br>(0.03013) |
| Newbuilt housing 1990-1999 (4 or more rooms) | 0.14809<br>(0.41836) | 0.49057<br>(0.33897) | 0.38146**<br>(0.17833) | 0.30918**<br>(0.13644) |
| East | 0.04795***<br>(0.00930) | 0.03858***<br>(0.00866) | 0.00575<br>(0.00375) | 0.00118<br>(0.00241) |
| Apartment block/tenement building | 0.22936***<br>(0.01480) | 0.26939***<br>(0.01550) | 0.21205***<br>(0.00715) | 0.17875***<br>(0.00499) |
| Newbuilt housing 1990-2011 (2-3 rooms) East[2] | -0.00002<br>(0.00009) | 0.00002<br>(0.00007) | 0.00004<br>(0.00003) | 0.00003<br>(0.00002) |
| Newbuild housing 1990-2011 (4 or more rooms) East[3] | -0.00035<br>(0.00035) | 0.00008<br>(0.00025) | -0.00008<br>(0.00013) | -0.00008<br>(0.00010) |
| Constant | 35.09430***<br>(6.15316) | 53.063***<br>(6.53920) | 22.56077***<br>(3.02486) | 16.56177***<br>(2.05333) |
| $R^2$ | 0.720 | 0.762 | 0.884 | 0.924 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 214 | 214 | 214 | 214 |

Diversity measured as the entropy score for each category at the census tract level.
[2]Interaction term for newbuilt housing (2-3 rooms) and East.
[3]Interaction term for newbuilt housing (4 or more rooms) and East.
* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table 2 shows the regression results when including interaction term for newbuilt housing 1990-2011 (2-3 rooms) and East, and for newbuilt housing 1990-2011 (4 or more rooms) and East. All results in table 2 are from year 2011.

Table 2 Regression of all diversity categories[1] on housing characteristics, location and population density. OLS estimates with robust standard errors in parenthesis.

| | Ethnicity | Age | Education | Income |
|---|---|---|---|---|
| Newbuilt housing 1990-2011 (2-3 rooms) | 0.10732* (0.05927) | -0.11639* (0.06730) | -0.02414 (0.03031) | -0.01550 (0.023952) |
| Newbuilt housing 1990-2011 (4 or more rooms) | -0.22617 (0.20560) | 0.46280** (0.22638) | 0.13950 (0.10765) | 0.094979 (0.08737) |
| East | 0.04420*** (0.00686) | 0.03398*** (0.00882) | 0.01929*** (0.00348) | 0.009723*** (0.00256) |
| Apartment block/ tenement building | 0.13715*** (0.01689) | 0.17613*** (0.01875) | 0.12597*** (0.00773) | 0.01087*** (0.00633) |
| Population density (per acre) | 0.80863** (0.39242) | 1.27189*** (0.42558) | 0.61335*** (0.16146) | 0.42984*** (0.12690) |
| Newbuild housing 1990-2011 (2-3 rooms) East[2] | -0.00001 (0.00002) | 0.00002 (0.00003) | -0.000004 (0.00001) | -0.00001 (0.000009) |
| Newbuild housing 1990-2011 (4 or more rooms) East[3] | -0.00006 (0.00015) | 0.00004 (0.00021) | 0.00004 (0.00009) | 0.00004 (0.00007) |
| Constant | 27.98609*** (5.54416) | 50.01575*** (9.16485) | 27.97329*** (4.20256) | 22.04868*** (3.24594) |
| $R^2$ | 0.758 | 0.725 | 0.874 | 0.891 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 212 | 212 | 212 | 212 |

[1]Diverstiy in all categories measured as the entropy score for all categories at the census tract level.
[2]Interaction term for newbuilt housing (2-3 rooms) and East.
[3]Interaction term for newbuilt housing (4 or more rooms) and East.
* p<0.10, ** p<0.05, *** p<0.01.

Table 3 shows the regression results when including interaction term for newbuilt housing 1990-2011 (2-3 rooms) and East, and for newbuilt housing 1990-2011 (4 or more rooms) and East. All results in table 3 are from year 2015.

Table 3 Regression of all diversity categories[1] on housing characteristics, location and population density. OLS estimates with robust standard errors in parenthesis.

|  | Ethnicity | Age | Education | Income |
|---|---|---|---|---|
| Newbuilt housing 1990-2011 (2-3 rooms) | 0.09442* (0.05558) | -0.12746** (0.05846) | -0.01011 (0.02130) | -0.00797 (0.02041) |
| Newbuilt housing 1990-2011 (4 or more rooms) | -0.15788 (0.18654) | 0.52168** (0.21153) | 0.08918 (0.07861) | 0.08606 (0.07713) |
| East | 0.02305*** (0.00707) | 0.02407*** (0.00725) | 0.00967*** (0.00220) | 0.00707*** (0.00208) |
| Apartment block/ tenement building | 0.16741*** (0.01569) | 0.17041*** (0.01626) | 0.10418*** (0.00554) | 0.10658*** (0.00524) |
| Population density (per acre) | 0.91316*** (0.34698) | 0.82391** (0.34563) | 0.29802*** (0.10440) | 0.30088** (0.09737) |
| Newbuilt housing 1990-2011 (2-3 rooms) East[2] | 0.00001 (0.00002) | 0.00003 (0.00002) | -0.00001 (0.00001) | -0.00001 (0.00001) |
| Newbuild housing 1990-2011 (4 or more rooms) East[3] | -0.00006 (0.00013) | -0.00001 (0.00013) | 0.00004 (0.00005) | 0.00003 (0.00005) |
| Constant | 36.35818*** (6.95681) | 59.52342*** (9.31394) | 23.47844*** (3.15165) | 23.46958*** (3.02984) |
| $R^2$ | 0.756 | 0.740 | 0.905 | 0.914 |
| F-test | 0.000 | 0.000 | 0.000 | 0.000 |
| N | 209 | 209 | 209 | 209 |

Diversity in all categories measured as the entropy score for each category at the census tract level.
[2]Interaction term for newbuilt housing (2-3 rooms) and East.
[3]Interaction term for newbuilt housing (4 or more rooms) and East.
* p<0.10, ** p<0.05, *** p<0.01.