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Evaluating the impact of social housing construction on segregation patterns in Vienna

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Abstract

This thesis investigates the impact of Vienna's resumption of social housing construction on segregation. It assesses the impact of the policy on segregation indices across Vienna's 23 districts and 250 subdistricts. The analysis finds that construction was pursued in a way that marginally increased segregation across districts which indicates that segregation was most likely not considered in the planning of the placement of the new social housing units. Moreover, the results indicate that the heterogeneity of the different districts plays a large role in terms of influencing segregation. This especially applies to the number of sub-districts but also to socio-economic characteristics. The findings suggest that a substantial amount of the segregation is caused by district heterogeneity. However, no indications for heterogeneous treatment effects could be found.

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1. Introduction

Policy decisions around housing have a profound impact on forming cities and living quality, affecting everything from social cohesiveness to economic prospects. One of the most significant ways in which governments and policymakers can ensure housing and improve living quality is through the provision and management of social housing- which (although shrinking) remains an established part of most housing regimes choice all across Europe. Throughout the continent, social housing regimes can range from being almost nonexistent or marginal to playing an important role in the national housing market.

There are two distinct categories into which social housing systems can be classified- the universalistic and the residual housing regime. While the social policies of the universalistic model address the population as a whole, the residual approach focuses mainly on lower-income groups or otherwise disadvantaged groups residing in social housing (Malpass 2014; Boelhouwer 2020; Norris and Murray 2004). Residual social housing regimes usually make up a smaller percentage of the housing stock and the access to social housing is usually given to a much smaller percentage of the population. The right to enter social housing is usually dependent on a few criteria which tend to include income and in some cases additional criteria meant to measure vulnerability (e.g. having been evicted, illness, disability or age). This approach is more cost-effective and the purpose of it is to provide housing to the most vulnerable people who would have difficulties finding decent housing in the private sector (Priemus and Dieleman 2002).

In countries where the social housing sector is more pronounced, the provision of public housing can be one of the most important pillars for welfare provision- a trampoline for disadvantaged groups and a mechanism for equal opportunity. However, in the last decades the social housing regimes have started to become smaller and host a smaller range of socio-economic backgrounds. Social housing is being refocused on the most economically needy population groups, and eligibility regulations are restructured to affect the other, nowadays much smaller, social housing sectors. The competition law in the EU contributes to this tendency towards a restricted number of potential beneficiaries, encouraging states with more universal approaches to move toward a more targeted and thus residualised system (Czischke 2014; Boelhouwer and Hoekstra 2009; Angel 2023). This change can be referred to as residualisation, which can be defined as a process in which social housing increasingly moves towards affordable housing options, becoming a "safety net" for people who can't find suitable private sector housing because of their age, disability, or poverty (Malpass and Victory 2010). Since the 1990s, due to the overall restructuring of the welfare state, scholars have observed a trend of residualisation intensifying across Europe. Due to a decreasing amount of government

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support for social housing, housing stocks all across Europe are being-re-commodified (Angel and Mundt 2023).

This is problematic because, throughout the history of social housing, especially in the United Kingdom and the United States, a lot of social housing estates had become associated with poverty and segregation, exacerbating social divisions by fostering secluded areas of disadvantage. The marginalisation and process of degradation of districts with high levels of social housing can be a problem for social cohesion and lead to a lowered quality of life overall. It is sometimes also referred to as "ghettoisation" (although this term is contested and will not be used in this paper) and refers to a process in which the higher concentration of public, low-income housing in segregated regions creates a number of socioeconomic problems, such as increased crime rates, worsening public health, and restricted access to high-quality education. People living in areas that have undergone this process usually suffer from not only fewer opportunities but also stigmatisation and isolation. Social housing stock can lead to districts undergoing such a process, especially if their population hosts the most marginalised and disadvantaged members of society.

Residualisation tendencies are less prevalent in universalistic housing regimes which usually give access to a big percentage of the population and allocate the access to housing through the use of waiting lists. Oftentimes, these are combined with sorting mechanisms,e.g., citizens in urgent housing need might get prioritised in the waiting list or a percentage of the social housing stock might be reserved for people fulfilling certain needs-based criteria. This way governments aim to ensure that there is a social mix within social housing whilst still making sure that vulnerable people find access to it. The balance between these two is not always easily achieved and also largely depends on the size of the social housing stock as well as the exact criteria to access it. One of the main reasons for governments to choose a universalistic system is the idea that it will foster a social mix within social housing and also blend more easily into the overall housing landscape. By making social housing attractive for middle-income groups and having a socially mixed population, the risk of stigmatisation and residualisation becomes inherently smaller.

Residualisation however, usually occurs and is particularly problematic when social housing is concentrated in spatial clusters. Therefore, the interplay of social housing and residualisation is what essentially leads to the marginalisation and degradation of certain residential areas. In order to create effective policy responses that help prevent a vicious cycle of underinvestment, increased stigmatisation, and weak social cohesion, policymakers must increasingly monitor the extent of segregation and residualization in social housing. The placement of social housing in particular is a policy decision that has long been crucial in defining and impacting the social fabric of cities and has the potential to foster a social mix overall. By making sure that social housing is not consigned to the

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periphery but is instead skillfully woven into the urban fabric, policymakers can create social cohesion. By locating social housing in different locations throughout the city, they can foster relationships across socioeconomic divisions, improve mutual understanding, and create more cohesive communities.

Nevertheless, the neoliberal discourse around housing as well as outside pressure by e.g., the EU competition law have forced many universalistic systems to adopt more targeted policies and thus residualisation is on the rise. It is therefore even more important that social housing units are well integrated into the city. Next to fostering a diverse social housing population, it is the most important way in which policymakers can support social cohesion and prevent the creation of socio-economically weak neighbourhoods. Therefore, the avoidance of segregation between the social housing sector and the private housing sector is of interest for many governments (Czischke 2014).

This is also the case for Vienna, a universalistic housing regime with one of the cities with the biggest social housing stocks in all of Europe. Continuously, over the last decades governing party of Vienna has reiterated that successful coliving through the fostering of a social mix is one of their greatest policy priorities. That is why they have stressed the importance of a) having social housing dispersed throughout Vienna and b) allowing for middle-class families in order to also access social housing and therefore prevent residualisation (as well as making sure it is attractive for them) (Putschögl 2023; Kadi, Vollmer, and Stein 2021). Recognising the importance of carefully placing and constructing social housing throughout the city, it came as a surprise to many when the government announced that it would stop constructing social housing in 2004. In the period of 2004-2015, only limited-profit housing associations were allowed to plan and construct social housing, which led to a decline of construction.

The resumption of construction of social housing at the end of 2015 is therefore interesting to evaluate in terms of segregation because it meant that Vienna had gained back a powerful policy tool that can be used to alter segregation patterns. Therefore, the central Research Question pertains to whether the recently initiated construction efforts were distributed over the urban area in a way that aligns with promoting de-segregation. The structure of the thesis will be as follows- after the introduction, a literature review will investigate the relationship between residualisation and segregation, as well as outline in which ways social housing policy has affected segregation (positively or negatively) in order to then delve into Vienna as our case study. After contextualising the Viennese housing regime, this thesis will explain the methodology applied to the project. Descriptive statistics will allow exploring existing social housing trends in Vienna setting up the analysis chapter which consists of the

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calculation of dissimilarity indices as well as a multiple regression analysis. Lastly, the findings will be discussed and policy implications explained.

2. Literature Review

2.1 Segregation

Segregation is a persistent issue in urban environments as it greatly impacts the overall social and economic environments of cities. It can be defined as the geographical separation of two or more social groups, whereby one group often has better access to educational or occupational resources and an overall better quality of living. It can lead to the creation of urban pockets with high concentrations of disadvantage and even lead to the forming of marginalised neighbourhoods, or "ghettos". Due to these areas having limited access to quality education, decent employment opportunities and essential basic services, the socio-economic disadvantage is usually reinforced and cycles of social exclusion exacerbated. It is therefore fundamental to consider segregation when designing and evaluating housing policies, as it affects the overall social cohesion of a city and has the potential to undermine equality of opportunity(Hoekstra 2017; Norris and Murray 2004).

Whilst ethnic and racial segregation has already been extensively studied, this thesis focuses on the segregation between social and private housing (Czischke 2014). Social housing, which refers to the housing establishments that are owned and administered by the state and sometimes in cooperation with non-profit housing associations, usually apply income limits as one of their primary criteria for access. Whilst most social housing, in its origins, was a large-scale intervention to house the lower middle income working population, this is no longer the case. Many social housing estates across the globe have become synonymous to hosting mainly low-income those who have difficulties to find housing access on the private housing market. This process of change in which the objective of social housing moves from a broad tenure towards becoming a safety net for individuals who are unable to sustain themselves is also referred to as residualisation (Pearce and Vine 2013). Areas with a lot of social housing units that have been heavily residualised can end up becoming marginalised and deprived. For the residents of these social housing units this can come with many significant repercussions including issues of social exclusion, stigma, and lowered quality of their neighbourhood. Advanced levels of residualisation lead to deprivation neighbourhoods which exhibit many characteristics of disadvantage, such as high rates of unemployment and few job opportunities, a high proportion of impoverished students in schools, high crime rates and even disparities in health- in short, less equal opportunities for someone who grows up there (Berube 2005).

The physical separation from private housing has the potential to intensify the process of a residualization. A prevention of segregation can therefore also prevent the downgrading of neighbourhoods and ensure better equality of opportunity. This is very relevant nowadays because social housing sectors all across Europe are experiencing residualisation tendencies in the last two decades. The social housing sectors are shrinking, even in generally universalist social housing regimes, they are in the process of residualisation. (Malpass and Victory 2010).

2.2 Housing policy and its potential to impact segregation levels

Housing policy can have a plethora of goals as outcomes including improving quality of living, accessibility to housing, social cohesion and equality of opportunity. Urban policymakers have long found that that social mixing (i.e., preventing segregation) improves many such beneficial outcomes such as increased social capital, social cohesiveness, chances for social mobility, better services, and even lower crime rate and residential stability (Marra, Melis, and Gelormino 2015; Arthurson 2002). Essentially, this prevents social housing from being associated with a few certain district or certain shared districts as it is the case in many cities (e.g. peripheral districts, working-class districts or districts that saw a lot of housing construction post-WW2). Instead, and this is particularly true in cities with a large social housing stock, social housing is accepted as an integral part of the housing landscape in every district without certain socio-economic or political stigmas being connected to them. By placing social housing well, policymakers can foster social cohesion by ensuring that social housing is expertly integrated into the urban fabric rather than being relegated to the periphery. They can promote relationships across socio-economic divides, enhance mutual understanding, and build more cohesive communities by dispersing social housing across the city. Therefore, it is incredibly important to strategically plan construction of new social housing units, in order to foster de-segregation and prevent the increase of deprecation of any residential areas.

Policy decisions therefore have the power to shape and influence segregation, residualisation and the decay of neighbourhoods. The most important policy decision which dictates levels of segregation between the social housing population and the private housing population is related to the location of where social housing is constructed. The most important policy tool is the careful placement of social housing units throughout the city. A cohesive as well as inclusive urban setting can be created by constructing social housing all over the city.

Nevertheless, despite the need for social mixing, recent policy trends in Europe are actually going in the opposite direction and are worsening segregations as well as residualisation tendencies. Increasingly more governments make allocation of social housing more focused and even the bigger,

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more universalist social housing sectors in Europe are now moving towards residualisation (Angel and Mundt 2024a; Hoekstra 2017).

Starting in the year 2005, there have been discussions regarding housing on the EU level. The result of which was a framework that defines the housing industry would be categorised as an services of general economic interest (SGEI), which leads to it falling under EU competition legislation. Main reason for that is the fact that housing does not fall under any of the three welfare pillars of education, health or social security but instead tends to be understood in terms of property and ownership (Cziske). This had repercussions for many nationals across the EU as the notion of social housing that this new framework implies conflicts with several national forms of social housing supply. As a consequence of that many nationals felt pressure to impose additional criteria for access to social housing, which would lead to social housing to fall under requirements of "social services", instead of SGEI. Other countries decided to completely liberalise and privatise their social housing stock.

2.3 Vienna's segregation tendencies

After establishing the relevance of segregation for equal opportunity, and after outlining the role that housing policy plays in this, we can now introduce the case of Vienna to examine these dynamics. Vienna offers a very interesting case of social housing policy and its effects and is often considered a role model for other cities. Vienna is one of the longest standing and most universalist social housing regimes that exist worldwide. In contrast to many other cities, Vienna has managed to preserve a much larger social housing stock (although that is also declining as can be seen later) still accommodating a sizable part of the residential population. Through an analysis of Vienna's social housing policies and how they impact segregation, a lot of important lessons can be learnt about social housing segregation in other metropolitan settings.

Vienna's social housing sector consists of two parts: Municipal housing and Limited-Profit Housing (LPH), whereby the former is planned, constructed and administered by the state (to be exact it is administered by the "City of Vienna - Wiener Wohnen") and the latter is constructed in cooperation between the city of Vienna and so-called "limited-profit housing associations" (LPHA). The decisions on where to build municipal housing are made centrally by the Viennese government, in consultation with local district governments. LPH is constructed in partnership between the state and LPHAs, whereby the government of Vienna is included in discussions regarding the planning and construction of social housing but has less discretion over placement and design of social housing units in comparison to municipal housing. Around two thirds of all social housing is municipal housing, whilst one third is LPH (Angel and Mundt 2024b).

In the 40 years in which the Austrian Social Democratic Party, in "Sozialdemokratische Partei Österreich" (SPÖ), housing policy in Vienna has long followed a generally similar path. It was a policy priority to keep the social housing character of Vienna universalist. Enabling a social mix and therefore preventing segregation has often been stressed in speeches in congress by both Michael Häupl and Michael Ludwig in congress as well as press conferences. For instance, at the townhall correspondence in 2014, Michael Ludwig stated that he believes the main reason for the success of the Viennese model is its continuous focus on enabling a social mix (Ludwig 2014). Therefore, the SOÖ has kept the the upper-income limit for social housing residents high- i.e., at 53340€/year, which means that social housing remains (theoretically) available to about 75% of the population (Kadi, Vollmer, and Stein 2021). In practice, that is not the case due to the needs-based criteria for council housing and the fact that the demand for housing is significantly larger than the supply, which explains why the waiting lists for municipal housing access spans years.

Anyhow, since the late 2000s and the 2010s, the SPÖ has received a lot of pressure from opposing parties, external actors and the EU to change the policy trajectory. For instance, the opposition parties such as the Freedom party of Austria (FPÖ) and Austrian People's Party (ÖVP) have argued that social housing was not accessible for those who should be entitled to it and have proposed to implement salary checks on the social housing population, narrow the criteria for accessing social housing and privatise some of the housing stock. Multiple attempts to impose salary checks and privatise social housing have been rejected by the SPÖ. However, the competition law from the EU has led to the SPÖ restructuring a large part of the social housing stock to reserve it for more precarious populations. For instance, two third of all new municipal housing that was built since 2015 have to be built as "SMART" houses- i.e., as particularly small, affordable apartments which shall only be available to residents who can prove an "urgent housing need". Due to these policy changes, Vienna's social housing character is slowly becoming more residualised. That was also found by Angel and Mundt (2024), who evaluated recent policy developments in terms of residualisation in Vienna. In the last decades, Vienna has seen levels of social housing residualization grow. Although the rate of residualisation is lower compared to other large European cities, it is still significant and worth noting (Angel 2023). Here the residualisation tendency has been lower but can still be observed. Especially due to the construction stop and a shrinking percentage of social housing along with more targeted housing policies that protect certain parts of the population, Vienna loses its universalist character.

Mundt (2024), as well as Mundt and Amann (2010) and Mundt (2018) indicate that this residualization especially applies to the municipal rental sector in Vienna, which can most likely be attributed to the higher rent requirements for renters' down payments for LPH.

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In addition to Vienna's slowly residualising housing stock, another one of Vienna's greatest challenges is its gradual population growth. In the last decade, Vienna has seen its population grow by around 10.000 people each year (City of Vienna 2022). To accommodate that, the housing sector was forced to also expand rapidly. However, as the growth of the population and thus the demand for housing outgrew supply, Vienna saw its rental prices grow rapidly on the private housing market. Rental prices in Vienna increased by 39% between 2004 and 2015 (Wiener Landesstatistik 2023). Whilst many old rental contracts in Vienna remained protected, most new rental contracts are no longer under rental control. The resumption of social housing construction by the state of Vienna was therefore primarily a policy to ensure housing accessibility in Vienna and stock up on the demand for (affordable) housing supply. In the speech by the former mayor of Vienna, where he announced the social housing construction resumption, he stressed the need of upholding the promise of decent housing for all. The original plan was to construct 2,000 new municipal housing units by 2020 (Putschögl 2015), a mark that was missed by about 400 units. Nevertheless, another 3.700 units have been planned or are in construction since then (City of Vienna 2022). The reason that this policy is so important in the context of segregation is due to the fact that the placement of new social housing units is the most important factor influencing the segregation of social housing. It is also one of the two deciding factors that determine if social housing becomes residualised and marginalised (the other one being access criteria to said housing). Hence, this large policy shift has the potential to impact Viennese segregation patterns greatly. As municipal housing placement, construction and administration is at full discretion of the Viennese state, it gives even more power to the governing party to shape the housing landscape in Vienna. It is an opportunity for the SPÖ to ensure the urban development in Vienna progresses towards a wider social mix- as they have continuously reiterated this as being the foundation of the Viennese success model.

This thesis will evaluate if the construction resumption had an impact on the overall segregation tendencies in Vienna. It tests whether the policy, although that was not the primary objective (seeing that the primary objective was simply to create affordable housing) successfully dispersed throughout the city in a de-segregating tendency. Thus the research question investigated in this thesis is :

How did the resumption of municipal social housing construction by the city of Vienna in 2015 impact segregation patterns in Vienna?

3. Data and Methodology

3.1 Data Collection and Sources

The data was retrieved from the housing registry of years 2009-2023. The data was available yearly and the units of analysis are districts and subdistricts. The numbers were only accessible in aggregated terms (aggregated by sub-district). As for the socio-economic controls (unemployment, overcrowding and homelessness), these are only recorded once every decade in the nation-wide census. Therefore, the pre-treatment control values applied to the analysis come from the 2011 census whilst the post-treatment control values applied were from the 2021. This does limit the accuracy of the controls, hence, control coefficients should be interpreted carefully. Nevertheless, these controls enable taking account of some heterogeneous factors between districts and, due to them being available on sub district-level they can aid to give more context to out dependent variables and the consequences it could have for residualisation.

3.2 Regression analysis

In order to examine how the resumption of construction affected segregation, a few multiple linear regression models are going to be used. This method was selected because they can handle several predictors at once. For fixed effects a panel linear model (plm) is used. In the base model a dependent variable and a few district characteristics are included as controls. The controls make the assessment of the policy change more robust as they take into account major characteristics that would lead to a higher Duncan dissimilarity index - especially the amount of subdistricts (as that is what each district will be divided by in the calculator of the index), but also housing percentages and whether a district is an inner district of Vienna. Moreover, models with fixed effects are included to improve robustness of the analysis. It is meant to take out some of the time-invariant unobserved heterogeneity across districts as well as temporal differences that happened across all districts. Moreover, this thesis will test if there are heterogeneous treatment effects depending on different district characteristics by looking at the interactions between controls and the policy change.

Dependent Variable

The dependent variable is the segregation index which was calculated using the method of the duncan dissimilarity index. It measures the average spatial separation of two different groups in a spatial area that is separated into parts. The parts are the subdistricts, hence, each district will be divided into as many sub districts as it consists of, (which ranges from minimum 3 (in district 8) and maximum 32 (in district 22) . The value between 0 to 1 denotes to what extent the share of social housing in each sub-district differs from the share of social housing in the overall district.

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How to measure segregation : the Duncan dissimilarity index

$$D_{ab} = \frac{1}{2} \sum_i |p_{ia} - p_{ib}|$$

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"The spatial "distance" between occupation groups, or more precisely the difference between their areal distributions, is measured by the index of dissimilarity. To compute this index, one calculates for each occupation group the percentage of all workers in that group residing in each area unit (tract or zone-sector segment)" (Duncan and Duncan 1955).

Essentially, this means calculating the difference between the percentage of social housing in a subdistrict and the absolute percentage of social housing. The sum of all the differences divided by half gives a value between 0 and 1, whereby 0 is a completely diverse area and 1 a completely segregated space. This, however, also means that the value only presents a segregation mean and does not give more context about clusters or degree of isolation. However, it is a very useful measurement that can serve as a base for other research.

Independent Variable: the resuming of social housing construction by the city of Vienna which is marked with a post-2016 dummy, which denotes all years including and after 2016.

Control Variables: Key variables include

      1.   percentage of social housing

This measures the percentage of people who live in social housing. It measures the overall percentage of the housing market, which includes all of Vienna's residents and includes homeowners as well as renters. Depending on the percentage that social housing makes up in a district, it might be easier or harder to gradually spread it across all subdistricts. The relationship between percentage and segregation is not quite straight forward. However, observational evidence shows that it is easier for an urban planner to place a lower percentage of social housing in every subdistrict ,than to place high percentages (above 35% in some of the outer districts) evenly into all subdistricts, mainly due to the fact that not all sub districts offer the same ground for construction of social housing.

      2.   Number of sub districts per district

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A higher number of sub districts means that in the calculation of the dissimilarity index, the district is split into more units which are compared. I.e., district 8 with only 3 sub districts can more easily distribute the same percentage of social housing into the three sub-districts, compared to district 22 which consists of 32 subdistricts

3. Districts category- i.e. if it is an inner district,

Inner and outer districts might differ in terms of socioeconomic conditions (living close to the first district often means living closer to the old/town, city centre, connected to the best employment opportunities, infrastructure, and historical development patterns, all of which can affect segregation. Indeed, within urban studies , scholars often distinguish between central and peripheral areas to understand spatial disparities and segregation patterns (Mundt & Amann, 2010). It is expected that inner district would show less segregation due to their size being smaller and due to being split into fewer sub-districts.

3.3 Socioeconomic controls:

Including socio-economic controls can allow this thesis to give more depth and meaning to our dependent variable. The dissimilarity index is essentially a value that indicates the evenness of the spread of social housing. This can show if there are segregation tendencies which are relevant for understanding and assessing the risk of residualisation. Nevertheless, additional context, such as if socio-economically weaker subdistricts show stronger or weaker tendencies of segregation, can add more depth to the analysis and allow a better understanding of the situation. The socio-economic context is crucial when looking at segregation and even more so when assessing residualisation tendencies. If one or more socio-economic controls indicated that districts with stronger signs of disadvantage (i.e., higher rates of unemployment, higher rates of overcrowding and higher rates of homelessness) show stronger segregation tendencies, that would mean that residualisation and marginalisation of residential clusters could become a problem.

4. Unemployment rates,

The first socio-economic control is measured by the unemployment percentage. This control measures the percentage of unemployed people in a given sub-district, excluding those in education and retired people. It is relevant for the regression analysis because segregation may be exacerbated by high unemployment rates, which are frequently linked to higher degrees of socioeconomic deprivation. Studies of residential segregation and social mix depend heavily on socioeconomic status, which includes employment opportunities (Pearce & Vine, 2013). Therefore, if creating a social mix was

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taken into account in the policy design, it would be expected that higher rates of unemployment would discourage building more social housing units as that would lead to a potential exacerbation of the socio-economic advantage and could worsen residualisation tendencies. Consequently, a negative correlation is expected.

5. Overcrowding

Segregation patterns may be influenced by overcrowding, which can be a sign of poverty and a reflection of financial difficulties. Studies of social and geographic segregation frequently employ overcrowding and housing quality as markers (Priemus & Dieleman, 2002). As overcrowding also measures deprivation and standards of living, policy decisions to prevent residualisation would try to not build more social housing units in areas with high concentrations of overcrowding. As with unemployment, a negative correlation is expected

6. Homelessness

The prevalence of homelessness may be correlated with the availability and distribution of social housing and serve as a gauge of the disadvantage in a community. As with the previous two socioeconomic controls, this control is meant to assess whether social housing was constructed in more disadvantaged areas. If segregation and residualisation were considered in the decision of where to place new social housing, it would be assumed that districts with higher rates of homelessness would receive fewer new social housing units. As with the other two socio-economic controls, a negative correlation is expected.

3.3 Fixed effects

The use of fixed effects models is justified by the need to control for time-invariant district factors that may influence segregation as well as time-varying factors (such as the pandemic) that would affect all districts. This approach allows us to increase the robustness of the effect of the resuming of construction on segregation indices, whilst also assessing potential heterogeneity of the treatment effect using interactions. Both the temporal differences that occurred in every district and some of the time-invariant unobserved variation between districts are intended to be eliminated this way. For instance, if one or more of the socioeconomic controls demonstrate increased or decreased segregation

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after the policy, that would provide some insight into whether sub-districts are in the process of marginalisation or degradation as a result of the policy change.

3.4 Interaction Effects:

In addition to the fixed effects models, the analysis also considers interaction effects between the post-2016 dummy variable (which measures the policy impact) and other controls. Specifically we look at the interaction between :

1. The policy and the number of sub districts
2. The policy and whether it is an outer district
3. The policy and the unemployment rate
4. The policy and and the rate of overcrowding
5. The policy and and the rate of homelessness

As noted above, these interactions will allow the thesis to interpret and contextualise the regression coefficients better. If the thesis was to find that numbers of sub-districts and district category mattered in how they responded to the policy, that might indicate that policies might have to be implemented less homogeneously. For instance, if segregation of big districts was affected more strongly by the resumption of construction, it might be worth considering involving the local governments of the biggest districts in policy decisions regarding social housing construction. At the same time, it would be interesting to find out if some districts, depending on their characteristics, are less prone to be affected by a policy change so that complementary policies could be put in place to accommodate such heterogeneity. Lastly, if the interactions between socio-economic controls and the policy change were to be significant, that would give a lot of context to understand the consequences and severity the segregation. For example, finding that districts with higher levels of overcrowding would be correlated with higher rates of segregation could indicate that city wide inequalities could potentially deepen as the districts with higher levels of disadvantage are also the ones with more segregation.

4. Descriptive Statistics

Fig.1 Percentage of the population living in social housing

Percentage of Population in Social Housing vs. Non-Social Housing (2009-2023)
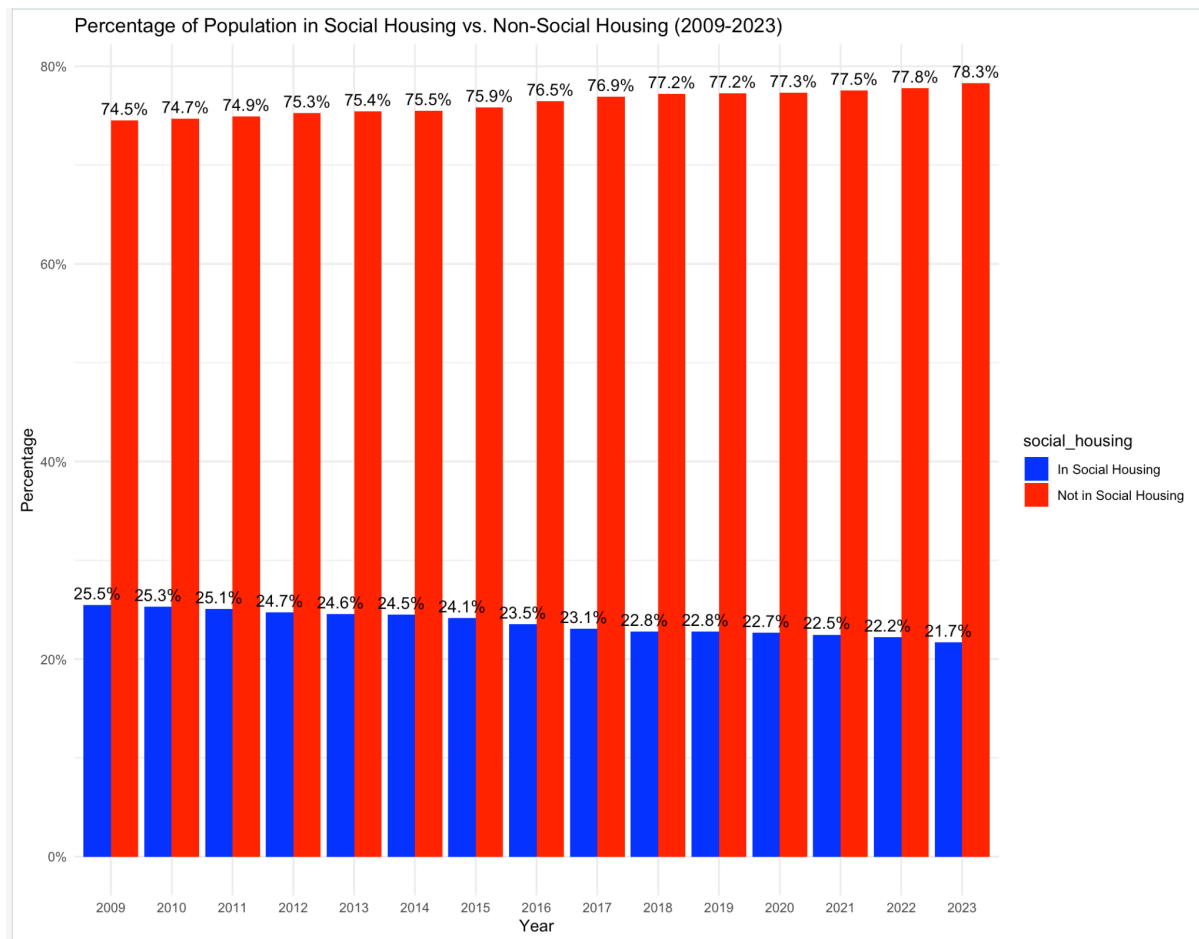
This graph shows social housing as a percentage of the resident population of Vienna. This includes homeowners as well as renters. In general, social housing does remain a prominent part of the housing regime. As of 2023, 76% of all Viennese residents live in rented housing (of any kind). Hence the social housing proportion of rental rental housing (excluding homeowners) is around 29% (Wiener Wohnen 2023). It is striking that the trend of social housing declining remains constant throughout the years. This indicates that, when considering absolute numbers, the social housing construction resumption has not affected social housing to a great extent. However, the graph does not demonstrate where or how social housing construction might differ in terms of placement and its consequences for segregation and residualisation in Vienna, which will therefore be analysed in the following chapter.

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Fig. 2 Percentage of the population living in social housing per district
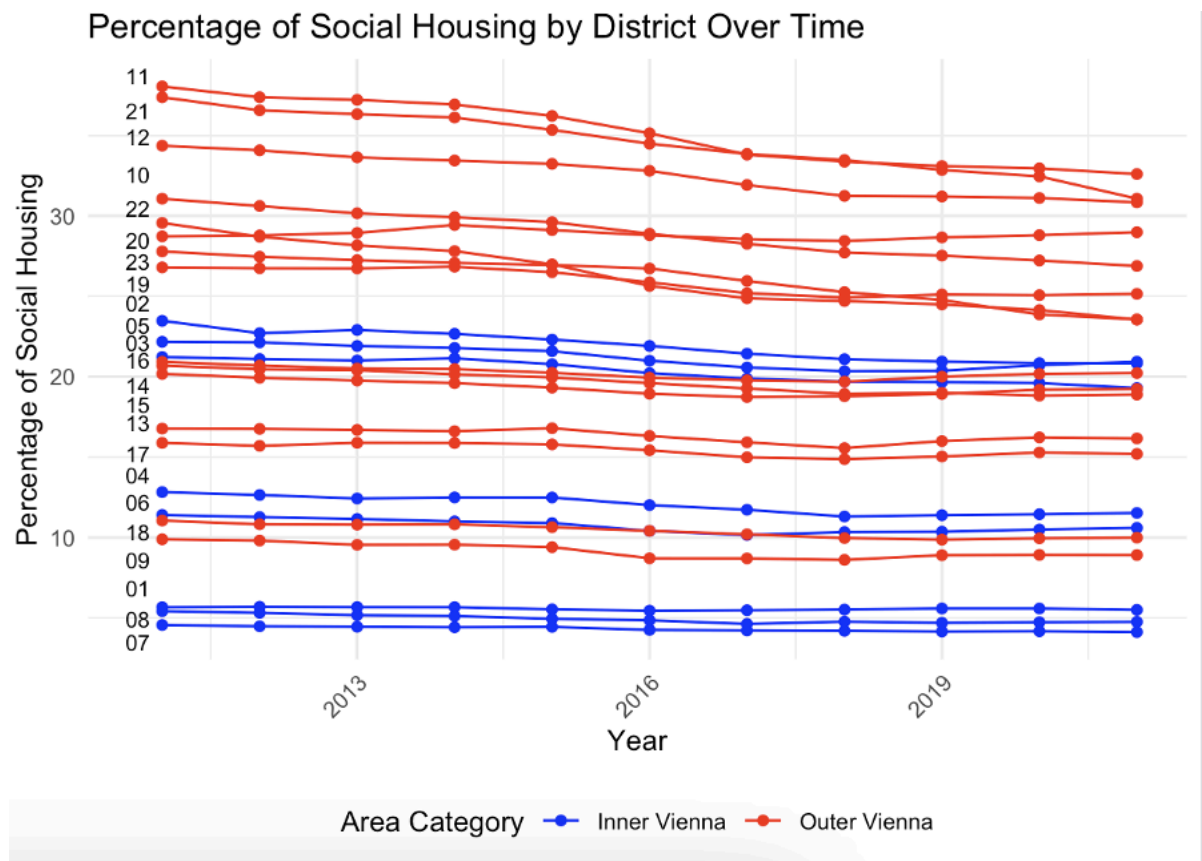
This chart gives an insight into how much space (in percentage) the social housing units take up in each of Vienna's 23 districts. The blue lines denote inner Viennese districts (which means they are located within the so-called "belt" that separates the inner districts 1-9 and the other districts 10-23). Percentages of social housing will be a control variable in my regression analysis, as it is usually more challenging to evenly spread higher percentages of social housing across all sub-districts than lower percentages. Notably, some of the smallest districts in Inner-Vienna show up at the bottom of the graph. The three districts with the lowest percentages of social housing (6-7%) are the 1st, 7th and 8th district, which are centrally located district, where the residents usually have a higher socio-economic status and are home to some of Vienna's most prestigious institutions such as the university and the opera., which are the 1st, 7th and 8th have the lowest percentage. Meanwhile a lot of outer districts have high percentages of their population living in social housing. This finding leads this thesis to

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include a "district category" control variable into the regression analysis, in order to see if there are correlations to be found.

Generally, it can be seen that most districts are seeing their social housing stock gradually decrease in terms of percentage of total housing- especially districts with the highest initial percentage of social housing tend to see a more pronounced decrease. The top 8 districts with the biggest social housing percentage are notably all outer Viennese districts. This might be due to the fact that outer districts have more construction in general hence the social housing construction stop would be more visible here as private construction would have continued at a regular pace whilst social housing construction was slowed considerably.

Discussion of descriptive statistics

Overall, it can be observed that the social housing stock is slowly declining, as is the case in almost all European cities. Taking the fact that social housing is not being sold or demolished in Vienna into account (rather the opposite is the case, as the Viennese government is following a policy agenda of renewing some of its oldest social housing units), the decline of percentage must come from private construction increasing faster than that of social housing.

It is important to consider that, whilst social housing construction by the government was re-started in 2016, the finalisation of social housing units would only follow a few years later. As the data set refers to people actively living in social housing, the policy changes would only show up after residents would have moved into the newly constructed social housing units. The latter fact in combination with the pandemic which greatly impacted housing construction (in both the private and public sector) between 2020 and 2022 might have added to the slowness and gradualness of the change. Overall, the charts indicate that the resumption of housing construction by Vienna in 2016 did not create a very visible supply shock in terms of percentages in the whole city but seem to have been rather gradual. Looking at the percentiles continuously declining, it seems as though social housing construction had continuously been much slower than the construction on the private housing market.

As it seems like the resumption of social housing construction in 2016 did not make a significant change in absolute numbers, it can be assumed that potential shifts in segregation due to the policy would be caused more by the placement of new social housing units than by shifts in the proportion of housing overall.

The second graph (Fig. 2) shows a continuation of what could be seen in the first graph. It can be observed that that the declining percentage is mainly due to a handful of outer districts seeing their

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housing stocks decline (mainly 11, 21, 22), whilst most districts, and this applies especially to all inner districts, show almost no trends of change throughout the years. Again, considering the fact that social housing was not demolished or sold in the last two decades, this must therefore imply that the social housing construction was continuing at a slower rate than private housing construction in these districts specifically. This is also consistent with the fact that over the past 20 years, housing construction (private and social) has increased in the outer districts, with the 21st and 22nd districts in particular developing sizable residential complexes to meet Vienna's rapidly growing population. Moreover, the 21st and 22nd districts are also among the biggest districts (*see annex Fig. 10*) which would explain why the relative change would show in a graph of absolute scale.

5. Regression analysis

5.1 Segregation indices

Fig. 3 Segregation Indices at City, District and Sub-district Levels
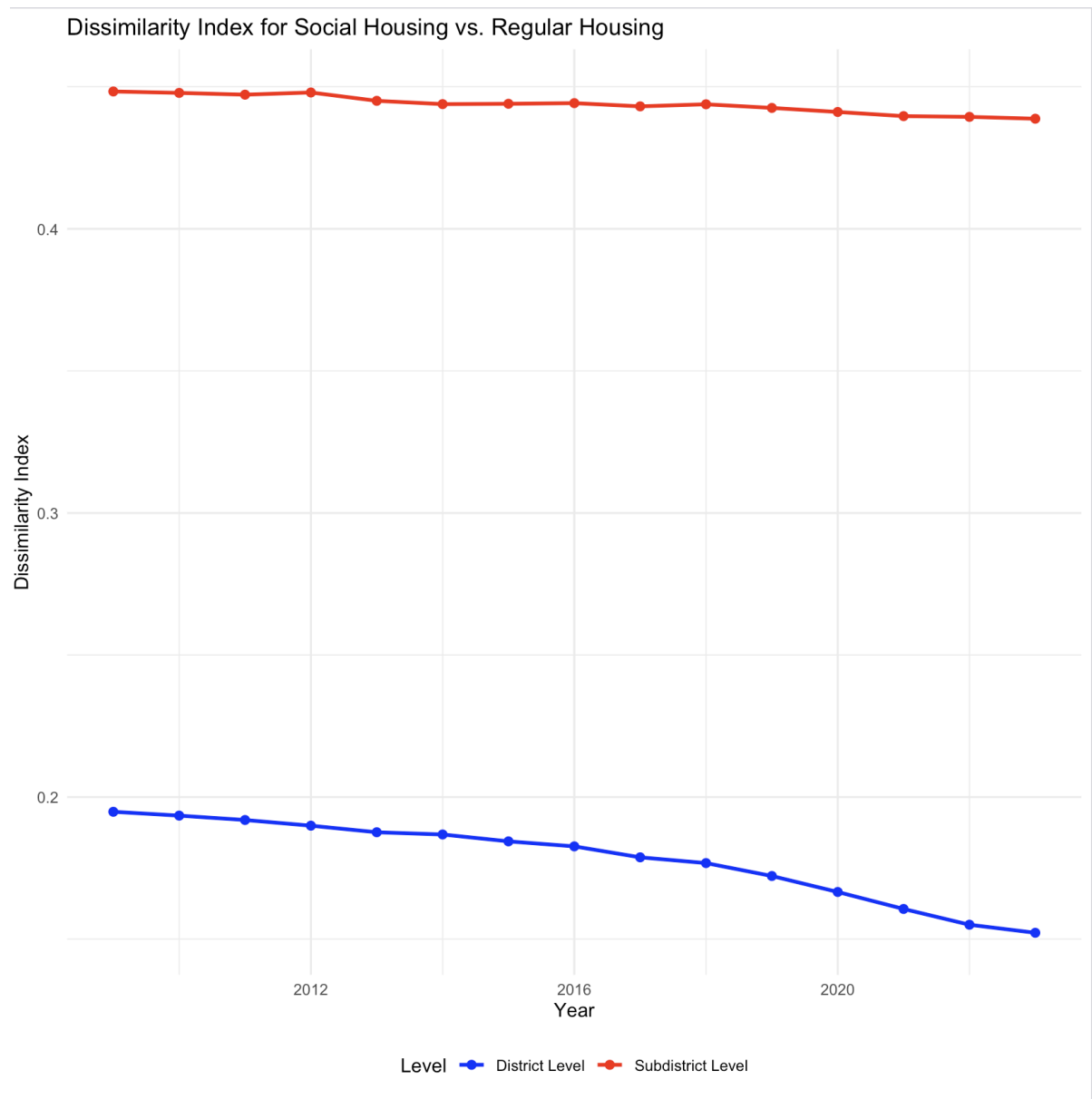
The plot shows Vienna's overall segregation index over the years 2009-2023. The red line denotes data of the 250 sub-districts while the blue one denotes segregation on the level of the 23 districts.

In general, Vienna's segregation has gone down generally over the years. Based on district data, one might argue that the policy priority of ensuring a social mix in the city seems to hold. Evidence shows that there is an overall trend of desegregation- potentially the resuming of construction could have accelerated the desegregation a bit further as we see a stronger decline from 2018. That would be the

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year where it would be likely for changes in the social housing population to first show up on an absolute scale (given that the process of designing housing, constructing it and allocating it takes time).

It is striking that on district level the dissimilarity indices are considerably lower than on sub-district level- which is to be expected as it presents the difference of dividing Vienna in 23 pieces to evaluate segregation or splitting it in 250 pieces to do the same. This means that within some districts there must be clusters - sub districts with considerably lower or higher percentages of social housing, which could indicate a segregation tendency within districts and potential clusters within districts.

Fig. 4 Dissimilarity index of 23 sub-districts with a distinction of inner and outer Vienna [1]
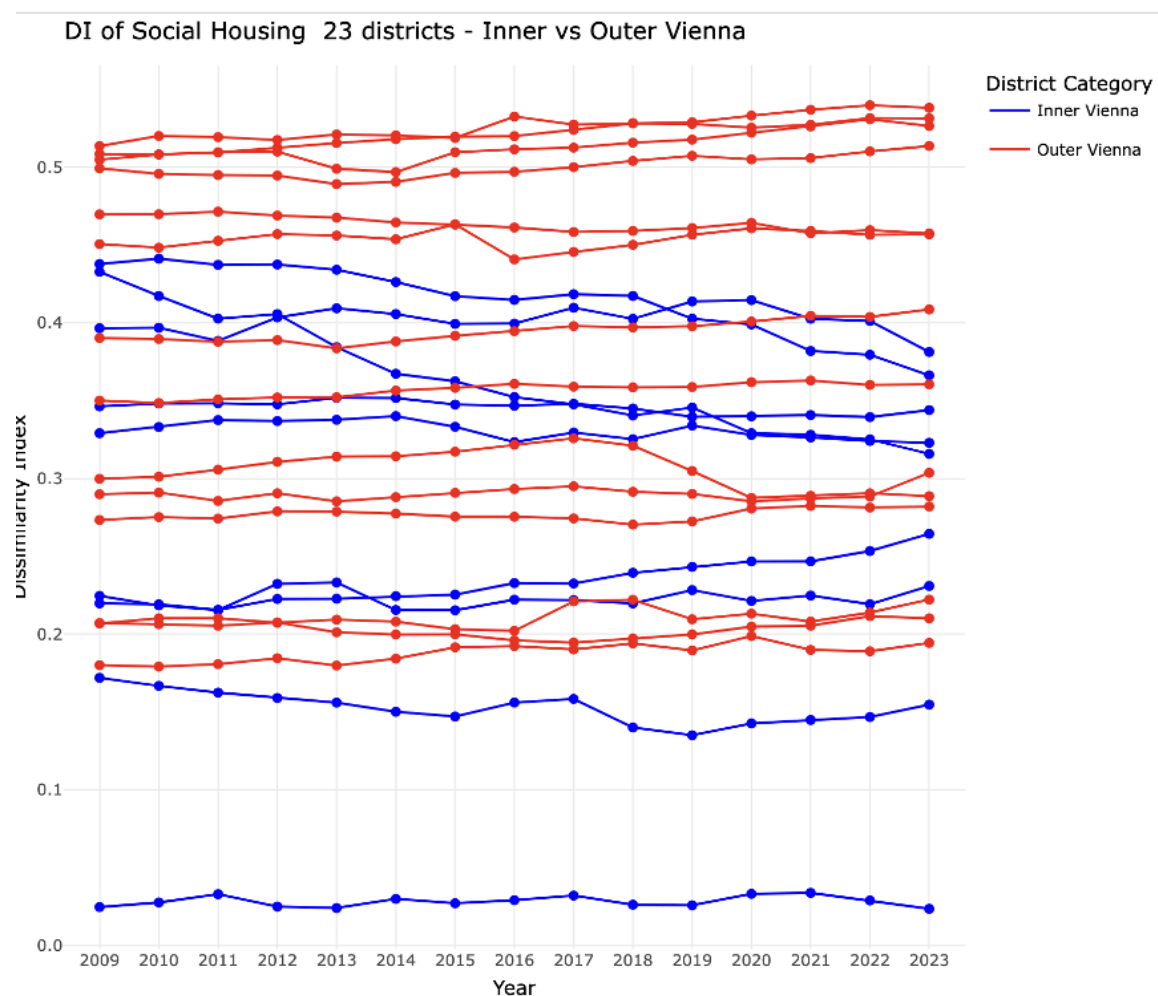
After calculating the segregation index of Vienna overall in the previous section, the next step is understanding why the sub-district based index shows significantly higher levels of segregation. In

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[1] *See annex plot Fig. 11 to see the the different districts labelled to more easily discern which lines are increasing/declining can be found*

order to do that, 23 district dissimilarity indices have been calculated. This can help to assess which districts might be the ones that have clusters and therefore raise the levels of segregation.

It becomes apparent that segregation varies significantly throughout districts and that it is rather few districts that drive up segregation rates. Districts 22, 12, 10 and 21 have a dissimilarity index of over 0,5 and even with a slight upward tendency, whilst other districts all have different values from as low as 0.17. One district is an outlier with a dissimilarity index of 0.02. This outlier denotes district 8, Vienna's smallest district, which also has the smallest social housing percentage- both factors that give an explanation to this irregularity.

It is discernible that district-specific shifts have increased somewhat after 2018, which is consistent with the prior graph showing the absolute shares of people in Social housing, where changes after 2018 were similarly negligible. Following 2018, the trend direction is not consistent, differing throughout districts; whilst some indicate rising trends, others show the opposite. This discovery tentatively hints at the assumption that there is no discernible difference when temporal trends or year fixed effects are controlled for. On the other hand, the basic characteristics of the district appear to be of importance. There is some evidence of mean reversion, which means that districts that were initially less segregated now tend to show a slight increase, and districts that were initially more segregated tend to show a reduction of segregation. The outlying districts with the highest levels of segregation are the main exceptions, and they seem to show trends towards even greater segregation. Interestingly, all of these districts are outer districts and have larger populations and geographical areas, along with more subdistricts (see annex Fig. 11).

5.2 Regression analysis

Fig. 5 Baseline Model

Term	Estimate	Std. Error	t value	Pr(>|t|)	Model
District Model - Baseline					
(Intercept)	0.203***	0.016	12.5270960	0.000	Baseline Model
post_policyshift	-0.009	0.012	-0.7198834	0.472	Baseline Model
num_subdistricts	-0.113***	0.031	-3.6688888	0.000	Baseline Model
prop_overcrowded_rooms	0.119***	0.031	3.8458023	0.000	Baseline Model
prop_unemployed	0.118**	0.036	3.2792143	0.001	Baseline Model
prop_homeless	0.181	0.309	0.5855890	0.559	Baseline Model
percentage_social_housing	0.004***	0.001	3.9388556	0.000	Baseline Model
district_categoryOuter Vienna	-0.009	0.015	-0.5724689	0.567	Baseline Model

The baseline model follows a regular OLS linear regression and includes only the key independent variable and some controls for district characteristics (number of sub districts and district category) and socio-economic factors. The policy shift is not statistically significant, but some of the controls seem to have significant effects on segregation levels. It can be observed that, according to this model, the resumption of construction did not have a measurable impact on segregation when controlling for these controls. It seems as though the characteristics of districts themselves are what influence segregation.

Moreover, the number of sub-districts is significant and positively associated with segregation, suggesting more subdistricts correlate with higher segregation, which is in line with what was hypothesised in the methodology section. As for the socio-economic factors, we find a positive correlation between higher levels of unemployment and overcrowding being correlated with segregation. This finding suggests that social housing placement might not have taken into account the socio-economic factors indicating disadvantage, which indicates a higher risk for residualisation/marginalisation of social housing units. Lastly, the variable "district category" is not significant, implying no substantial difference between inner and outer districts in this model.

Fig. 6 Model with Year Fixed Effects

Term	Estimate	Std. Error	t-value	Pr(>|t|)	Model
		District Model - Controls and Year FE			
post_policyshift	0.000	0.003	0.04341354	0.965	Controls and Year FE
prop_overcrowded_rooms	-0.006	0.005	-1.33401660	0.183	Controls and Year FE
prop_unemployed	0.042***	0.010	4.07284831	0.000	Controls and Year FE
prop_homeless	-0.470***	0.135	-3.48938305	0.001	Controls and Year FE
num_subdistricts	0.115***	0.016	7.12877383	0.000	Controls and Year FE
percentage_social_housing	0.002**	0.001	2.79963325	0.005	Controls and Year FE
as.factor(year)2010	0.000	0.003	0.01321992	0.989	Controls and Year FE
as.factor(year)2011	0.000	0.003	-0.17869263	0.858	Controls and Year FE
as.factor(year)2012	0.002	0.003	0.87862102	0.380	Controls and Year FE
as.factor(year)2013	0.001	0.003	0.27551176	0.783	Controls and Year FE
as.factor(year)2014	-0.001	0.003	-0.20791457	0.835	Controls and Year FE
as.factor(year)2015	0.000	0.003	0.03707918	0.970	Controls and Year FE
as.factor(year)2016	-0.004	0.003	-1.42872089	0.154	Controls and Year FE
as.factor(year)2017	-0.001	0.003	-0.40624194	0.685	Controls and Year FE
as.factor(year)2018	-0.002	0.003	-0.70181717	0.483	Controls and Year FE
as.factor(year)2019	-0.002	0.003	-0.74811433	0.455	Controls and Year FE
as.factor(year)2020	-0.002	0.003	-0.58752273	0.557	Controls and Year FE
as.factor(year)2021	-0.002	0.003	-0.90002481	0.369	Controls and Year FE
as.factor(year)2022	-0.002	0.003	-0.56577053	0.572	Controls and Year FE

Year fixed effects are incorporated into this model in order to account for potential time-dependent factor variations. This could have been particularly relevant for the years 2020 and 2021, due to the Covid-19 pandemic, when there was a general halt of housing construction of both social and private housing units. However, none of these years show any statistical significance, not even the year 2018 that seemed to have stood out in Fig. 4. It appears that there isn't a substantial time-dependent component.

The post-policy shift variable is still statistically not significant. However, segregation is correlated with higher rates of unemployment and homelessness; it seems that in this model districts with higher

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levels of unemployment and higher levels of homelessness have lower rates of segregation. The percentage of social housing is marginally positively correlated with segregation, which is in line with the idea that it is harder to evenly disperse larger percentages of social housing in a district. Lastly, the number of sub-districts is still a strong positive predictor of segregation, as to be expected.

Fig. 7 Model with District Fixed Effects

Term	Estimate	Std. Error	t value	Pr(>|t|)	Model
		District Model - Controls and District FE			
(Intercept)	1.419	1.378	1.0300643	0.304	Controls and District FE
post_policyshift	0.003*	0.001	1.9852066	0.048	Controls and District FE
prop_overcrowded_rooms	0.005	0.005	1.1305213	0.259	Controls and District FE
prop_unemployed	-0.019*	0.008	-2.4457128	0.015	Controls and District FE
prop_homeless	-0.168**	0.062	-2.7344717	0.007	Controls and District FE
geographical_size	-0.519	0.491	-1.0577158	0.291	Controls and District FE
num_subdistricts	0.062***	0.005	12.2265326	0.000	Controls and District FE
District category.xOuter Vienna	14.297	14.311	0.9990211	0.319	Controls and District FE
District 2	-0.154	0.113	-1.3613268	0.174	Controls and District FE
District 3	-4.294	4.325	-0.9928763	0.322	Controls and District FE
District 4	-11.696	11.729	-0.9972126	0.319	Controls and District FE
District 5	3.602	2.797	1.2878653	0.199	Controls and District FE
District 6	1.335	0.864	1.5440234	0.124	Controls and District FE
District 7	-13.787	13.788	-0.9999804	0.318	Controls and District FE
District 8	-11.391	11.445	-0.9952868	0.320	Controls and District FE
District 9	-10.017	10.123	-0.9895219	0.323	Controls and District FE
District 10	-12.618	12.672	-0.9956923	0.320	Controls and District FE
District 11	-3.172	3.505	-0.9049246	0.366	Controls and District FE
District 12	8.298	8.017	1.0350554	0.301	Controls and District FE
District 13	-12.908	12.934	-0.9979675	0.319	Controls and District FE
District 14	5.929	6.069	0.9768019	0.329	Controls and District FE
District 15	35.867	34.471	1.0404904	0.299	Controls and District FE
District 17	2.123	2.230	0.9520715	0.342	Controls and District FE

This model includes district fixed effects to control for time-invariant district-level differences and intends to take out effects of segregation that are not due to the policy but rather district-specific characteristics (such as varying socio-economic standing, unique historical development or political characteristics).

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The post-policy shift variable is now significant and positive, suggesting that we see an increase in segregation following the resumption of social housing when taking into account the differing district characteristics. The policy becoming significant in this model emphasises the fact that the districts of Vienna are inherently heterogeneous and that their heterogenous attributes impact segregation more than the policy shift. When taking the districts' heterogeneity into account, socio-economic controls (homelessness and unemployment) remain to still indicate the same as in the previous model (but the opposite of the baseline model, which needs further consideration and investigation). The district category variable remains insignificant.

Fig 8 Model with Both Year and District Fixed Effects

District Model - Controls and Year FE

Term	Estimate	Std. Error	t-value	Pr(>|t|)	Model
post_policyshift	0.000	0.003	0.04341354	0.965	Controls and Year FE
prop_overcrowded_rooms	-0.006	0.005	-1.33401660	0.183	Controls and Year FE
prop_unemployed	0.042***	0.010	4.07284831	0.000	Controls and Year FE
prop_homeless	-0.470***	0.135	-3.48938305	0.001	Controls and Year FE
num_subdistricts	0.115***	0.016	7.12877383	0.000	Controls and Year FE
percentage_social_housing	0.002**	0.001	2.79963325	0.005	Controls and Year FE
district_categoryOuter Vienna	0.007	0.009	0.98681634	0.006	Controls and Year FE
as.factor(year)2010	0.000	0.003	0.01321992	0.989	Controls and Year FE
as.factor(year)2011	0.000	0.003	-0.17869263	0.858	Controls and Year FE
as.factor(year)2012	0.002	0.003	0.87862102	0.380	Controls and Year FE
as.factor(year)2013	0.001	0.003	0.27551176	0.783	Controls and Year FE
as.factor(year)2014	-0.001	0.003	-0.20791457	0.835	Controls and Year FE
as.factor(year)2015	0.000	0.003	0.03707918	0.970	Controls and Year FE
as.factor(year)2016	-0.004	0.003	-1.42872089	0.154	Controls and Year FE
as.factor(year)2017	-0.001	0.003	-0.40624194	0.685	Controls and Year FE
as.factor(year)2018	-0.002	0.003	-0.70181717	0.483	Controls and Year FE
as.factor(year)2019	-0.002	0.003	-0.74811433	0.455	Controls and Year FE
as.factor(year)2020	-0.002	0.003	-0.58752273	0.557	Controls and Year FE
as.factor(year)2021	-0.002	0.003	-0.90002481	0.369	Controls and Year FE
as.factor(year)2022	-0.002	0.003	-0.56577053	0.572	Controls and Year FE

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This comprehensive model includes both year and district fixed effects. Here, the post-policy shift variable is yet again not significant, suggesting that there is no significant change in segregation following the policy shift when accounting for both time-invariant district-relating, as well as district-unvarying time-dependent factors. This indicates that the heterogeneity of districts as well as time-dependent variances account for a significant portion of the segregation, as it can be evidenced that the policy shift is no longer significant once the dummies are included.

Socio-economic controls

Depending on the model, different socioeconomic controls seem to be significant. Homelessness is continually negatively connotated with segregation, (except in the baseline model) which might indicate that policymakers might actively avoid placing large units of social housing in areas that have higher homelessness rates. District category never shows a significant effect in any of the models. Both overcrowding as well as unemployment sometimes show positive and other times negative coefficients, which hints at potential problems with the models and does not allow us to draw conclusions. It could be an error of model specification, omitted variable bias is simply a measurement error. Whichever it may be, it would be better to not interpret too much into the coefficients.

Fig. 9 Model with Interaction Effects

Regression Results: Interaction Effects Model					
Term	Estimate	Std. Error	t-value	Pr(>|t|)	Model
post_policyshift	0.009*	0.004	2.259979473	0.025	Interaction Effects Model
prop_unemployed	0.155***	0.030	5.126255433	0.000	Interaction Effects Model
num_subdistricts	0.181***	0.038	4.829779534	0.000	Interaction Effects Model
prop_overcrowded_rooms	0.008	0.008	0.986816345	0.325	Interaction Effects Model
prop_homeless	-1.204***	0.334	-3.599543596	0.000	Interaction Effects Model
as.factor(year)2010	0.000	0.003	-0.126458575	0.899	Interaction Effects Model
as.factor(year)2011	-0.001	0.003	-0.497522367	0.619	Interaction Effects Model
as.factor(year)2012	0.001	0.003	0.412626210	0.680	Interaction Effects Model
as.factor(year)2013	-0.001	0.003	-0.366798326	0.714	Interaction Effects Model
as.factor(year)2014	-0.002	0.003	-0.971599822	0.332	Interaction Effects Model
as.factor(year)2015	-0.002	0.003	-0.933453807	0.351	Interaction Effects Model
as.factor(year)2016	-0.001	0.003	-0.378873369	0.705	Interaction Effects Model
as.factor(year)2017	0.001	0.003	0.445912674	0.656	Interaction Effects Model
as.factor(year)2018	0.000	0.003	-0.082410147	0.934	Interaction Effects Model
as.factor(year)2019	0.000	0.003	-0.141291573	0.888	Interaction Effects Model
as.factor(year)2020	0.000	0.003	0.005082831	0.996	Interaction Effects Model
as.factor(year)2021	-0.001	0.003	-0.450308633	0.653	Interaction Effects Model
as.factor(year)2022	-0.001	0.003	-0.228362829	0.820	Interaction Effects Model
post_policyshift:geographical_size	0.001***	0.000	4.077002135	0.000	Interaction Effects Model
post_policyshift:prop_unemployed	-0.018	0.016	-1.092862278	0.275	Interaction Effects Model
post_policyshift:num_subdistricts	-0.011	0.009	-1.216722164	0.225	Interaction Effects Model
post_policyshift:prop_overcrowded_rooms	0.008	0.009	0.911508139	0.363	Interaction Effects Model
post_policyshift:prop_homeless	0.458	0.243	1.887951483	0.060	Interaction Effects Model
post_policyshift:district_categoryOuter Vienna	0.000	0.003	-0.060198604	0.952	Interaction Effects Model

This model serves the purpose of testing interactions between the different district characteristics and the treatment variable. Its objective is to find out if the housing construction resumption affected certain districts stronger due to any previously defined characteristics.

The findings show that the policy shift has a positive and significant (at the 0.05 level) effect on the dependent variable, suggesting that post-policy shift, the dissimilarity index increased by 0.009 units on average. However, all interactions are insignificant which means that whilst the characteristics of the different districts do directly impact levels of segregation, there is no evidence of the treatment effect of the resumption of construction having been heterogeneous on the different districts due to other characteristics.

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As expected, and as seen in all previous models, more sub-districts within a district are still associated with an increase in the dissimilarity index, indicating that more subdistricts contribute to higher dissimilarity. The interaction between the policy and the number of sub districts is not statistically significant which means that the treatment effect of the policy does not differ depending on the number of subdistricts.

In this interaction model we also find significant effects in the socio-economic controls of unemployment and homelessness rate. An increase in the proportion of unemployed individuals is associated with an increase in the dissimilarity index, while an increase in the proportion of homeless people is associated with a decrease in the dissimilarity index. These findings are yet again not very intuitive and clear and thus need more careful consideration. Here, as well as in previous models the year dummy variables are not significant, which strengthens the finding that there seem to be no year-specific effects that affect Vienna's segregation overall.

Fig. 10 Refined Interaction effects model

Regression Results: Refined Interaction Effects Model					
Term	Estimate	Std. Error	t-value	Pr(>|t|)	Model
post_policyshift	0.008**	0.003	2.617648	0.009	Refined Interaction Effects Model
prop_homeless	-0.558***	0.128	-4.349494	0.000	Refined Interaction Effects Model
num_subdistricts	0.120***	0.014	8.402432	0.000	Refined Interaction Effects Model
prop_unemployed	0.129***	0.017	7.635823	0.000	Refined Interaction Effects Model
post_policyshift:geographical_size	0.000***	0.000	5.095284	0.000	Refined Interaction Effects Model
post_policyshift:num_subdistricts	-0.003***	0.000	-7.075176	0.000	Refined Interaction Effects Model

In this refined model, which takes out a few irrelevant controls but still includes fixed effects for districts and years,we still see a positive coefficient for the policy shift. Here the interaction between the policy and the subdistricts is statistically significant, indicating that the treatment effect might be slightly smaller in districts with more subdistricts. However, this is offset to some extent by the fact that districts with more sub districts have higher segregation in general.

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5.3 Interpretation of Results

Firstly, several important conclusions can be drawn from the first part of the analysis which is the computation of the different segregation indices. The calculation of Vienna's overall segregation index on the basis of districts shows a very low value with a steady decline, whilst the index on the basis of sub-districts shows considerably stronger levels of segregation with a much slower decline. These findings already point to the fact that, whilst there might be considerable social housing in all of Vienna's districts, within districts there must be segregated clusters. The calculation of 23 districts dissimilarity indices showed that segregation levels vary greatly across all districts and that it is mainly a handful of outer districts that drive up the segregation index on sub-district level. Consistent trends post-policy cannot be seen, although many districts start to either show an increase or decrease post 2018 after being steady in the years prior to that.

Whilst construction of social housing resumed in 2016 it is reasonable to assume that changes in the housing population would not be seen until two years later, hence these developments might have to do with the consequences of the policy change. A reason for that could be that by this time social housing construction could have picked up (as the data we are referring to is not units of social housing in construction but rather people actively living in social housing). The districts with the highest segregation levels, however, do seem to have a trend towards segregation. Notably, these districts are all outer districts, are bigger in geographical size and, most importantly, have a higher number of sub districts. These could be reasons for districts to have a higher segregation index and this already anticipates that initial district specific attributes are indeed important for assessing segregation.

In the second part of the analysis, the regression analysis, the policy impact is tested methodically in order to find out more about the descriptive findings. Different district characteristics, including number of sub districts and district category, are all included as controls in order to better assess the effect of the policy change. As expected, many of the initial district attributes seem to play an important role in terms of affecting segregation levels. The baseline model indicates that there was no discernible change in segregation after the resumption of social housing construction, which is in line with the very slight variations in social housing supply and segregation patterns seen in the previous plots.

In the next model which includes year fixed effects, there is also no substantial difference, which makes sense given the uneven trend we observed in fig. 3 and fig.4. Only a small, marginally significant effect of the post-2016 treatment variable is shown when district fixed effects are used to test for time-invariant district-level heterogeneity. This is consistent with the significant variations in average degrees of segregation seen in Fig.4 among districts. By taking this variation into

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consideration, a tiny marginal impact of the policy change can be found. It is suggested that in order to improve model fit and clarify the impact of the policy change, cross-sectional district heterogeneity rather than year or time trends should be taken into consideration.

In the next part, district fixed effects are included to test for time-invariant heterogeneity at the district level. A slight but marginal effect of the treatment variable can be found in this model. This confirms the significant variations in average segment levels observed in the graph across districts. Therefore, after taking this heterogeneity into consideration, we can identify a tiny marginal impact of the policy change. It appears that only the cross-sectional district heterogeneity—not the year/time trends—needs to be taken into consideration in order to enhance model fit and make the impact of the policy change more clear. Adding both district and year fixed effects might add to the noise rather than improving the analysis.

Lastly, the interaction models show that there is no heterogeneous treatment effect of the policy shift with any of the controls. It seems as though socio-economic processes affect segregation directly rather than interacting with the policy change.

This indicates that the heterogeneity of districts as well as time-dependent variances account for a significant portion of the segregation, as it can be evidenced that the policy shift is no longer significant once the dummies are included. However, it needs to be considered that adding fixed effects for both also adds a lot of noise into the analysis, hence the results need to be interpreted with caution.

6. Discussion

6.1 Implications of findings

Overall we see that the shift in policy has had a mixed effect on segregation. In simpler models, like the baseline model, it is not significant, but in models that take district-specific factors into account, it becomes significant. This means that a small treatment effect can be noted once time-invariant heterogeneity between districts is accounted for. The heterogeneity between districts is therefore important when assessing segregation levels. Nevertheless, the impact of the construction resumption disappears when cross-district time trends in segregation are taken into account. Considering that earlier data showed a significant structural tendency toward segregation decreasing (which was already in place pre-treatment). Lastly, no evidence of heterogeneous treatment effects was found so the heterogeneity of the district seems to directly affect segregation.

The findings suggest that there was only a limited effect of the policy change. However, the policy's overall low impact must be weighed against the fact that it did not specifically have desegregation as a set objective. On one hand, Vienna's governing party already publicly prides itself with having social housing in all districts and a continuously lowering trend of segregation (although in public accounts that talk about segregation they seem to refer to numbers on district level, not subdistrict level, where segregation tendencies are declining more rapidly). Hence, the prevention of segregationmight not be considered a current urgent problem that is put on top of the policy agenda (at least in comparison to the need for creating affordable housing) On the other hand, the importance of a social mix has continuously been reconfirmed. However, given the residualisation tendency that we already start to see in Vienna, policymakers will want to consider and prioritise this when constructing new housing in the future.

The significant variation in segregation levels and trends seen throughout districts implies that a more centralised strategy might be required if future policies do seek to alleviate segregation. This suggests that it could be advantageous to rely less on district-by-district social housing policymaking. Furthermore, in order to reduce segregation, if private development is encouraged, it should be supported by robust incentives that promote the dispersion of new social housing units. A more integrated and balanced urban environment may be attained with the use of this more centralised and incentive-based strategy.

One of the reasons we see that might be due to the construction stop by the city of vienna to construct additional housing units from 2004 until 2015- which essentially means that only Non-for-profit associations (that usually construct less than a third of all social housing) were allowed to construct additional housing units, whilst construction of housing in the private sector remained

Looking at segregation patterns, it becomes clear that changes in segregation have come from changes due to location of new social housing units rather than changes in the overall share of housing.

6.2 Limitations of the study

One of the greatest limitations of this study has to do with the availability of socio-economic controls. As these were not available yearly but only once per decade, their values might be incorrect or misleading. The fact that the coefficient of most of the socio-economic controls changed a lot between models and sometimes even flipped also suggests that there might be a measurement error.

Unclear as to which year the resumption of construction would really be seen, perhaps resuming construction at the end of 2015 and expecting differences to follow soon is too optimistic as there is a long process between construction and finishing of additional housing units and then people being allocated to housing and moving in.. The dataset used in this thesis measured people actively living in social housing, not finalised construction units. Using a dataset that denotes social housing units (in construction or finished) could have been helpful to assess immediate policy impact from social housing construction.

6.3 Suggestions for Future Research

Another policy decision that influences residualisation is regarding the eligibility criteria for the access of social housing. As previously mentioned, stronger targeting ensures that people from the lowest income bracket can have access to affordable housing, however, this comes with the repercussions of intensifying residualisation, hence, it would be complementary to understand the interplay of decisions regarding social housing construction as well as housing access/allocation.

The Duncan dissimilarity index does not provide much detail about the segregation and the way that clusters might have formed. Therefore, an additional calculation of an isolation or exposure index could help assess segregation better.

Moreover, this thesis studied segregation in terms of social housing vis-a-vis private housing. To add to the discussion on residualisation and potential marginalisation of areas, this analysis would have to be complemented by other studies that test socio-economic levels of residents in social housing or test segregation in terms of income groups.

7. Conclusion

This thesis examined the impact of Vienna's resumption of social housing construction on segregation patterns in the city. According to the findings of analysis, the approach taken in pursuing construction resulted in a very marginal increase in segregation between districts. That indicates that segregation was most likely not considered (or perhaps only partially) in the planning of the placement of new municipal housing units. Given the fact that the construction of social housing is the most powerful policy tool to influence segregation and enable social cohesion, policymakers might want to assess where to place new social housing units in the future.

However, there is also the possibility that the city of Vienna was giving good advice and guidance during the time in which the construction of social housing was up to LPHAs. As LPHAs work in a partnership with the city of Vienna, they could have followed the government's recommendations. This could be the reason why the difference post social housing construction resumption is close to zero.

Furthermore, our findings indicate that there is a considerable difference in segregation between districts with most trends remaining relatively stable over the course of 2009-2018. Following that year, trends do start to differ among districts with the biggest districts showing tendencies to more segregation.

Additionally, the models clearly show that heterogeneity in terms of size and socio-economic factors plays a major role when it comes to assessing segregation levels. Areas with elevated rates of homelessness most likely exhibit somewhat weaker segregation patterns. The findings are not completely clear on that, hence this assumption can only be made tentatively and needs to be further explored. There were no signs of heterogeneous treatment effects of any kind. It seems as though the controls interact with and impact segregation directly.

This could be as a result of careful planning of social housing construction, taking into account the risk of a district becoming marginalised if social housing is placed in a subdistrict that exhibits high levels of homelessness or unemployment. This is a trend that should be continued in the future as this mitigates the negative consequences of segregated social housing units.

Another reason for the policy shift yielding no effect could be related to the effects of COVID-19, and maybe because these alterations are yet too early to be fully understood. Even in the absence of a pandemic, the process of construction until the first residents move in takes a few years, as our data represents people who live in social housing.

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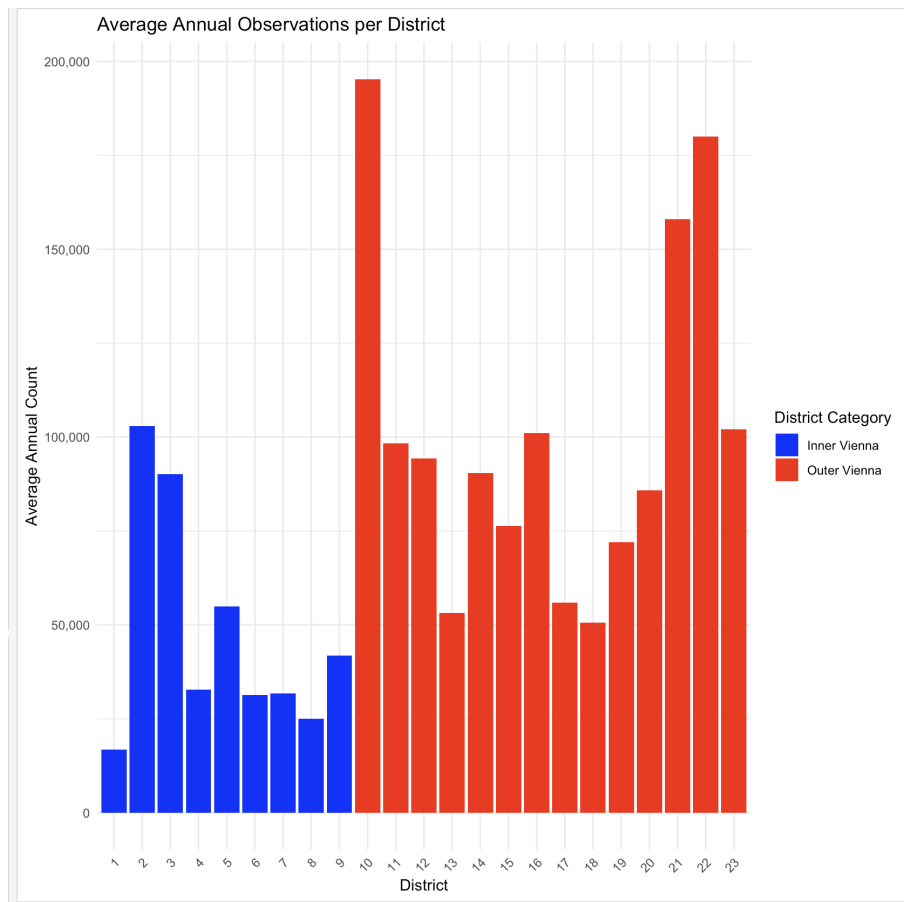
9. Annex

Fig. 10 size of districts

Fig. 11 Dissimilarity index of social housing by district with labels per observation