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Tipping Points and the Local Housing Market:

Dynamics of Segregation and Integration in Jerusalem

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Tipping Points and the Local Housing Market:

Dynamics of Segregation and Integration in Jerusalem

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Abstract

This paper examines the effect of migration in Jerusalem on housing prices, with a focus on the migration of Haredi Jews (Jewish ultra-Orthodox; pl. *Haredim*) into previously non-Haredi Jewish neighborhoods. I use a novel dataset of national election results at the statistical area (sub-neighborhood) level to identify the presence of Haredi communities. A rich administrative dataset of apartment transactions between 2003 and 2015 is used to analyze changes in house values. I apply two empirical strategies. First, a Regression Discontinuity design is used to test whether there are Tipping Point dynamics in Jerusalem's neighborhoods. Second, Hedonic Price regressions are used in order to estimate how continuous changes in the religiosity level of the neighborhood affects local house prices. To address endogeneity concerns, I exploit the pattern of geographic spatial diffusion of Haredi communities from the core Haredi neighborhoods to the surrounding areas as an instrument which is exogenous to housing prices. The findings are consistent with a simple model of endogenous social amenities in a segregated urban housing market which is presented in this paper. I do not find robust evidence of Tipping Point dynamics in Jerusalem. However, I do find that an increase of one percentage point in the share of Yahadut Ha'Torah voters in a neighborhood increases relative house prices by about 0.8 percent.

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1. Introduction

The Israeli housing market is composed of several sub-markets which differ, among other things, by geographic location, socioeconomic status, religiosity level, and ethnic composition. This segmentation of the housing market according to nationality, origin or level of religiosity stems from residential segregation of groups which avoid or are prevented from living in certain neighborhoods or localities. Nevertheless, in some cases, the invisible boundaries become blurred, and neighborhood change their character when new types of households enter in significant numbers. This could lead to increasingly integrative neighborhoods, or if a certain threshold is crossed, to a new equilibrium of segregation where the former minority group becomes the majority. This threshold point, which is modelled in the famous "Tipping Point" model by Schelling (1971) is the starting point of this paper.

This study investigates the relationship between neighborhood change and house values. In particular, it deals with the migration of Haredi Jews (ultra-Orthodox Jews) into non-ultra-Orthodox Jewish neighborhoods. The Haredi population, a self-segregating group by definition, experiences opposing forces of segregation and integration in the residential sphere as well as in the labor market, the education system and the cultural and political surroundings. The response of the original non-Haredi residents of these changing neighborhoods is also crucial in the dynamics of segregation processes and may eventually determine the neighborhood's religious character. The research questions that guide this study are: What are the dynamics of neighborhood change in the case of Haredi migration? Is there an empirical evidence of the Tipping Point model in neighborhoods which become more Haredi? And how do house prices respond to such changes in neighborhood composition?

This paper focuses on Jerusalem as a case study for religiosity-related neighborhood change for two reasons. First, Jerusalem, in comparison to other Israeli cities, has more observations of neighborhoods in different stages (Haredi, heterogeneous and non-Haredi) to enable the use of the statistical methods which are described below. The second reason is the ongoing political debate that is fueled by the social process of "Haredization" (the common name for the process in which a non-Haredi neighborhood becomes more Haredi). About a third of Jerusalem's population today is ultra-Orthodox. The core neighborhoods of the Haredi community today are still located in the area of the historic Haredi center “Me’ah She’arim” (in Hebrew: “One hundred gates”) but the community has expanded spatially to nearby neighborhoods and today the Haredi core is much bigger than it used to be.

In order to cope with the changing character and needs of neighborhoods which have changed, a political agreement was signed last year between the mayor of Jerusalem and the Haredi representatives regarding the future of Jerusalem's neighborhoods. The informal agreement includes funding of Haredi synagogues, schools and kindergartens in neighborhoods which have transformed into Haredi neighborhoods (e.g. Ramot Polin, Ramat Eshkol, Gilo Aleph) and are not part of the original Haredi core, while other neighborhoods, which are already experiencing some changes in the population’s religious character (e.g. the French Hill, Qiryat Yovel, Ramot Bet), will be guaranteed funding oriented at secular institutions in order to keep their secular character.[1] The agreement emphasizes the importance of this paper in the field of urban planning - supporting policy makers in foreseeing the inevitable social changes in their cities in order to invest their resources in the most suitable way which will benefit all residents in the long run. It also emphasizing the need to analyze the city as a whole instead of treating each neighborhood as a separate case.

The main dataset used in this paper includes data on national election results since 2003 at the statistical area (sub-neighborhood) level.[2] The election data is used to characterize the level of religiosity of each neighborhood in two to four-year intervals.[3] Data on apartment purchases (the “Karmen” dataset) is available from The Israel Tax Authority via the Bank of Israel. The housing transactions data enables analysis of quality-adjusted house values and their relation to the changing neighborhood-level attributes.

I apply two empirical strategies. First, a Regression Discontinuity design is used to test whether there are Tipping Point dynamics in Jerusalem’s neighborhoods. Second, Hedonic Price regressions are used in order to estimate how continuous

[1] For more details see Shaham’s article (2017) on the opposition to the Mayor’s “neighborhoods plan”.
[2] Statistical areas are equivalent to the American census tracts, they are the smallest most homogeneous geographical unit of analysis in the Israeli census and usually contain between 3,000 and 5,000 inhabitants.
[3] By law, elections in Israel are supposed to take place every four years, but due to political instability most elections were conducted before the end of the elected parliament’s term.

changes in the religiosity level of the neighborhood affects local house prices. To address endogeneity concerns, I exploit the pattern of geographic spatial diffusion of Haredi communities from the core Haredi neighborhoods to the surrounding areas as an instrument which is exogenous to housing prices.

The findings are consistent with a simple model of endogenous social amenities in a segregated urban housing market which is presented in this paper. I do not find robust evidence of Tipping Point dynamics in Jerusalem. Nonetheless, by using panel data and Hedonic price regressions, I do find that Haredi migration into non-Haredi neighborhoods increases relative house values in those neighborhoods. An increase of one percentage point in the share of voters for Yahadut Ha'Torah (one the biggest Haredi political parties, also known as Gimel) increases house prices in the neighborhood by about 0.8 percent.

The rest of this paper is organized as follows. Section 2 reviews the theoretical as well as the empirical literature in the fields of sorting and residential segregation as well as the migration patterns of the Haredi society. Section 3 presents the novel dataset which is used for the analysis and discusses the different methods for identifying Haredi residents in the data. Section 4 is based on the Regression Discontinuity methods suggested by Card et al. (2008) for testing the existence and magnitude of Tipping Points in different cities. This ex-post exercise is interesting and reveals different dynamics in Jerusalem and their connection to the housing market. Section 5 offers an additional layer to the sociological model which takes into account urban equilibrium conditions and the impact of alternative options on the rate of change in the heterogeneous neighborhood. This is done by developing a simple framework which describes the relationship between the demand for housing and endogenous social amenities, which are a function of the level of religiosity of the neighborhood's population. Section 6 contains the empirical estimation of the model, by using panel data of house purchasing transactions and election results, and the final section concludes.

2. Literature Review

2.1. Sorting and Segregation

The literature treats the state of the housing market as an enforcer of the existing social order as well as a result of economic forces. Modern urban theory is based on the monocentric-city model developed by Alonso (1964), Mills (1967) and Muth (1969) which describes the effect of housing prices on sorting within cities and vice versa. Their models describe the opposing forces that determine the spatial distribution of income groups: on the one hand, the rich value floor space more than the poor and are therefore attracted to the city's periphery and suburbs. This is due to the assumption that housing is a normal good and the richer you are, the bigger the house you would want to live in. On the other hand, their opportunity cost of commuting to the central business district (CBD) is higher because of their higher wages. This might make the rich want to live closer to the city center. Since in the US the rich tend to live in the suburbs and the poor in the inner cities, we can conclude, according to the above model, that the first effect dominates the second.

As European cities do not fit the above model, Brueckner et al. (1999) argue that European cities offer exogenous natural and historical amenities that attract the rich enough to make them choose to live in the city center. This choice increases the bid-price function of housing, pushing the poor to live in the suburbs.

Sorting is not only a result of preferences which differ by socioeconomic level, but also the result of racial preferences. Boustan (2013) reviews the causes of racial residential segregation in the United States. Self-segregation of the Black populations, collective action to exclude blacks from white neighborhoods and the individual mobility of whites away from heterogeneous neighborhoods are some of the causes of racial segregation in the US. The migration of white residents out of mixed neighborhood, when occurring rapidly, is also referred to as "White Flight". Bayer et al. (2005) provide evidence of self-segregation behavior, and Cutler, Glaeser and Vigdor (1999) provide historical evidence of the different forms of segregation of Black communities in the US since the 1940s. While the American literature deals mostly with racial or socioeconomic segregation, other countries face other forms of residential segregation, such as ethnic or religiosity-related segregation. It is therefore interesting to expand the literature in this field to other types of recognizable groups.

In Israel, segregation has been researched mainly by geographers and sociologists. Benenson et al. (2006) use high-resolution GIS methods to compute segregation indices. They find mixed patterns of segregation and integration in Israeli cities. Nonetheless, no research has been done on the effect of segregation on housing prices, and certainly not on the connection between tipping points and housing market outcomes.

To the best of my knowledge, this paper is the only one in the field of Urban Economics and specifically in the segregation literature that distinguishes between groups according to their degree of religiosity. Residential mobility is more restricted for conservative groups, whose set of choices is more limited, and this may have an amplifying effect on the sorting pattern which is observed in Israel. In addition, conservative groups, when in power (both in local and national politics), affect the public sphere to a greater extent since they enforce specific social norms that are not acceptable by other groups. Finally, in the Haredi case, since men's labor force participation rate is very low, the geographic clustering is mostly around yeshivas and less around the central business districts.[4] The Israeli case of religious conservative groups might also be relevant to European countries that recently saw big waves of immigration of conservative Muslim populations and may experience similar patterns in the years to come.

Sorting takes a somewhat extreme form when it comes to the Tipping Point Model. The main idea of the agent-based model formulated by Schelling (1971) is that individual relocation choices may aggregate to a collective result. It is assumed in the model that there is a spectrum of tolerance levels among the residents of a homogeneous neighborhood. When a new household that does not "belong" moves into the neighborhood, the marginal effect is insignificant. However, the least tolerant agent may decide to leave. When neighborhoods grow more heterogeneous, the original inhabitants begin to fear that they will become a minority, even those who were previously tolerant to heterogeneity. Native residents gradually choose to leave, until a certain threshold is reached. When the threshold is crossed, the neighborhood is expected to experience big wave of out-migration by the original inhabitants.

[4] Yeshivas are religious academies for the study of Jewish texts, aimed mostly for men.

Therefore, the incoming minority group becomes a complete majority once the neighborhood has "tipped".

The literature in this field ranges from theoretical papers (Frankel and Pauzner, 2002) to more empirical ones (Card, Mas and Rothstein, 2008; Dorn, 2008; Yin, 2009; Easterly, 2009). Card et al. (2008), use tract-level US census data from 1970 to 2000 and find that certain shares of Black residents are correlated with clear discontinuities in the growth rate of the White population in the same neighborhood in the following decade. They also test the white residents' attitudes towards Blacks using the General Social Survey, and find that cities with more tolerant white people have higher tipping points, namely that "White Flight" occurs after reaching a higher share of Black residents. As for housing prices, they find that the rents evolve smoothly, despite discontinuity in racial composition, and that house values decline slightly and experience only modest discontinuities. Dorn (2008) incorporates expectation of homeowners into the empirical testing of the Tipping Point model. He concludes that US neighborhoods with a higher share of white homeowners are more likely to tip due to a positive feedback effect in which the owners fear that housing values will drop, causing them to sell and leave the neighborhood before renters do.

The work by Card et al. (2008) is replicated in Aldén et al. (2015) and Carmi et al. (2014) for Sweden and Israel, respectively. Aldén et al. (2015) use administrative data of residents and their countries of origin, in order to find the tipping points in Swedish cities. They find that 4-7 percent of immigrants is the threshold above which Swedish "Native Flight" occurs.

Carmi et al. (2014) use election results for the years 1996 and 2006 and divide the different cities in Israel into 4 districts. The Jerusalem district in Carmi et al. (2014) includes also the growing new Haredi cities: Beitar Illit, Modi'in Illit, El'ad and Ramat Beit-Shemesh. They find that in the Jerusalem district 19-23 percent of Haredi residents represent the threshold above which the share of non-Haredi residents drops in the following decade. The weakness of the previous Israeli paper is threefold. First, the 1996 election included a direct election of the Prime Minister, in addition to the parliamentary election. This voting system may have changed the strategy of the voters and made those election results incomparable with the following ones.[5] Therefore, in my paper 2003 is used as the base year and the beginning of the research period. Second, the treatment of the entire Jerusalem district as one urban area is problematic since it includes many homogenous small localities which are not affected at all by the process of changing and could bias the results which should represent a city-specific tipping point. Third, the measure of Haredim is the share of votes for the two big Haredi Parties, Yahadut Ha'Torah and Shas. As I will show in this paper, the specification of Haredim is a crucial element that affects the results of the different estimations, since not all Shas voters are Haredi and Yahadut Ha'Torah voters usually represent bigger households.

My added value with regards to these replications is that I add the layer of the housing market which plays a crucial role in the ongoing processes of neighborhood change and segregation. Additionally, though the results of the Tipping Point testing papers are strikingly robust and large in their magnitude, they are cross-sectional in their methodology. They search for a city and year-specific tipping point instead of investigating the dynamics of cumulative process which is described be Schelling (1971). In contrast, my paper uses longitudinal approach to test a within neighborhood change relative to other neighborhoods.

2.2. Marginal Willingness to Pay for Neighborhood Amenities

The Hedonic Price Model (Rosen, 1974) expresses property value as a function of its observable components (e.g. number of rooms, size, age, location, air pollution). Urban economic theory also deals, to a large extent, with estimating the "price" of quality of life. Roback (1982) constructs a model that evaluates quality of life using the labor and real estate markets. According to her approach, certain areas are characterized by amenities that affect demand for housing in addition to the physical and geographic attributes of the house. Some amenities are positive and increase the value of the house (e.g. good schools, public parks, cultural centers), while others may

[5] Up to 1996 and since 2003 the voting system for the Prime Minister is indirect. According to the parliamentary system, the political parties form a coalition according to the number of votes they had received and if they have more than fifty percent of the seats in the Parliament, the coalition is able to nominate a Prime Minister. In the direct election system voters can vote to their chosen candidate and political party separately. Since the Prime minister identity does not depend on the coalition, in 1996 and 1999 voters were found to be following a more sectorial strategy, voting for the smaller parties and less to the big political parties. See Hazan et al. (2018) for more details.

diminish its value (e.g. noise or air pollution, high crime rates, lack of access to public transportation etc.). The definition of amenities can be applied also to the social characteristics of one's neighbors, including socioeconomic status, racial and ethnic composition. This paper adds another important amenity to the basket of goods – the changing level of religiosity of the neighborhood and its effect on the public sphere.

The early literature that tested the effects of racial composition on housing values found a temporary effect and some weak evidence of long term effects (as reviewed in Bayer et al., 2005). Harris (1999) uses hedonic price analysis and finds that, once socioeconomic status is controlled for there is no significant correlation between racial composition and housing costs in the US. Coulson and Bond (1990) reach a similar conclusion - tipping is correlated with changes in median income and not by racial composition.

The main challenge in the literature reviewed so far is causal inference. In our case, the question is whether the changes in neighborhoods' social composition affect housing prices or is it the other way around. In order to check for the causal effect of segregation on socioeconomic outcomes, Cutler and Glaeser (1997) use exogenous geographic constraints of the city's structure as instrumental variables to predict segregation in American cities. Boustan (2007) examines whether the suburbanization process in the US was the result of "White Flight" rather than the simple result of increasing house prices in the cities. By using the economic conditions in the states from which Black migrants arrived to the North as an instrumental variable, she predicts the migration of Blacks to each state and finds that each Black arrival led to 2.7 White departures. Card et al. (2008) use a sub-sample to predict when a sharp change in the racial composition is expected to occur and use an out-of-sample technique in order to test for its magnitude and its effect on house prices.[6]

2.3. Tipping Neighborhoods in Light of Haredi Demand for Housing

The phenomenon of Haredi enclaves is widespread in Israel. According to Shilhav and Friedman (1985), Haredi life can only be fully expressed in a defined closed territory. Thus, Haredi communities use strategies of invasion and succession in non-populated or socioeconomically declining neighborhoods as part of their competition

[6] A more detailed explanation of the latter is presented in section 4.

over the public space. The expansion of the Haredi territory allows the community to deepen their detachment from the modern city. The concentration of Haredi institutions and commercial establishments creates social economies of scale. This is demonstrated in Cahaner (2012) who research the patterns of migration of Haredi population to non-Haredi neighborhoods in Haifa.

According to Berman (2000), The community members benefit from belonging to a club that offers mutual insurance and charity in all fields of life. These mechanisms create a disincentive for Haredi households to move away to non-Haredi neighborhoods. Moreover, the segregated non-modern lifestyle prevents human capital accumulation and intergenerational social mobility, and acts as another pulling mechanism which prevents future generations from leaving the community.

This paper makes a significant contribution to the existing literature on Haredi patterns of segregation and integration in several ways. First, it makes use of quantitative methods unlike most previous Israeli studies in this field. Second, it finds a clear connection between the changing character of neighborhoods and housing market dynamics.

In summary, the existing literature on segregation and tipping points focuses mainly on racial and socioeconomic division. Adding the level of religiosity and the extreme self-segregation of Haredi society makes an interesting and meaningful contribution to our knowledge of social processes of separation and integration. The analysis of housing values aids in understanding the capitalization of the changes in amenities as perceived by the incoming, departing and remaining residents and this adds a quantitative measure of the value that individuals attach to the process of neighborhood change.

3. Data

3.1. Defining Who is Haredi

The main challenge in analyzing Haredi migration is defining who is Haredi. Many approaches can be found in the Israeli literature. These include:

(a) Haredi households in the Labor Force, Household Income, and Household Expenditures Surveys are the ones that include a male respondent that has listed a High Yeshiva as his most recent educational institution. In most cases, this helps in distinguishing him from Modern Orthodox respondents. Modern Orthodox men who decide to study in a Yeshiva will usually not go to a High yeshiva and are more likely to pursue higher education in a college or university afterwards, thus, not listing Yeshiva as their most recent educational institution. (Dahan, 1998);

(b) Respondents who subjectively identify themselves as Haredi in the annual CBS Social Survey since 2002 or in the Labor Force Survey since 2014. (CBS, 2009);

(c) Current and former pupils or parents of pupils who studied in Haredi Schools or Haredi Yeshivas. This information originates in administrative files created by the Ministry of Education and the Ministry of Religious Services (Portnoy, 2007);

(d) In order to determine the degree of Haredi homogeneity of a neighborhood, Gurovich and Cohen-Kastro (2004) introduce the Haredi homogeneity index. This index is calculated according to the share of votes to the Haredi parties in the election for the Israeli Parliament (The Knesset).[7] Neighborhoods that are completely Haredi are assigned the value 1, and the least Haredi (most secular) neighborhoods get 13.[8] A list of the detailed criteria for each level is presented in Appendix A.

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[7] The main parties are: Degel Ha'Torah and Agudat Israel (running together under the name "Yahadut Ha'Torah", henceforth: Gimel) and Shas. Since 2003 there have been several smaller parties that attracted mostly traditional voters for Shas. These parties were called: "Ahavat Israel" (led by rabbi Kaduri in the 2003 election) and "Yahad" (led by Eli Ishai in the 2015 election). In this paper I attribute the votes to these two political parties to Shas, as they are Sephardic movements.

[8] In the original scale there are twelve degrees of ultra-Orthodox homogeneity, I add the thirteenth degree to include the secular neighborhoods in that scale.

A methodological review by Friedman et al. (2011) of the above definitions elaborates on the advantages and disadvantages of each definition. They also compare the different estimates of the Haredi population and conclude that a combination of self-identification and administrative data is ideal. Since I do not have frequent micro data of residents by neighborhoods, I use a modified version of Cohen-Kastro's method.

3.2. National Election Results

Since my interest is in the neighborhood-level and not the individual household, I use Gurovich and Cohen-Kastro's method to calculate the homogeneity index for each statistical area in Israel according to election results for the years 1996 and 2015.[9] Since the boundaries of the statistical areas have changed twice since 1996, I use GIS tools to find the geographical areas which are comparable across all election years. I refer to these areas as neighborhoods, which I consider as the smallest units of analysis in this paper.[10]

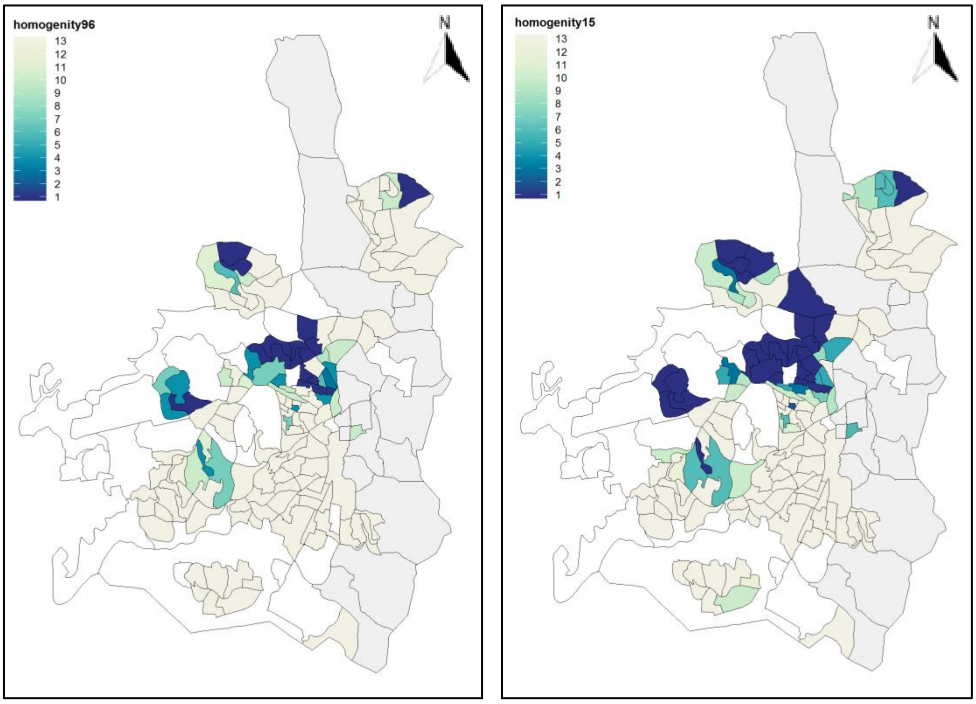
Figure 1 presents the changes in Haredi homogeneity indices by neighborhood in Jerusalem between 1996 and 2015. Note that the pattern of Haredi spatial expansion can be characterized geographically: the new Haredi neighborhoods are in most cases adjacent to the older neighborhoods, where the best Yeshivas, commercial and social centers of Haredi Society are located, and they create a territorial link between the old neighborhoods and other detached Haredi neighborhoods. This pattern is in line with our expectations and the description of Haredi territorial expansion by Shilhav (1984). The desire to stay close to the community's core leads to an expansion de-facto of the Haredi zone beyond its original borders.

[9] Most statistical areas in Jerusalem contain 1-5 ballot boxes.

[10] I use "Union" and "Dissolve" operations between the Statistical Areas layers of the 1995, 2008 and 2011 censuses. In Jerusalem, for example, the algorithm creates 184 neighborhoods where 88 percent of them contain one statistical area in terms of 2008 census boundaries, 8 percent contain two statistical areas, 3 percent contain three statistical areas and less than 1 percent contains 4-6 statistical areas.

Figure 1: Homogeneity Indices in Jerusalem According to National Election Results by Statistical Area, 1996 and 2015

A. 1996 **B. 2015**



Source: Based on election results by Statistical Area \ Ballot box published by the Israeli Central Elections Committee.

Notes: The colors represent the Homogeneity Index which is calculated according to Gurovich and Cohen-Kastro (2004) where 1 is the most Haredi and 13 is completely non-Haredi. The grey areas are Palestinian neighborhoods of East Jerusalem where most residents are not Israeli citizens and therefore do not have the right to vote in the national elections. White areas are non-residential areas.

In order to calculate voting rates for each political party, I sum the number of votes in each neighborhood and calculate the share of votes for each political party directly instead of using a simple or a weighted average of the share in the statistical areas which each neighborhood contains. The result is a dataset of all neighborhoods in Israel with the appropriate homogeneity level in each of the aforementioned years. This study's focus is Jerusalem's neighborhoods between 2003 and 2015 for the reasons mentioned previously.

Though comparing election results between 1996 and 2015 is problematic due to the change from a direct Prime Minister election to an indirect one, it is interesting to see the massive changes in Haredi homogeneity levels in Jerusalem's neighborhoods over two decades.

In order to estimate a continuous measure of the share of the Haredi population in each neighborhood during each election year, it is not enough to calculate the share of votes to the Haredi political parties, since they do not include children and some of the Shas voters are not Haredi. I use the 2008 Census confidential microdata, which includes highly detailed information on households in the statistical area level in order to find out to what extent the Haredi political parties voting rates represent the population shares of Haredi residents in each neighborhood. The census data consists of about one million observations, representing the entire population of Israel. I define an individual as ultra-Orthodox if her household fulfills one or more of the following conditions:

(1) At least one man has studied in a High Yeshiva for three years or more.[11]
(2) At least one of the women in the household gave birth to six children or more and was not born in Africa or Asia.[12]
(3) At least one of the women gave birth to two or more children by the age of 24.
(4) The household is in one of the Haredi cities (Ramat Beit-Shemesh, Modi’in Illit, Beitar Illit, Emanuel, El’ad and 11 other small communities) or a very homogeneous Haredi neighborhood (with a rank of 1 according to Gurovich and Cohen-Kastro's index of Haredi homogeneity)

Using the approximated share of Haredi residents in each statistical area in the 2008 census, I run the following linear regression:

$$Haredi_{2008,s} = \alpha Gimel_{2009,s} + \beta Shas_{2009,s} \tag{1}$$

Where $Haredi_{2008,s}$ is the share of Haredi residents (including children) in neighborhood s according to the above conditions (based on the 2008 census), $Gimel_{2009,s}$ is the share of votes for Yahadut Ha'Torah in the same neighborhood during the 2009 national election and $Shas_{2009,s}$ is the share of votes for Shas.

I use this method because the census was carried out only once during the research period while elections occurred roughly every three years, enabling a higher frequency analysis of the main explanatory variable (share of the Haredi population)

[11] Three years as a minimum enables to distinguish between modern-Orthodox men, who are obliged to serve in the army and most of them study less than 3 years in Yeshiva programs, and ultra-Orthodox men, who must study for more than 3 years in order to avoid the draft order.
[12] Women who immigrated from North-African and Asian countries have a higher probability to have a larger family, even if they are not ultra-Orthodox.

over time. This regression determines the weights that should be assigned to the voting rate of each political party in 2009 in order to have a proper representation of total population share of Haredi residents. The resulting α represents the factor by which every Gimel percentage point of votes should be multiplied and the resulting β is the factor by which every Shas percentage point should be multiplied. I assume that the coefficients are constant across different election years in the research period and apply those which are found in 2008/9 to other election years in order to find the estimated share of Haredi residents in each neighborhood in years for which there is no other indicator.

The results of the linear regression show that α = 1.265 and β = 0.633. These results are reasonable according to our prior intuition. Those who vote for Gimel are almost certainly Haredi, which means that each vote for Gimel represents a Haredi voter and some of her children (α = 1.265). In contrast, given that many traditional Sephardi Jews vote for Shas, even though they are not Haredi, the result of β = 0.633 means that not every vote for Shas represents a Haredi voter. Table 1 presents the country-wide results of this procedure.

The above calculation can be thought of as a continuous approximation of Gurovich and Cohen-Kastro's index, since it gives a bigger weight to Gimel voters in representing the level of religiosity of the voters to the Haredi political parties. Its advantage is that it creates a continuous variable that allows more precision of the main explanatory variable. Figure 2 shows a comparison of the calculated share of Haredi residents for the election years of 2003 and 2015. Figure 2 shows that the spatial patterns of neighborhood change across the different areas of Jerusalem remain similar to the pattern presented by the homogeneity index method (Figure 1).

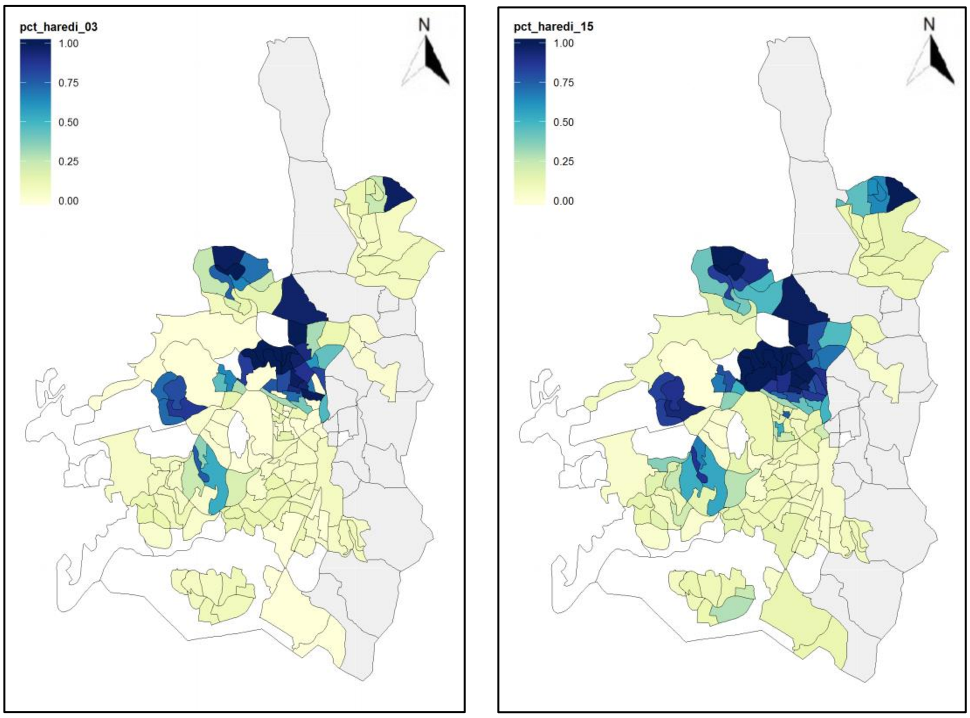
Table 1: Calculated Share of Haredi Population in Israel According to the National Election Results, 2003-2015

	Share of Votes for Shas + other Haredi Sephardi Parties (%)	Share of Votes for Gimel (%)	Calculated Share of Haredi residents (%)
2003	8.4	4.3	10.7
2006	9.5	4.7	12.0
2009	8.5	4.4	10.9
2013	9.7	5.2	12.7
2015	8.7	5.0	11.9

Source: Based on election results by Statistical Area \ Ballot box downloaded from the national election committee's website and the Israel Social Sciences Data Center (ISDC).
Notes: The calculated share of Haredim is a synthetic measure created using the weights: 0.633 for each percent of votes for Shas and 1.265 for each percent of votes for Gimel. The details of the method for estimating these weights are presented in section 3.2.

Figure 2: Haredi Share of Total Population by Neighborhood, Jerusalem

A. 2003 **B. 2015**



Source: Based on election results by Statistical Area \ Ballot box downloaded from the national election committee's website and the Israel Social Sciences Data Center (ISDC).
Notes: The colors represent the calculated share of Haredim. The calculated share of Haredim is a synthetic measure created using the weights: 0.633 for each percent of votes for Shas and 1.265 for each percent of votes for Gimel. The details of the method for estimating these weights are presented in section 3.2. The grey areas are Palestinian neighborhoods of East Jerusalem where most residents are not Israeli citizens and therefore do not have the right to vote in the national elections. White areas are non-residential areas.

3.3. Karmen Dataset of Real Estate Transactions

The Karmen administrative dataset includes every transaction in the Israeli real estate market since 1998. I limit the transactions in this research to household purchases of residential properties. The dataset is obtained from the Israel Tax Authority via the Bank of Israel. This dataset is used by the CBS to construct the official Prices of Dwellings Index; transactions that do not meet the criteria set by the CBS are dropped.[13] The variables of interest are attributes of the apartment such as price, area in square meters, number of rooms and the building's age. These attributes enable a hedonic price analysis. Summary statistics of the data used in the analysis are available in Table 2. Figure 3 presents a graphical illustration of the distribution of price changes across different neighborhoods in Jerusalem during the analysis period. We can see that the largest price increase in concentrated mainly in the northern neighborhoods of Neve Yaacov and Pisgat Ze'ev and in the southern neighborhoods of Katamon, but large price increases are also evident in smaller parts of other neighborhoods.

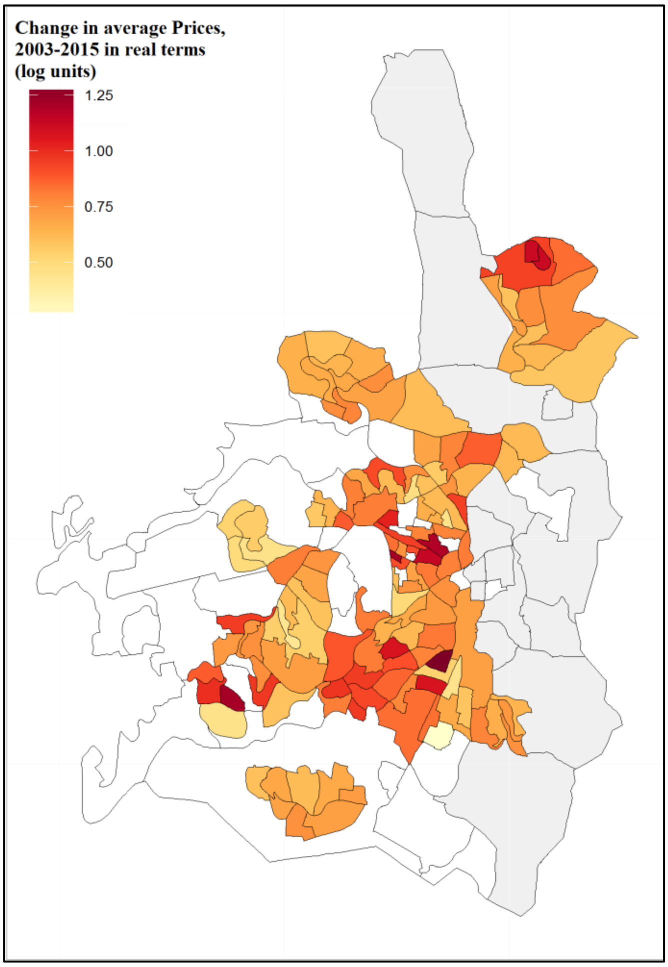
Table 2: Summary Statistics of Apartment Sales in Karmen, 2003 and 2015

	Israel (N=708,166 in 2003-2015)				Jerusalem (N=59,059 in 2003-2015)			
	2003 (N=40,391)		2015 (N=67,462)		2003 (N=3,746)		2015 (N=5,138)	
Variable	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd
Price (current thousands of NIS)	654.7	327.8	1,375.1	736.2	761.7	321.3	1,780.8	721.5
Area (m^2)	84.3	25.1	88.5	26.7	80.2	23.6	84.0	26.5
Age (years)	18.1	18.1	22.5	23.2	22.9	17.0	26.6	22.1
Rooms	3.6	0.9	3.7	0.9	3.4	0.8	3.6	0.9

Source: Data on purchase transactions are from the Israel Tax Authority (via the Bank of Israel).

[13] The most important criteria are the following: (1) the number of rooms is between 1.5 and 5.0 (the share of properties outside this range is negligible); (2) the ratio between property area and the number of rooms is within a certain range; (3) the price per square meter is within a certain range (determined separately for each locality).

Figure 3: Change in Average House Prices across Jerusalem, 2003-2015 in real terms (log units)



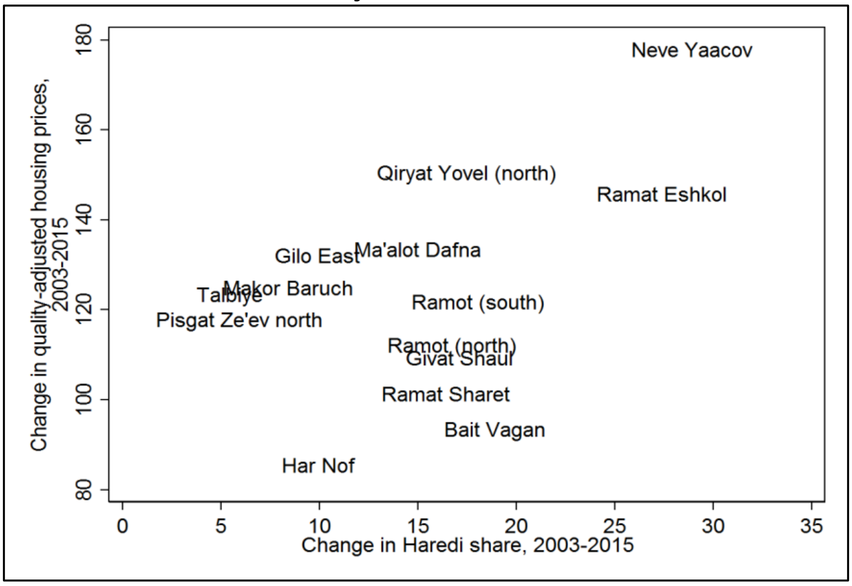
Source: Data on purchase transactions are from the Israel Tax Authority (via the Bank of Israel).
Notes: The colors represent the change in the simple average of log prices for each neighborhood. The change is in real terms. The grey areas are Palestinian neighborhoods of East Jerusalem where most residents are not Israeli citizens and therefore do not have the right to vote in the national elections. White areas are non-residential areas.

It is difficult to find a visible connection between Figures 2 and 3. Thus, Figure 4 presents a basic scatter plot of the relationship between the quality-adjusted change in house prices and the change in the Haredim's share by sub-quarters.[14,15] Note that this is a simple average of the neighborhoods in each sub-quarter. The sub-quarters which are presented in Figure 4 are the ones that saw an increase in Haredi share which was

[14] The quality-adjusted average change in prices is partialled out of apartment attributes.
[15] In most cases sub-quarters contain 3-4 neighborhoods as defined above.

higher than five percent between 2003 and 2015. When the rest of the neighborhoods are added to the scatter plot (See Appendix Figure D.1) the relationship between the change in Haredi share and price change looks more quadratic. Nonetheless, since the focus of this paper is in the neighborhoods which have experienced dynamics in the population composition, Figure 4 portrays the relationship which is of more interest to this study. The division to neighborhoods (which are smaller than sub-quarters) in the following sections allows me to run a much finer analysis in areas that are close to each other geographically but may experience different changes in social composition.

Figure 4: Change in House Prices and Haredi Share by Sub-Quarter, 2003-2015



Source: See Figures 2 and 3.
Notes: The unit of observation is a sub-quarter in 2003 and 2015. Only sub-quarters that saw an average increase of more than five percentage points Haredim are included in the plot.

4. A Test for the Existence of a Tipping Point in Jerusalem

Following the methodology suggested by Card et al. (2008), I use a two-stage procedure to test if there is a correlation between the rate of change of non-Haredi population share and the initial Haredi population share across different neighborhoods of Jerusalem. More specifically, I test if this correlation can be representing a city-specific Tipping Point. In the first stage, I use what Card et al. (2008) refer to as the "fixed point procedure".[16] This procedure assumes that a tipping point exists, and the goal in the first stage is to find the point that best predicts a future sharp change in the neighborhood's population composition. The goal in the second stage is to test the hypothesis that the minority share which is found in the first stage is indeed a point that predicts a discontinuity in the trend of population change in Jerusalem's neighborhoods. Subsection 4.2 tests if there is a discontinuity in house values at the candidate Tipping point.

4.1. Religiosity-Level of the Neighborhood

I use a sub-sample of neighborhoods (half of the total sample) for the in-sample search procedure (henceforth: the first stage) and the rest in the out-of-sample estimation stage (henceforth: the second stage).[17] In order to create two balanced groups, I first sort the neighborhoods according to the share of Haredi residents in the base year (2003) and assign neighborhoods into each group alternately. The technical details of the first stage are presented in greater depth in Appendix B. The result of the first stage, which is based on the "fixed point procedure", is a candidate tipping point which is found to be at a Haredi share of 12 percent in the initial year of the research.

The first stage is bound to yield a result by construction. However, it may not be a real point of discontinuity. In order to confirm or reject this result we need to run an out-of-sample test. In the second stage, I use the second half of the sample in order to test the hypothesis that the result of the first stage, the share of Haredi residents in

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[16] The authors suggest several methods of locating the potential tipping point and conclude that the fixed-point procedure is the most stable method when dealing with small samples.

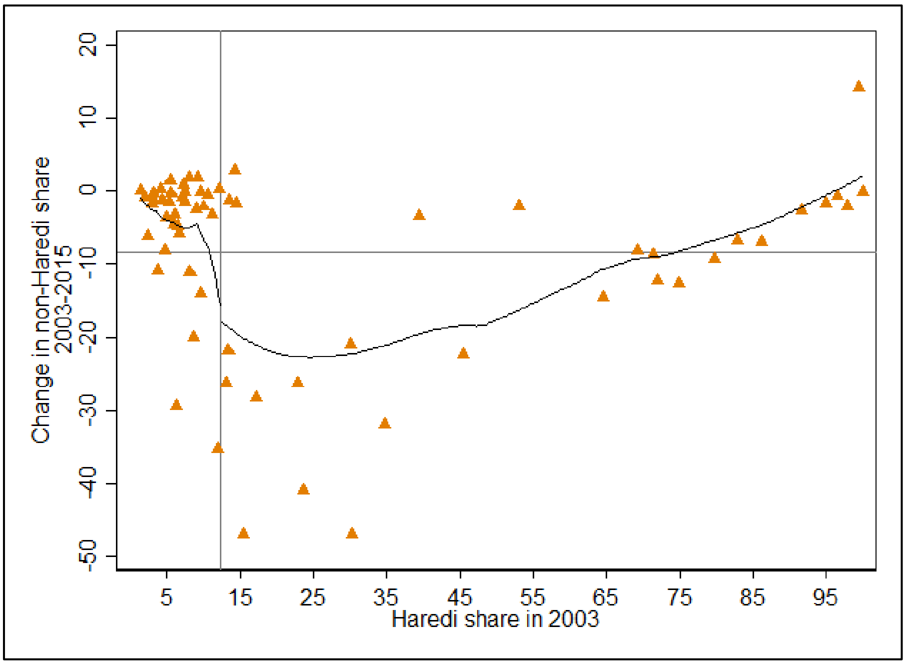
[17] The original paper uses two thirds of the neighborhoods for the first stage and a third for the second stage. Since I have too few observations (neighborhoods) in the full sample, I divide the data into two sub-samples of the same size.

2003 ($UO^*_{2003} = 12.3$ percent), is indeed a point of discontinuity (i.e. there is a steeply downward-sloping section in the region of UO^*_{2003}).

Figure 5 presents the results of the second stage graphically, with the initial share of Haredi residents on the horizontal axis and the percentage change in the share of non-Haredi residents on the vertical axis. The dashed horizontal line marks the city-wide simple average of change (-8.4 percentage points). The dashed vertical line represents the share of Haredi residents that marks the candidate tipping point.

I find that there is a cluster of neighborhoods that are below the candidate tipping point threshold in 2003, and indeed these neighborhoods experienced a smaller than average decrease in non-Haredi population during the years 2003-2015. Above the candidate tipping point we see several neighborhoods that experienced a sharp drop in the share of non-Haredi residents, while above 60 percent we see a smaller decrease which is caused by the fact that there were not so many non-Haredi inhabitants to begin with. The solid lines are local linear regression fit to the neighborhood-level data, using an Epanechnikov kernel, estimated separately on each side of the candidate tipping point. We can see in Figure 5 that there is a sharp decrease in the share of non-Haredi residents in the region of UO^*_{2003}, but it does not look like a point of a sharp discontinuity.

Figure 5: Change in Non-Haredi Share, Below and Above the Candidate Tipping Point, 2003-2015



Notes: The horizontal line is the city's simple average of the change in non-Haredi share and the vertical line shows the 12.3 percent candidate tipping point threshold found in the first stage. The triangles represent second stage neighborhoods sub-sample and the solid lines are two local linear regressions, using Epanechnikov kernel and estimated separately on each side of the vertical line. This line is chosen in the first stage which is described in Appendix B.

I continue to follow Card et al. (2008) with a few modifications.[18] In order to estimate the magnitude of the change in the non-Haredi population share, I run the following model:

$$\Delta NUO_s = \beta_0 + \beta_1 Past_s + \beta_2 \delta_s + \beta_3 {\delta_s}^2 + \beta_4 Population_{2003,s} + \beta_5 housing\_stock_{2003,s} + \overline{\log(\text{price})}_{2003,s} + \epsilon_s \quad (2)$$

Where:

ΔNUO_s	-	The relative change in share of non-Haredi residents in neighborhood s between 2003 and 2015 (relative to the city's simple average of change), in percentage points
$Past_{s,2003}$	-	A dummy indicating the neighborhood is past the candidate tipping point already in 2003
$\delta_{s,2003}$	-	The numeric distance of each neighborhood from the city's candidate tipping point in 2003 ($UO_{2003,s}$-UO^*_{2003})
$Population_{2003,s}$	-	The population in neighborhood s in 2003
$housing\_stock_{2003,s}$	-	The housing stock in neighborhood s in 2003
$\overline{\log(\text{price})}_{2003,s}$	-	The average of log(price) for 3-4 rooms apartments in neighborhood s in 2003.

The main coefficient of interest is β_1 which is an indicator of the discrete change in the share of non-Haredi residents in neighborhoods that were initially above the threshold. If the estimate is statistically significant, we can conclude that UO^*_{2003} is indeed a tipping point. A negative (positive) coefficient means that the neighborhoods above UO^*_{2003} experienced a significantly bigger (smaller) decrease in non-Haredi population on average. β_2 and β_3 measure the continuous change in non-Haredi

[18] The modification includes: testing a quadratic instead of fourth-order polynomial and not using some of the control variables which are available in the original paper. Gelman and Imbens (2018) specify the reasons for using just a second order polynomial.

population with relation to the neighborhood's initial numerical proximity to the candidate tipping point. The population size, housing stock and average house price variables are meant to be used as controls for neighborhood attributes which might cause future changes in population composition.

Table 3 presents the results from estimating Equation (2) when adding the control variables gradually. I find a significant effect for neighborhood which are above the 12 percent threshold, which amounts to a 15 percentage points decrease in the share of non-Haredi inhabitants for neighborhoods that were initially above the 12 percent threshold (columns 1-2). However, this result is not very robust. When zooming into the sub-sample of neighborhoods with less than 60 percent Haredi residents in 2003, the sign of β_1 remains negative but it is much smaller and no longer statistically significant (columns 3-4). There is still a clear correlation between the numeric proximity to the candidate tipping point and future change in neighborhood composition, but we cannot reject the null hypothesis, namely that UO^*_{2003} is not a point of discontinuity. Nonetheless, this could also be a result of a small sample problem so it is hard to have a clear conclusion regarding the existence of a tipping point. Yet, the 12 percent threshold does mark some point of importance in the dynamics of population change in Jerusalem's neighborhoods during that time period.

In Appendix C, I run additional robustness tests to check the sensitivity of the second stage results to the choice of the candidate tipping point by choosing arbitrarily 3 different points: 10 percent, 15 percent and 20 percent. I find that the second stage results are very sensitive, thus it is hard to rely on the above results to make a claim about Jerusalem's exact tipping point. The 10 percent threshold looks the same as the 12.3 percent, the 15 percent threshold seems to lead to classic tipping point pattern and the regression shows a very large decline of 27-28 percentage points in non-Haredim's share in the following decade (Table C.1). This clear pattern disappears in Panel C which uses 20 percent as the threshold, but it is still evident that there is a sharp decline in the local linear regression at about 15 percent. Since the 15 percent threshold is chosen arbitrarily and not according to the methodology suggested by Card at el. (2008), I prefer to use the first stage result of 12.3 percent as the point of significance in the following estimations, while keeping in mind that there could be a small range which points out the tipping dynamics of neighborhoods and not just one point.

The 15 percent result is consistent to a certain extent with the results found by Carmi et al. (2014) despite the weaknesses of their data.[19] While they find 19-23 share of Haredim as Jerusalem's tipping point, my results show a non-robust threshold of 12-15 percent. Nevertheless, if I were to compare the results, they would suggest that Jerusalem is experiencing a trend opposite from the one found in Card et al. (2008), namely that the tolerance level is declining with time.[20]

Table 3: The Numeric Proximity to Tipping Point and the Change in Non-Haredi Share ,2003-2015

	All Neighborhoods		Neighborhoods with less than 60 percent Haredi residents in 2003	
	(1)	(2)	(3)	(4)
$Past_{s,2003}$	-14.12***	-14.92***	-6.98	-9.36
	(4.95)	(5.21)	(6.62)	(6.69)
$\delta_{s,2003}$	-0.20	-0.14	-0.97**	-0.92*
	(0.22)	(0.23)	(0.44)	(0.47)
$\delta^2_{s,2003}$	0.01**	0.01**	0.03**	0.03**
	(0.00)	(0.00)	(0.01)	(0.01)
$\log(population_{2003})$		-5.76		-8.13
		(3.54)		(5.16)
Housing $stock_{2003}$		0.00		0.00
		(0.00)		(0.00)
average log $price_{2003}$		3.71		0.09
		(4.71)		(6.17)
Number of neighborhoods	66	62	46	46
Adjusted R^2	0.35	0.36	0.35	0.36

Notes: The unit of observation is a neighborhood in 2003 and 2015. The dependent variable is the change in percentage points of non-Haredi Share in that neighborhood. The regression is estimated using only half of the neighborhoods which are not used to identify the candidate tipping point.

[19] The problem with using the entire Jerusalem district during the years 1996-2006 is explained in the literature review.

[20] Card et al. found that the white residents' tolerance is increasing with time, as the tipping point adjusts to a higher rate of black residents from 11.87 percent in the 1970s to 14.46 percent in the 1990s. The same upward trend is evident in Aldén et al. (2015) who found the mean tipping point in 1990 to be 6.9 percent and 9.5 percent in 2000.

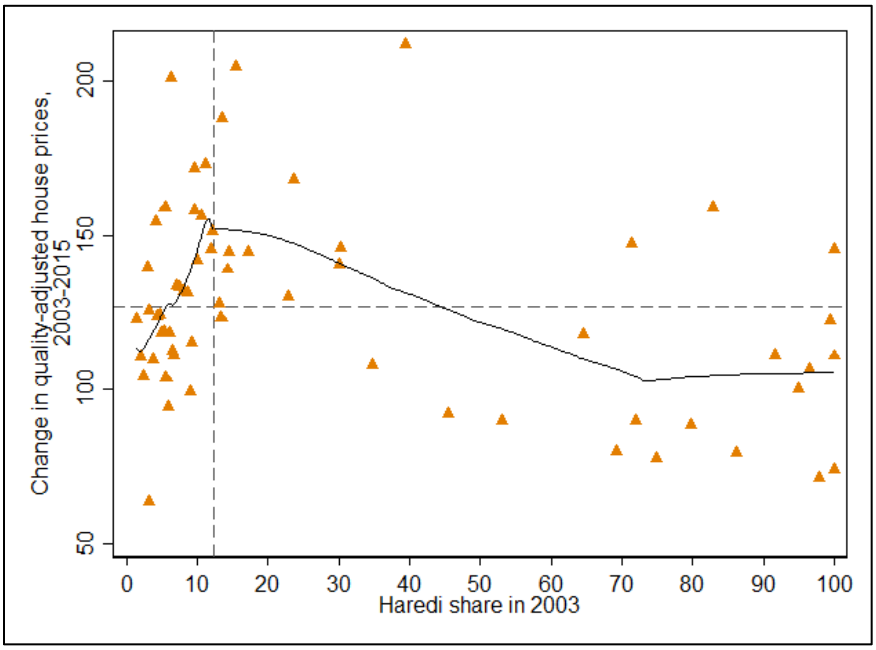
4.2. The Housing Market

The model presented by Card et al. (2008) predicts that rents will evolve smoothly as a neighborhood exceeds the tipping point and they find a small insignificant negative discontinuity in house prices. Due to the results of the previous subsection, from now on I will refer to the candidate tipping point as the "first stage result". I continue to use the first stage result since it does draw the line to some extent between the segregated non-Haredi neighborhoods and heterogeneous neighborhoods which are in the process of population change.

In order to check whether there is discontinuity in house values at the first stage result, I replace the change in non-Haredi share of residents on the vertical axis with the average quality-adjusted house price change between 2003 and 2015.

In order to test if there is a tipping pattern in the housing market, I use in Figure 6 the same estimation method that is used in Figure 5 to create the two local regression lines in each side of the vertical line. It seems that neighborhoods on both sides of the tipping point experienced higher than average changes in house values, but the plot does not reveal a pattern of regression discontinuity around the potential tipping point, therefore suggesting that there is no tipping behavior in the housing market.

Figure 6: Change in House Prices, Below and Above the Candidate Tipping Point, 2003-2015



Notes: The dashed horizontal line is the city's simple average of the quality-adjusted change in house prices and the dashed vertical line shows the 12.3 percent candidate tipping point threshold found in the first stage. The triangles represent second stage neighborhoods sub-sample and the solid lines are two local linear regressions, using Epanechnikov kernel and estimated separately on each side of the vertical line. This line is chosen in the first stage which is described in Appendix B.

Table 4 uses the same model from Equation (2) but changes the dependent variable to be the quality-adjusted change in house prices between 2003 and 2015. In this estimation there is even a bigger difference between the full sample and the sample of non-Haredi neighborhoods. The result of the full sample shows no particular trend in the price dynamics with relation to the first stage result. When these neighborhoods are excluded from the regression, the coefficient of *Past* becomes negative and insignificant statistically, pointing at a slower increase in prices in neighborhoods that were initially above the first stage result. This big change in coefficients might be caused by an insufficient number of observations in both sub-samples or because of the sparsity in the right-hand side of the candidate tipping point. the distance from the 12.3 is not symmetrical. On the left-hand side of the candidate tipping point the maximal possible distance is 12.3 while on the right-hand side of the candidate discontinuity point, there are many observations which have $\delta_{s,2003} > 50\%$.

In Appendix C, I show the sensitivity of the second stage results in terms of house values to the choice of the candidate tipping point with the same arbitrary candidate points as in Subsection 4.1. The 15 percent threshold, which was correlated with a significant decline in non-Haredi shares in the previous subsection, looks like a point of discontinuity in house values in Figure C.2. Nevertheless, Table C.2 Shows that the house prices dynamics are very stable and similar to the results in Table 4 and even if there is a tipping point in the population's composition, house values evolve smoothly at the tipping point.

Nonetheless, while β_1 is not statistically significant, β_2 and β_3 indicate a continuous quadratic relationship between the change in house prices and initial numeric distance to the 12 percent point. In both samples the population size, housing stock and initial prices have a big influence on prices. This result is reasonable because these variables are directly related to the housing market.

The estimated coefficient of average log price_{2003} in Table 4 confirms the phenomenon of price convergence in which neighborhoods with initially higher prices are expected to see smaller price increases. This process could be explained by a situation in which initially there is relative excess supply in the cheaper neighborhoods which diminishes as demand shifts from the more expensive neighborhoods to the cheaper neighborhoods, in the process of converging to equilibrium.

The fact that the observed change is continuous across different starting points and the fact that the change in house prices is correlated with the level of religious homogeneity of the neighborhood calls for a wider view of the neighborhood in an urban context where the religious character and prices in the alternative options affects the dynamics in the heterogeneous neighborhood to a great extent. In section 5 I propose a theoretical model which explains the social and economic channel through which this relationship is formed in the context of an entire city and not just a single neighborhood (the original Tipping Point model is limited to a bounded single neighborhood). In section 6 I analyze this social and economic process, by using longitudinal annual data, and show that the growth in Haredi share is an important factor in the observed price increases, especially in neighborhoods that have changed their religious character.

Table 4: The Numeric Proximity to the Tipping Point and the Change in House Prices, 2003-2015

	All Neighborhoods		Neighborhoods with less than 60 percent Haredi residents in 2003	
	(1)	(2)	(3)	(4)
$past_{s,2003}$	17.54	15.74*	-13.18	-5.54
	(12.04)	(9.34)	(13.78)	(10.06)
$\delta_{s,2003}$	-0.24	-0.11	3.04***	1.96***
	(0.53)	(0.41)	(0.92)	(0.69)
$\delta^2_{s,2003}$	-0.00	0.00	-0.09***	-0.04**
	(0.01)	(0.00)	(0.02)	(0.02)
log(population$_{2003}$)		-29.53***		-46.03***
		(6.43)		(6.87)
housing stock$_{2003}$		0.02***		0.03***
		(0.01)		(0.01)
average log price$_{2003}$		-72.17***		-67.76***
		(8.20)		(8.32)
Number of neighborhoods	125	123	93	93
Adjusted R^2	0.07	0.45	0.15	0.57

Notes: The unit of observation is a neighborhood in 2003 and 2015. The dependent variable is the quality-adjusted change in average house price. The quality-adjusted average change in prices is partialled out of apartment attributes. The regression is estimated using all of the neighborhoods with sufficient number of transactions in 2003 and 2015.

5. A Model of Neighborhood Change

This section explains why the neighborhoods that are initially heterogeneous are relatively cheaper and how does the migration of more Haredi residents into those neighborhoods act as the mechanism that drives the observed price convergence and equilibrates the urban housing market. This basic idea of the model is that migration is stimulated not only by price differentials between neighborhoods but also by social differentials (in this case religiosity levels) which are strong amenities that affect the demand for housing differently for various social groups. The migration induces a positive feedback. Initially prices increase because excess demand from Haredi neighborhoods finds an outlet in the cheaper neighborhoods. Like in Schelling (1971), a small flow of migrants at first sets the ground for others by increasing a group-specific social amenity in those neighborhoods. This process is expected to increase prices until a new equilibrium is reached where the marginal Haredi agent is indifferent between the heterogeneous and Haredi neighborhoods.

The following model is inspired by the models which are presented in two papers that deal with the effect of migration on local housing prices. Guerrieri et al. (2013) propose a model in which everyone benefits from living near rich neighbors. The mobility of agents inside the city is free for both rich and poor agents, and causes gentrification of poor neighborhoods during years of housing booms. My model is more similar to Accetturo et al. (2014) who do not presume disutility of natives from the presence of foreign immigrant neighbors. Their model hypothesizes that increasing prices may represent an attraction of natives to neighborhoods with more cultural variety. However, the model by Accetturo et al. (2014) does not include free mobility of the foreign immigrants, making the model based solely on the utility maximization of just one of the groups, while my model is reciprocal like in Schelling’s original model.

The current proposed model considers two groups and their intra-group bias which creates opposing forces within the same neighborhood. The starting point is a segmented housing market where the differences in religiosity-level between neighborhoods create frictions maintain the initial price differentials between different segments. The positive price differential between the segregated neighborhoods (both non-Haredi and Haredi) and the heterogeneous neighborhoods represent the value that people attach to living among those who are similar to them. The lower housing prices in the heterogeneous neighborhoods act as a compensating differential that makes up for the lack of certain social amenities (such as unique schools, formal and informal community institutions etc.), which are more abundant in the homogeneous neighborhood. As heterogeneous neighborhoods become more similar to either of the segregated neighborhoods, they become part of a different segment in the urban housing market and prices in those neighborhoods are expected to converge to the prices in the group of homogeneous neighborhoods to which they would now belong.[21]

Suppose a closed city (a city that has no external inflows or outflows of residents). For simplicity, assume that there are only three neighborhoods: the homogeneous non-Haredi neighborhood (s=1), the heterogeneous neighborhood (s=2) and the homogeneous Haredi neighborhood (s=3). Suppose also that neighborhoods 1 and 3 are big enough and neighborhood 2 is small enough so that migration from the big neighborhoods to the small neighborhood does not change the religious composition in neighborhoods 1 and 3 but it does change the religious composition in the heterogeneous neighborhood. There are only two types of households: non-Haredi (i=a) and Haredi (i=b). Each agent has a Cobb-Douglas utility function of the form:

$$U_{i,s} = C_i^{(1-\alpha)} H_i^{\alpha} A_s^{\delta_i} \tag{3}$$

Where A_s is an amenity level which, in this case, is the share of Haredim in neighborhood s, H_i is quantity and quality of Housing, C are other consumption goods, δ_i represents the agent's preferences for having Haredi neighbors. If $\delta_i > 0$ the agent gets a positive utility (benefit) and if $\delta_i < 0$, she extracts disutility from additional Haredi neighbors. I call this coefficient the tolerance measure. I assume that $\delta_a < 0$ and $\delta_b > 0$.

When choosing where to live, the agent maximizes her utility function while considering her budget constraint:

$$Max\ C_i^{(1-\alpha)} H_i^{\alpha} A_s^{\delta_i} \tag{4}$$

$$s.t.\ Y_i = p_c C_i + r_{s,i} H_i \tag{5}$$

Where p_c is the price of the numeraire and $r_{s,i}$ is the price of housing. In this model the value of a house is proportional to the rent that would be paid for it.

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21 In practice, most of the neighborhoods in Jerusalem which go through population change in the long run, become more Haredi and not the other way around.

When normalizing the price of the consumption good to 1, the demand of agent *i* is therefore:

$$H_i = \frac{\alpha Y_i}{r_{s,i}};\ \ C_i = (1-\alpha)Y_i \tag{6}$$

And the Indirect Utility function is: $V_{i,s} = [(1-\alpha)Y_i]^{1-\alpha}\left(\frac{\alpha Y_i}{r_s}\right)^{\alpha} A_s^{\delta_i}$

The Spatial Equilibrium condition entails that the indirect utility of an agent should be identical across locations: $V_{b,2} = V_{b,3}$; $V_{a,1} = V_{a,2}$. Thus, the price that agents of different types are willing to pay is determined by the prices and by the share of Haredim in the alternative neighborhoods which are relevant to their type:

$$r_{2,a} = r_1\left(\frac{A_2}{A_1}\right)^{\frac{\delta_a}{\alpha}};\, r_{2,b} = r_3\left(\frac{A_2}{A_3}\right)^{\frac{\delta_b}{\alpha}} \tag{7}$$

Where $r_{2,a}$ is the price paid in equilibrium by agent *a* (non-Haredi) in the heterogeneous neighborhood and $r_{2,b}$ is the price paid in equilibrium by agent *b* (Haredi) in the same heterogeneous neighborhood.

Transforming these conditions to their logarithmic form, we get:

$$\log(r_{2,a}) = \log(r_1) + \frac{\delta_a}{\alpha}[\log(A_2) - \log(A_1)] \tag{8}$$

$$\log(r_{2,b}) = \log(r_3) + \frac{\delta_b}{\alpha}[\log(A_2) - \log(A_3)] \tag{9}$$

Under very simplifying assumptions, the observed average price in the heterogeneous neighborhood is the price each agent type is willing to pay, weighted by her share in that neighborhood:

$$\log(r_2) = (1-A_2)\log(r_{2,a}) + A_2\log(r_{2,b}) =$$

$$(1-A_2)\{\log(r_1) + \frac{\delta_a}{\alpha}[\log(A_2) - \log(A_1)]\} + A_2\,\{\log(r_3) + \frac{\delta_b}{\alpha}[\log(A_2) - \log(A_3)]\}$$

(10)

Equations 8-11 result in several theoretical predictions:

(1) *The housing prices in the homogeneous neighborhoods are higher than prices in the heterogeneous neighborhood.* This can be seen in Equation (8) where both types of agents are willing to pay lower prices for the same type of apartment in the heterogeneous neighborhood in comparison to the homogeneous neighborhood of their own type.

$$\mathrm{r}_{2,\mathrm{a}} < \mathrm{r}_1\,, \mathrm{r}_{2,\mathrm{b}} < \mathrm{r}_3 \tag{11}$$

(2) *The prices in the homogeneous neighborhoods have a positive impact on prices in the heterogeneous neighborhood*. This is due to the free mobility of agents which enables diffusion of excess demand from the more expensive homogeneous neighborhoods to the less expensive heterogeneous neighborhoods.

$$\frac{\partial \log(r_2)}{\partial log(r_3)} > 0, \frac{\partial \log(r_2)}{\partial \log(r_1)} > 0 \quad (12)$$

(3) The share of Haredi inhabitants in the non-Haredi neighborhoods has a positive impact on prices in the heterogeneous neighborhood. This mechanism effects r_2^* positively since it is lowering the alternative opportunities for non-Haredi residents in other neighborhoods and it is making the heterogeneous neighborhood relatively more attractive to non-Haredi households.

$$\text{Since } \delta_a < 0, \quad \frac{\partial \log(r_2)}{\partial \log(A_1)} > 0 \quad (13)$$

(4) The level of homogeneity of the Haredi neighborhoods has a negative impact on prices in the heterogeneous neighborhood. This mechanism affects r_2^* since it is making the heterogeneous neighborhood relatively less attractive to Haredi people.

$$\text{Since } \delta_b > 0, \quad \frac{\partial \log(r_2)}{\partial \log(A_3)} < 0 \quad (14)$$

(5) The effect of a change in the share of Haredi residents on average rent ($\frac{\partial \log(r_2)}{\partial A_2}$) depends on r$_1$*, r*$_3$*, A*$_1$*, A*$_2$*, A*$_3$*, δ_a and δ_b.*

$$\frac{\partial \log(r_2)}{\partial A_2} = -\log(r_1) + \log(r_3) + \frac{\delta_a}{\alpha}\log(A_1) - \frac{\delta_b}{\alpha}\log(A_3) + \frac{\delta_a}{\alpha A_2} + \left(\frac{\delta_b - \delta_a}{\alpha}\right)[1 + \log(A_2)] \quad (15)$$

The bigger r_1 gets, the smaller the effect that a change in A_2 has on r_2, because the alternative is less attractive for non-Haredi agents. The bigger r_3 gets, the more A_2 impacts r_2 since the heterogeneous neighborhood will now attract more residents from the Haredi neighborhoods and its price trend will gradually become more similar to the dynamics of the Haredi segment of the housing market. The same rationale of the relative attractiveness of alternatives could explains why a higher A_1 will cause non-Haredi residents to think twice before leaving neighborhood of type 1 (non-Haredi homogeneous neighborhoods) and why a higher A3 will make the potential

Haredi migrants think carefully before moving away from the Haredi neighborhood to the heterogeneous neighborhood.

Finally, the level of A_2 (the amenities that the neighborhood offers) affects prices through two opposing forces. The first is the disutility of non-Haredi agents from increasing shares of Haredi households, which has a proportional negative effect on $\frac{\partial \log(r_2)}{\partial A_2}$. when A_2 increases, the share of people who dislike the change is reduced, and the negative effect on the price diminishes. The contrary force is based on the Haredi agent's point of view. A higher A_2 makes r_2 grow faster with A_2 since the Haredim's higher share means a bigger part of the agents is pleased with the change and those agents are willing to pay more for housing in neighborhood 2. Therefore, the sign of the total effect ($\frac{\partial \log(r_2)}{\partial A_2}$) depends on $A_1, A_2, A_3, r_1, r_3, \delta_a$ and δ_b. These represent the level of segregation in each type of neighborhood, the prices in the alternative neighborhoods, the tolerance level of each agent and the composition of the neighborhood which faces Haredi migration. This result stresses the importance of examining the dynamics of a neighborhood as part of a greater urban context and not just as a single separate market.

From all of the above we can see that the way prices change as a result of changes in neighborhood composition is not trivial, as it depends on which effect dominates – the increasing attraction of the Haredi population or the increasing unattraction of the non-Haredi population. In Section 6 I examine this question in greater depth.

The model and its empirical estimation become more complicated if we assume that the city is open, in which case residents can move freely between the city and other cities, but the intuition remains the same. In the case of out-migration, if we assume that agents will first move from the segregated neighborhoods to the integrative ones and only if housing prices in those neighborhoods are too high in relation to the available amenities and outside options, they will choose to leave the city and live elsewhere. The same process is expected in the case of migration into the city. The migrant prefers to live in the homogeneous neighborhood, but if prices there are too high, she will move into the heterogeneous neighborhood, until the marginal migrant is indifferent.

6. Empirical Analysis of Within Neighborhood Changes using Panel data

Section 4 does not find robust evidence of a sharp change neither in population composition nor in house prices. Nevertheless, there is some correlation between the initial share of Haredi residents in a neighborhood and changes in religiosity level and house prices. The weakness of the previous methodology is primarily in its cross-sectional strategy which looks at differences between neighborhoods in different levels of Haredization and on the within neighborhood dynamics. In this section, I explore the short-term dynamics of neighborhood change using a panel dataset of house purchases transactions and the relevant share of Haredi residents in each year.

The results of Section 4 are consistent with the theoretical model which is presented in Section 5. The empirical results show that house prices in neighborhoods that change the most, increase faster than in both ends of the spectrum (the more segregated neighborhoods).[22] The question arises as to whether the observed price convergence is related to the internal migration of Haredi households and to the changing character of those neighborhoods. The following subsections attempt to answer this question and show that there is a causal relationship between neighborhoods becoming more Haredi and the increase in prices in those neighborhoods.

6.1. OLS with Fixed Effects

In order to find the marginal effect of Haredi migration into the neighborhood, I use panel data with year and neighborhood fixed effect to reveal short-term dynamics in a within neighborhood analysis. The basic hedonic regression to be estimated is the following:

$$\ln P_{i,s,t} = \beta_0 + \beta_1 Haredi_{s,t} + \gamma X_i + \delta_s + \lambda_t + \epsilon_{i,s,t} \quad (16)$$

[22] This may seem contradictory to Appendix Figure D.1, but the two results are not comparable because Section 4 uses neighborhood-level data and Appendix Figure D.1 uses sub-quarters which are bigger and more heterogeneous – that is why the need to look as locally as possible is so important.

Where:

$lnP_{i,s,t}$	-	Log price of apartment *i* in neighborhood *s* sold during year *t.*
$Haredi_{s,t}$	-	The share of Haredi residents in neighborhood s in year t (representing the A_s term in the model).[23]
X_i	-	The physical attributes of apartment i: log area (in square meters), number of years since construction (age) and grouped number of rooms.[24]
δ_s	-	Neighborhood Fixed effects.
λ_t	-	Year Fixed effects.
$\epsilon_{i,s,t}$	-	An error term clustered at the neighborhood level**.**

The share of Haredi voters in non-election years is calculated using a linear interpolation between election years, assuming that the rate of change is constant in those two to four-year intervals.[25]

To check the effect of additional explanatory variables which represent the general supply and demand trend in the neighborhood, I gradually add to the basic model: the year-residential quarter fixed effects, $\log(pop)_{s,t-2}$ – log of population in neighborhood s in year t-2, and $\log(stock)_{s,t}$ –the log of housing stock in neighborhood s in year t.[26,27] A selected number of specifications and their OLS regression results are presented in Table 5.

The estimated coefficients for the year fixed effects and apartment attributes are not presented, but they turn out to have the expected signs. The coefficients of the years, which represent the average rise in nominal prices across the city, increase on

[23] As presented in Table 5, I run the regressions both on the calculated share of ultra-Orthodox voters and on the share of Gimel voters and Shas voters separately. Both are positive and significant but the Gimel variable is stronger and represents a more drastic change in the neighborhoods character so the following results are based on the share of Gimel voters variable.

[24] The groups are: 1.5-2.5,2.5-3.5,3.5-4.5 and 4.5-5.

[25] In a sense, this assumption contradicts the Tipping Point theory, but since the results of Section 4 pointed at a continuous pattern in a twelve-years interval, I find this empirical compromise reasonable.

[26] Jerusalem is divided to 10 Jewish residential quarters and another 9 Palestinian residential quarters. The dataset contains only transactions which took places in the Jewish quarters.

[27] I use population in year t-2 since the population size in year t might be endogenous to the change in prices and I use the stock of apartments in year t since housing supply in perfectly inelastic to prices in the short run.

average to about 80 percent by 2015 relative to 2003 and the coefficients of the apartment attributes are positive for more rooms and for bigger apartments and negative for older apartments.

The results in Table 5 show that the way the share of Haredim is measured is crucial for the understanding of their effect on housing market results. For example, the calculated share of Haredim in year t (column 1) shows a correlation with house prices of 0.2 percent increase in prices for every additional percentage point of Haredi resident.[28] Nonetheless, when decomposing this effect to its components of Shas and Gimel vote shares in year t, the former is negatively correlated with house prices, though in a statistically insignificant way, and the latter is significantly and positively correlated with house prices. An additional percentage point of Gimel voters is correlated with a 0.33 percent increase in house prices within the same neighborhood (column 2). In column 3 I use the two-year lag of the share of Gimel voters, which is expected to be more exogenous to prices in year t, and in column 4 I use only the share of Gimel voters in year t as the main explanatory variable. Columns 3-4 show very similar results to that of column 2. Thus, I use the share in year t in the following estimations. This enables me to include more years in the analysis, and to compare the OLS to the IV results in Subsection 6.3.

One can argue that the price change is due to unobservable local development, e.g. building the light rail to the Qiryat Yovel neighborhood could have had an unobserved effect on both prices *and* the population that decides to live there. By using year-residential quarter fixed effects in columns 5-7, we can flexibly control for any local developments in each of the ten residential quarters. This addition makes the coefficients even bigger and more significant since they manage to describe very local differences between neighboring communities in the same quarter. In the last two columns (6-7) I add the natural log of apartment stock and population size and find that they have the expected signs: The faster the stock of houses increases the more moderate the increase in prices and the faster the population grows the more prices rise. The latter is insignificant in almost all of the following models, and decreases the amount of available observations. For this reason, the model in column 6 is used as the basic specification in the rest of the paper.

[28] The calculation of the ultra-Orthodox share is described in Subsection 3.2.

6.2. Sub-Groups and Sub-Periods

The pooled data presents some interesting results which are quite stable between different specifications. However, the theoretical model in section 5 predicts that there should be heterogeneity in the treatment effects between different time periods and different types of neighborhoods. According to the proposed model and the results of Section 4, we expect to see the effect growing in heterogeneous neighborhoods which are in a process of transition – the more Haredi a neighborhood becomes, the more attractive it is for other Haredi households and the less attractive it is to non-Haredi households. I divide the different neighborhoods into 3 groups, using the results from Section 4: (1) the non-Haredi group, which contains only neighborhoods that have remained below the first stage threshold (12.3 percent) during the entire period. (2) the heterogeneous group (neighborhoods which had either between 12 percent to 60 percent Haredi residents or switched between groups during the years 2003-2015) and (3) the homogeneous Haredi neighborhoods that had a share of at least 60 percent Haredi throughout the entire period.

When pulling the neighborhoods together (column 1 in Table 6) the difference in effects of growing shares of Gimel voters between the heterogeneous neighborhoods (the base group in the interaction term) and the non-Haredi neighborhoods is negative and large in absolute terms. The marginal impact of the already very religious neighborhoods is positive but not significant (as expressed by the coefficient of the interaction of Gimel voters and with the Haredi neighborhoods dummy).

Nevertheless, when running the basic model separately on each group of neighborhoods, I find that the results fit the theoretical model. As expected in the homogeneous non-Haredi neighborhoods, prices are negatively correlated with increasing shares of Haredi residents, though this not statistically significant. It means that Haredi migration to such neighborhoods is associated with lower house values. According to the model, the disutility of the non-Haredi residents from a higher Haredi share in the neighborhood lowers the demand for the neighborhood while the growing Haredi demand is not big enough to offset this lower demand. Since this is just a correlation it could also mean that Haredi migrants will only move to non-Haredi homogeneous neighborhoods where prices are declining. In the heterogeneous neighborhoods, prices are positively correlated with increasing shares of Haredim, and the magnitude is even bigger in the most Haredi neighborhoods (most of which are not 100 percent homogeneous).

As explained by the model in Section 5, the reason for the bigger effect in the Haredi neighborhoods is that there are more agents who benefit from the change in character of the neighborhood and this makes the Haredi neighborhood even more attractive to other Haredi migrants. In the most homogeneous Haredi neighborhoods there are less non-Haredi residents who are displeased with the increasing share of Haredi households. Moreover, the offset of the price increase by non-Haredim whose demand for the neighborhood contracts due to the growing share of Haredim is smaller in the most Haredi neighborhoods.

Another possible heterogeneity in treatment effect may exist between the earlier period of 2003-2008 and the housing boom period of 2009-2015. I therefore divide the data between these two sub-periods and find that the effects which are found in the previous analysis stem mostly from the first period of 2003-2008 (Table 7).

Table 5: Change in Share of Haredi Residents and House Prices

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Share of $Haredim_t$	0.21*						
	(0.11)						
Share of Gimel $voters_t$		0.33**		0.32*	0.50***	0.48***	0.38***
		(0.14)		(0.14)	(0.11)	(0.11)	(0.11)
Share of Shas $voters_t$		-0.11					
		(0.20)					
Share of Gimel $voters_{t-2}$			0.29*				
			(0.13)				
Log (housing $stock)_t$						-9.72**	-9.40**
						(3.76)	(4.05)
Log $(population)_{t-2}$							2.05
							(2.00)
Residential quarter X Year fixed effects					V	V	V
Number of Observations	52,506	52,506	51,855	52,506	52,506	52,506	48,512
Number of neighborhoods	126	126	126	126	126	126	126
Adjusted R^2	0.76	0.76	0.76	0.76	0.77	0.77	0.76

Source: Data on purchase transactions are from The Israel Tax Authority (via the Bank of Israel): Karmen Database. Data on election results downloaded from the national election committee's website and the Israel Social Sciences Data Center (ISDC). Data on population by statistical area downloaded from the Jerusalem Institute for Policy Research, *The Jerusalem Statistical Yearbook*.

Notes: The unit of observation is an apartment. Dependent variable is log price. Coefficients are transformed from log units to percentages; control variables include: year fixed effects, neighborhood fixed effects and apartments characteristics: rooms group, log area and years since construction and a constant term. Estimated by OLS. Standard errors in parentheses, clustered by neighborhood. *** p<0.01, ** p<0.05, * p<0.1

Table 6: Change in Share of Gimel Voters and House Prices by Neighborhood Type

	All	Non-Haredi Neighborhoods	Heterogeneous Neighborhoods	Haredi Neighborhoods
	(1)	(2)	(3)	(4)
Share of Gimel voters$_t$	0.47***	-1.50	0.37***	0.50***
	(0.12)	(1.36)	(0.11)	(0.18)
Share of Gimel voters$_t$ X Non-Haredi Neighborhoods	-1.53*			
	(0.90)			
Share of Gimel voters$_t$ X Haredi Neighborhoods	0.03			
	(0.18)			
Number of Observations	52,506	16,902	26,871	8,733
Number of neighborhoods	126	39	57	30
Adjusted R^2	0.77	0.76	0.80	0.75

Source: see Table 5

Notes: The unit of observation is an apartment. Dependent variable is log price. Coefficients are transformed from log units to percentages; control variables include: year fixed effects, year-residential quarter fixed effects, neighborhood fixed effects and apartments characteristics: rooms group, log area and years since construction and a constant term. The base group for the interaction term "Share of Gimel voters X Haredi Neighborhoods" and "Share of Gimel voters X non-Haredi Neighborhoods" is the "Heterogeneous Neighborhoods" group. Neighborhood types are: (1) Non-Haredi: remained below 12.3% during the entire period. (2) Heterogeneous: had either between 12 percent to 60 percent Haredi residents or switched between groups. (3) Haredi: had at least 60 percent Haredi throughout the entire period. Standard errors in parentheses, clustered by neighborhoods. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Change in Share of Gimel Voters and House Prices Before and During the Israeli Housing Boom Period

	All Years	2003-2008	2009-2015
	(1)	(2)	(3)
Share of Gimel voters$_t$	0.48***	0.87***	0.09
	(0.11)	(0.22)	(0.12)
Share of Gimel voters$_t$ X After 2008	-0.01		
	(0.03)		
Year fixed effects	V	V	V
Residential quarter X Year fixed effects	V	V	V
Number of Observations	52,506	21,444	31,062
Number of neighborhoods	126	126	126
Adjusted R^2	0.77	0.62	0.66

Source: See Table 5.
Notes: The unit of observation is an apartment. Dependent variable is log price. Coefficients are transformed from log units to percentages; control variables include: year fixed effects, year-residential quarter fixed effects, neighborhood fixed effects and apartments characteristics: rooms group, log area and years since construction and a constant term. Estimated by OLS. Standard errors, clustered by neighborhoods.
*** p<0.01, ** p<0.05, * p<0.1

There are two possible explanations for this result. The first, and perhaps the more minor reason, is the Haredi population's ability to buy apartments. A significant source of credit for Haredi households is the interest-less lending organizations which operate as not-for-profit credit associations.[29] These NGO's lend money to Haredi members of the community under very favorable terms. These organizations rely heavily on foreign donors and have experienced financial hardships following the Great Recession in 2008-2009.[30] I do not have data on the magnitude of this activity but this could be a possible explanation of the decreased demand of Haredi households for houses in Jerusalem and their increasing migration to the peripheral Haredi cities (such as El'ad, Modi'in Illit, Beitar Illit, Ramat Beit-Shemesh) or other peripheral cities (e.g. Arad, Kiryat Gat, Yeruham). Another related explanation is the growing supply of housing in the peripheral Haredi cities, especially in Ramat Beit-Shemesh and Beitar Illit which are the main destinations for Haredi migration out of Jerusalem.[31] For these reasons we would expect to see a relative decline in prices in the Haredi neighborhoods, which would decrease the attractiveness of heterogeneous neighborhoods and offset the price increase which is driven by the increasing Haredi social amenities.[32]

Figure 7 gives and empirical support to these explanations and brings together the sub-groups and sup-periods. It presents the quality-adjusted price trends of the different types of neighborhoods in the first and second periods, respectively.[33] It is noticeable that the first type (the non-Haredi neighborhoods) has experienced a lower price increase relatively to the rest of the city during the years 2003-2008, but its prices have increased more than the rest of the city in the period of 2009-2015, showing that the prices in the Haredi neighborhoods (Type 3) declined relatively to the city's average. Another interesting observation from these figures is that the price trends of the heterogeneous neighborhoods (Type 2) and the Haredi neighborhoods

[29] These association are called Gamahim which is the Hebrew\Yiddish abbreviation for charitable funds.

[30] See Regev (2014) for a survey of the balance of household income, expenditures and savings in various population groups, with special attention to the patterns of consumption and savings in the Haredi sector and its activity in real estate. He finds a steep drop in the rate of Haredi households with a mortgage in the years 2008-2009.

[31] Bank of Israel (2017), *"The residential distribution and socioeconomic characteristics of ultra-Orthodox Jews and Israeli Arab"*.

[32] See result (2) in Section 5.

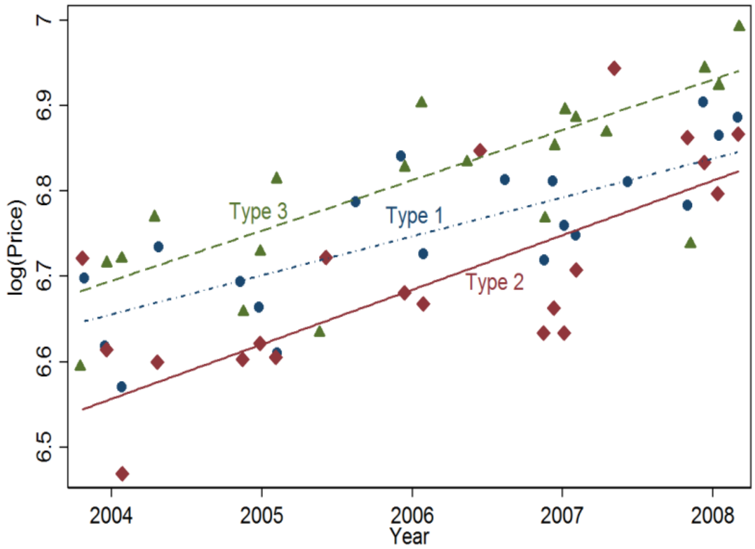
[33] The apartments' physical characteristics and the log stock of housing in each neighborhood are used as controls.

(Type 3) are very similar, which could mean that dynamics in the heterogeneous neighborhoods are more influenced by the trend in the Haredi neighborhoods than in the non-Haredi neighborhoods. The third and final interesting fact is that the level of average prices in the Haredi neighborhoods is higher than the rest of the city, emphasizing the excess Haredi demand for housing in Jerusalem. Yet, it also shows that the non-Haredi neighborhoods had caught up and almost reached the Haredi high level of prices by 2015.

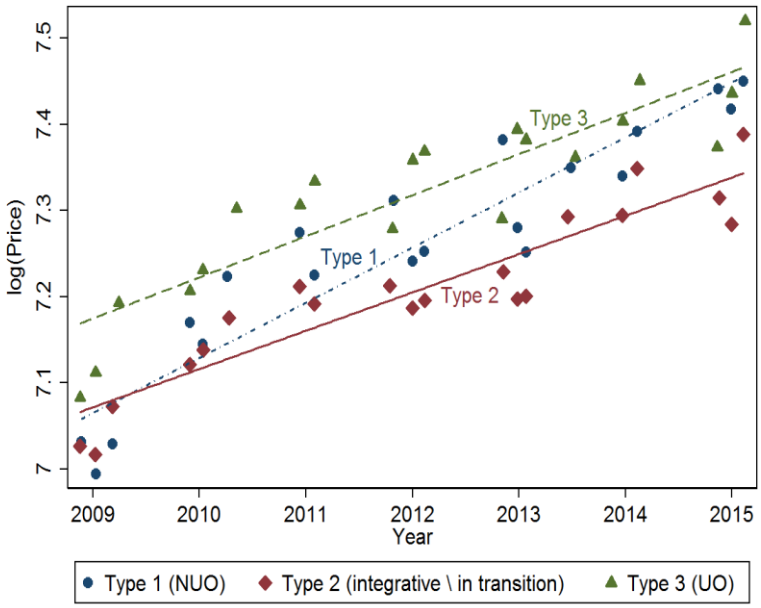
Figure 7: Mean House prices in Jerusalem

by Neighborhood Type

A. 2004-2008



B. 2009-2015



Notes: Figures are produced using Stepner, M., 2013. BINSCATTER: Stata module to generate binned scatterplots. Transactions are binned by date of purchase and type of neighborhood. The linear regressions controls for apartment attributes. Neighborhood types are:(1) Non-Haredi: remained below 12.3% during the entire period. (2) Heterogeneous: had either between 12 percent to 60 percent Haredi residents or switched between groups. (3) Haredi: had at least 60 percent Haredi throughout the entire period.

6.3. Instrumental Variable Estimation Using a Geographic Diffusion Model

The results above show the average change within neighborhoods but the identification is missing. One can argue that what we see is a reflection of reversed causality: Haredi families migrate only to poor neighborhoods which are bound to experience a higher price increase, regardless of the neighborhood's religious composition. This subsection addresses this issue.

As noted in the previous sections, the institutions of the Haredi community create very strong social amenities, and members are willing to pay higher prices to be close to the geographic center of their community. As explained in the literature review and the data section, the pattern of migration within the city can be characterized as a pattern of spatial diffusion, where the neighborhoods that change the most are the ones that are closest to the Haredi core. Using this information, we can apply an instrumental variable approach to predict the share of Haredi residents as an exogenous factor to developments in the house market.[34] I adopt a similar gravity pull index to the one used in Saiz and Wachter (2011) with some modifications.[35] The Gravity Pull index for each neighborhood is calculated as follows:

$$Pull_{i,t} = \sum_{j \neq i} \frac{Gimel_{j,last} * Pop_{j,last}}{(d_{ij})^{\beta}} \tag{17}$$

Where $Gimel_{j,last}$ represents the share of Haredi residents in neighborhood j (share of votes for Gimel) in the last election year, $Pop_{j,last}$ is the total population size in those neighborhoods in the last election year and d_{ij} is the Euclidean distance between neighborhoods i and j. The summation of shares multiplied by the population and divided by the distance with a spatial decay parameter β is the force with which neighborhood i is "pulling" (attracting) more Haredi residents from the all other neighborhoods.[36]

[34] For a detailed explanation of the econometric intuition behind this instrument please refer to Saiz and Wachter (2011).

[35] Saiz and Wachter (2011) use census data which has a 10-year frequency, while I use 3-4 years gap, based on election years. They also use the neighborhood area as a weighing parameter while I use the actual population size which I think is a better mass measure to be used in a gravity-type model.

[36] I chose β by running a linear regression of the actual share of ultra-Orthodox residents in year t on the calculated pull index for different values of β and selecting the value that gives the highest R^2. In Saiz and Wachter (2011) it is found to be 1.6, while in our case it is found to be 1.2. Nevertheless, they test the results and find them not sensitive to the choice of β.

The result is a weighted average of the shares of Haredi residents in the surrounding neighborhoods (up to the city's border) proportional to the population in each neighborhood and inversely proportional to the distance from neighborhood. See Appendix Figure D.2 for a graphical illustration of the change in the Gravity Pull Index in Jerusalem.

The abovementioned approach assumes that the sorting of populations is exogenous. But in fact, spatially correlated characteristics of adjacent neighborhoods could be affecting the prices in neighborhood i as well. To deal with this potential caveat, Saiz and Wachter (2011) recommend adding another source of heterogeneity. The initial share of Haredi residents in the neighborhood is used as a factor that mitigates the predictive power of the Pull index. As the neighborhood becomes more Haredi, its rate of change is likely to slow down as there are fewer non-Haredi residents that could move out of the neighborhood. An empirical demonstration of this explanation is presented in Figure 5 that shows that the most Haredi neighborhoods saw very small changes in their composition during the analysis. This second instrument is calculated by interacting the last known share of Gimel voters with the Gravity Pull index. The maps in Figure D.3 portray the heterogeneity of the Pull index between 2003 and 2015, represented by the calculated values of a new variable $Pull_{i,t}\,X\,(1 - Gimel_{i,last}) = Pull_{i,t} - Pull_{i,t}XGimel_{i,last}$.

I use a 2SLS regression, in which the first stage predicts the share of Gimel voters in year t based on the abovementioned variables. The results are presented in the second column of Table 8 and show a bigger impact of increasing shares of Gimel voters on prices than the one observed in the OLS estimation (the first column in Table 8). This means that the bias of the OLS estimate is actually downward, meaning that the Haredi public doesn't migrate to neighborhoods which are expected to see a relatively higher price increase but on the contrary – the Haredi households tend to migrate to declining neighborhoods which experience a lower rise in prices. The effect of the migration in itself is in fact stronger (around 0.83-0.92 percent increase for every additional one percentage point increase in Gimel voters) than the declining prospect of the neighborhoods. This causes an eventual positive increase in prices (the 0.4 percent that we see in column 1).

Another way of making sure that the instrument variable is exogenous enough is to include an interaction term of the Pull Index with the quarter's share of Haredi residents, which should be positively correlated with the future share of Haredi residents in the neighborhood.[37] The result of adding this interaction as an additional excluded variable (Colum 3) is about the same as in the model in Colum 2.

The coefficient of the main explanatory variable remains stable when adding an interaction term with the type of neighborhood (column 1 in Table 9), though the type of neighborhood becomes insignificant altogether (column 2 in Table 9). This shows that the OLS estimates point at a correlation between declining non-Haredi neighborhoods and their attraction of Haredi household and not a causal effect. The treatment effect seems to be similar across different types of neighborhoods.

Finally, Table 10 compares the estimates of the full period and the two sub-periods (2003-2008 and 2009-2015). Column 4 shows that there is no significant difference in the impact of Haredi internal migration between the first and second sub-periods. Column 5 shows that the effect is almost identical between the full period and the first sub-period. Note that the instrumented estimate for the second period in column 6 is probably biased due to a weak instrument problem as indicated by the low F-statistic (lower than the 10 rule of thumb weak instrument test). This means that we are unable to predict with certainty the future share of Gimel voters using the proposed instruments during the later sub-period. Thus, the result of the second stage should be considered carefully as it is probably biased upward.

[37] In Saiz and Wachter (2011) it is the MSA's flow of immigrants, in our case it is the last election share of Gimel voters in each residential quarter.

Table 8: The Impact of Gimel Voters Share on House Prices

	OLS	IV		
	(1)	(2)	(3)	(4)
	Dependent Variable: log price$_t$			
Share of Gimel voters$_t$	0.39***	0.89***	0.92***	0.83***
	(0.11)	(0.24)	(0.25)	(0.24)
Share of Gimel voters$_{last\ election}$		-0.10	-0.11	-0.08
		(0.14)	(0.14)	(0.13)
Pull Index$_t$				10.16
				(6.69)
First Stage:	*Dependent Variable: Share of Gimel voters$_t$*			
Pull Index$_t$		28.02***	25.20***	25.20***
		(4.53)	(4.47)	(4.47)
Pull Index$_t$ X Share of Gimel voters$_{last\ election}$		-0.35***	-0.37***	-0.37***
		(0.05)	(0.06)	(0.06)
Pull Index$_t$ X Share of Gimel voters in residential quarter $_{last\ election}$			0.09	0.09
			(0.07)	(0.07)
Kleibergen-Paap F-statistic on the excluded Instruments		23.01	15.31	22.34
Number of observations	49,607	49,607	49,607	49,607
Number of neighborhoods	126	126	126	126
Adjusted R^2	0.76	0.76	0.76	0.76

Source: Data on purchase transactions are from The Israel Tax Authority (via the Bank of Israel): Karmen Database. Data on election results downloaded from the national election committee's website and the Israel Social Sciences Data Center (ISDC).

Notes: The IV results are produced using Schaffer, M.E., 2010. xtivreg2: Stata module to perform extended IV/2SLS, GMM and AC/HAC, LIML and k-class regression for panel data models. http://ideas.repec.org/c/boc/bocode/s456501.html. The unit of observation is an apartment. Coefficients are transformed from log units to percentages; control variables include: year fixed effects, year-residential quarter fixed effects, neighborhood fixed effects and apartments characteristics: rooms group, log area and years since construction and a constant term. Standard errors in parentheses, clustered by neighborhoods. *** p<0.01, ** p<0.05, * p<0.1

Table 9: The Impact of Gimel Voters Share on House Prices by Neighborhood Type

	OLS	IV
	(1)	(2)
	Dependent Variable: log price$_t$	
Share of Gimel voters$_t$	0.37***	0.79***
	(0.12)	(0.23)
Share of Gimel voters$_{last\ election}$		-0.06
		(0.13)
Pull Index$_t$		8.79
		(6.71)
Share of Gimel voters$_t$ X Non-Haredi Neighborhood	-1.55*	-1.18
	(0.87)	(1.05)
Share of Gimel voters$_t$ X Haredi Neighborhood	0.09	-0.16
	(0.21)	(0.21)
First Stage:	*Dependent Variable: Share of Gimel voters$_t$*	
Pull Index$_t$		27.81***
		(4.68)
Pull Index$_t$ X Share of Gimel voters $_{last\ election}$		-0.38***
		(0.06)
Pull Index$_t$ X Share of Gimel voters in residential quarter $_{last\ election}$		0.05
		(0.07)
Kleibergen-Paap F-statistic on the excluded Instruments		26.86
Number of observations	49,607	49,607
Number of neighborhoods	126	126
Adjusted R^2	0.76	0.76

Source: See Table 5.
Notes: See Table 8 for details on the Stata module that produced these results and control variables. The unit of observation is an apartment. Coefficients are transformed from log units to percentages Neighborhood types are: (1) Non-Haredi: remained below 12.3% during the entire period. (2) Heterogeneous: had either between 12 percent to 60 percent Haredi residents or switched between groups. (3) Haredi: had at least 60 percent Haredi throughout the entire period. Standard errors in parentheses, clustered by neighborhoods.
*** p<0.01, ** p<0.05, * p<0.1

Table 10: The Impact of Gimel Voters Share on House Prices Before and During the Israeli Housing Boom Period

	OLS			IV		
	All Years	2004-2008	2009-2015	All Years	2004-2008	2009-2015
	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent Variable: log price$_t$					
Share of Gimel Voters $_t$	0.39***	0.71***	0.09	0.84***	0.85*	1.59**
	(0.11)	(0.22)	(0.12)	(0.23)	(0.44)	(0.74)
Share of Gimel Voters $_{last}$				-0.09	-0.00	-0.71*
				(0.13)	(0.08)	(0.41)
Pull Index$_t$				9.65	23.39**	0.60
				(6.35)	(11.81)	(6.43)
Share of Gimel voters$_t$ X After 2008	-0.01			-0.01		
	(0.03)			(0.03)		
First Stage:				*Dependent Variable: Share of Gimel voters$_t$*		
Pull Index$_t$				25.34***	16.40***	6.27
				(4.36)	(4.68)	(3.95)
Pull Index$_t$ X Share of Gimel voters $_{last}$				-0.37***	-0.35***	-0.13***
				(0.06)	(0.05)	(0.04)
Pull Index$_t$ X Share of Gimel voters in residential quarter $_{last\ election}$				0.08	0.16**	0.10**
				(0.07)	(0.08)	(0.05)
Kleibergen-Paap F-statistic on the excluded Instruments				24.27	26.11	7.13
Number of observations	49,607	18,545	31,062	49,607	18,545	31,062
Number of neighborhoods	126	126	126	126	126	126
Adjusted R^2	0.76	0.61	0.66	0.76	0.60	0.65

Source: See Table 5.
Notes: The unit of observation is an apartment. Coefficients are transformed from log units to percentages; control variables include: year fixed effects, year-residential quarter fixed effects, neighborhood fixed effects and apartments characteristics: rooms group, log area and years since construction and a constant term. Standard errors in parentheses, clustered by neighborhoods.
*** p<0.01, ** p<0.05, * p<0.1

7. Conclusions

This paper explores the phenomenon of neighborhood change in the context of the population's religiosity level. It emphasizes the reciprocal nature of the integration and segregation forces in the local urban housing market, derived by the preferences of both Haredi and non-Haredi people to live near those who are similar to them. This reciprocal nature creates a positive feedback effect which attracts more Haredi households to a changing neighborhood but also pushes away the non-Haredi families who prefer to live in a less religious environment. These preferences have an immediate effect on housing prices through the increased demand for housing and the slow adjustment of supply. The paper does not deal with longer term outcomes, which include the change in composition of supply, the change in income levels and induced changes in public services.

This paper applies different methods and indicators in order to define a process which is hard to measure. The results are very local (geographically and temporally). Yet, as the share of the Haredi community in the Israel becomes larger, due to their high fertility rates, this process is bound to occur in growing magnitude in other Israeli cities as well. It may also be a relevant process to many European countries which have received big inflows of Muslim migrants in the recent decade.

The empirical part of the paper begins with a long-term view of the change in religiosity level of different neighborhoods in Jerusalem. It inquires whether the initial social composition of a neighborhood can act as a predictor of a sharp change in the religious character of the neighborhood. I find that the answer is not as clear as in the original paper on which the methodology for this test is based. The candidate threshold in Jerusalem for neighborhoods to experience a sharp social change between 2003 and 2015 is found to be 12 percent, but it does not seem to act as a tipping point per se. Nevertheless, there is a relationship between the numeric proximity to this threshold and the future change in the share of Haredi residents, implying a continuous pattern of neighborhood change. Adding the change in house values points at a similar result: there is some observed correlation between the religiosity-level of a neighborhood and its future price trend.

By using annual data on house purchasing transactions and three-yearly election results, a closer examination of the relationship between neighborhood religious composition and house values is possible. The analysis shows that house values increase by about 0.8 percent for every additional percent of Gimel voters within the same neighborhood. This is a significant effect for neighborhoods in Jerusalem which have experienced between -17 to 35 percentage points change in the share of Gimel voters during the analysis. A quarter of those neighborhoods saw a cumulative increase of more than 3.5 percentage points increase in the share of Gimel voters. The identification strategy uses a geographic diffusion model of urban expansion of minorities and shows that some of the changing neighborhoods were to see a price decline relative to the rest of Jerusalem, if not for the Haredi growing demand by Haredim.

Much more can be done to improve the estimation of the model: using rent prices as an alternative measure, considering the spatial correlations between neighborhoods, extending the model to other cities as well as to demand shocks which are exogenous to Jerusalem. All of these could help to fine-tune the findings of this research. Nevertheless, the general conclusion is expected to remain the same: social interactions are key determinants of the local housing market equilibrium and the integration of different populations, though unavoidable, is unstable and likely to lead eventually to a new steady state of segregation. Policy makers should be aware of that and plan ahead in a way that will benefit all segments of the urban community.

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Appendix A: The Haredi Homogeneity Index

Table A.1: The Criteria for Classification of the Homogeneity Level in Neighborhoods Defined as Haredi

Index	Share of votes to Haredi parties	Share of votes to Gimel
1 (highly Haredi)	more than 70	more than 50
2	50-69	more than 50
3	more than 70	40-49
4	50-69	40-49
5	more than 70	25-39
6	50-69	25-39
7	25-49	25-39
8	more than 70	10-24
9	50-69	10-24
10	25-49	10-24
11	10-24	10-24
12	25-49	5-10
13 (non-Haredi)	less than 10	less than 10

Source: Gurovich and Cohen-Kastro (2004).
Notes: The 13^{th} level is added to the original scale to represent the most Secular neighborhoods.

The criteria in Table A.1 consider two variables: Gimel vote rates and Shas vote rates. Gurovich and Cohen-Kastro (2004) assume that 1 percent of votes for Gimel is not equivalent to 1 percent of votes that goes to Shas, since many Shas voters are not Haredi. For this reason, the index is a function of the total votes to these two parties *and* the share of votes to Gimel. If for example the share of Gimel voters is relatively low (15 percent) and the share of Shas voters is 10 percent, the neighborhood's Haredi homogeneity index will be 10. But if the share of Gimel voters is higher (40 percent) and the Shas voting rate is the same (10 percent) the neighborhood's index will be 4. This is because the surrounding is more Haredi, which probably means that the Shas voters are also Haredi. These criteria are a bit arbitrary. For this reason, I use a different method for calculating the share of Haredim in Section 3.2.

Appendix B: Finding Jerusalem's Candidate Tipping Point

In order to create two balanced groups, I first sort the neighborhoods according to the share of Haredi residents in the base year (2003) and assign neighborhoods into each group alternately. Figure B.1 presents all the neighborhoods and their assignment to first and second stage groups. We can see that the distribution of neighborhoods with relation to their initial share of Haredi residents and the following change in the share on non-Haredi residents is similar in the two sub-samples. Table B.1 contains a comparison of key variables for the two groups of neighborhoods. The similarity in means is the evidence that each sub-sample is representative of the entire sample.

Figure B.1: Assigning Observations to First Stage and Second Stage Sub-samples Before the Search Procedure

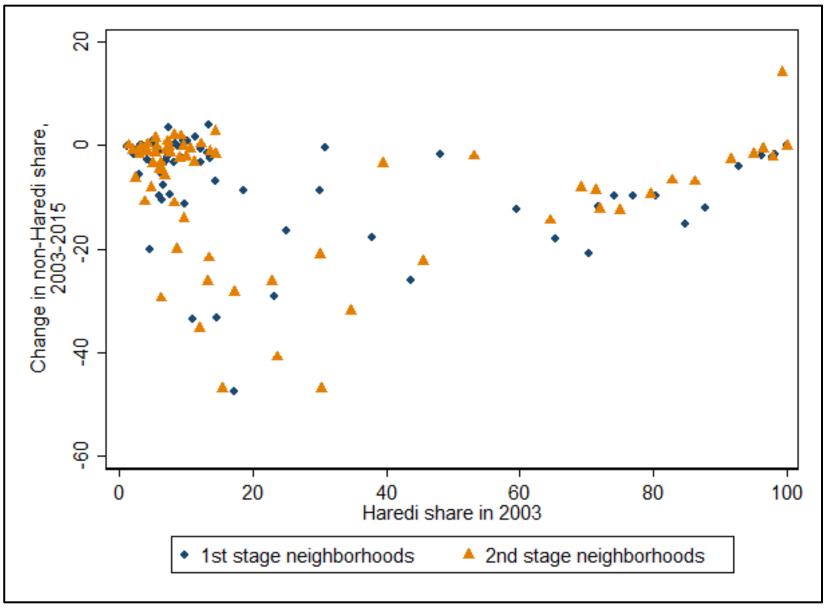


Table B.1: Comparison of First and Second Stage Neighborhoods

Variables	first stage neighborhoods	second stage neighborhoods	Difference in Means	t-statistic
% of Haredi residents, 2003	29.37 (33.51)	30.21 (34.03)	0.838 (5.88)	0.14
% of neighborhoods above the tipping point	0.455 (0.502)	0.470 (0.503)	0.0152 (0.09)	0.17
% change of non-Haredim, 2003-15	-6.985 (9.929)	-8.442 (12.57)	-1.457 (1.97)	-0.74
Population in 2003	3.483 (2.006)	3.448 (1.596)	-0.0350 (0.32)	-0.11
Housing stock in 2003	910.7 (465.6)	919.5 (569.8)	8.864 (90.57)	0.10
Average log price in 2003	6.555 (0.308)	6.618 (0.306)	0.0635 (0.055)	1.15
Number of neighborhoods	66	66	132	

Source: Data on election results downloaded from the national election committee's website and the Israel Social Sciences Data Center (ISDC). Data on purchase transactions are from The Israel Tax Authority (via the Bank of Israel): Karmen Database. Data on population by statistical area downloaded from the Jerusalem Institute for Policy Research (2004).
Notes: Mean coefficients; standard deviations in parentheses. Average prices are calculated for standard apartments with 3-4 rooms in each neighborhood. Only 124 neighborhoods have data on house prices in 2003.

In the first stage, I use only half of the neighborhoods to obtain a continuous approximation of the change in share of non-Haredi residents between the base and final years ($\Delta NUO_{s,2015-2003}$), conditional on the share of Haredi residents in the base year ($UO_{s,2003}$).[38] This is done by running the following regression on neighborhoods in which $UO_{s,2003}$ is smaller than 60 percent, since these neighborhoods do not have a Haredi majority yet:

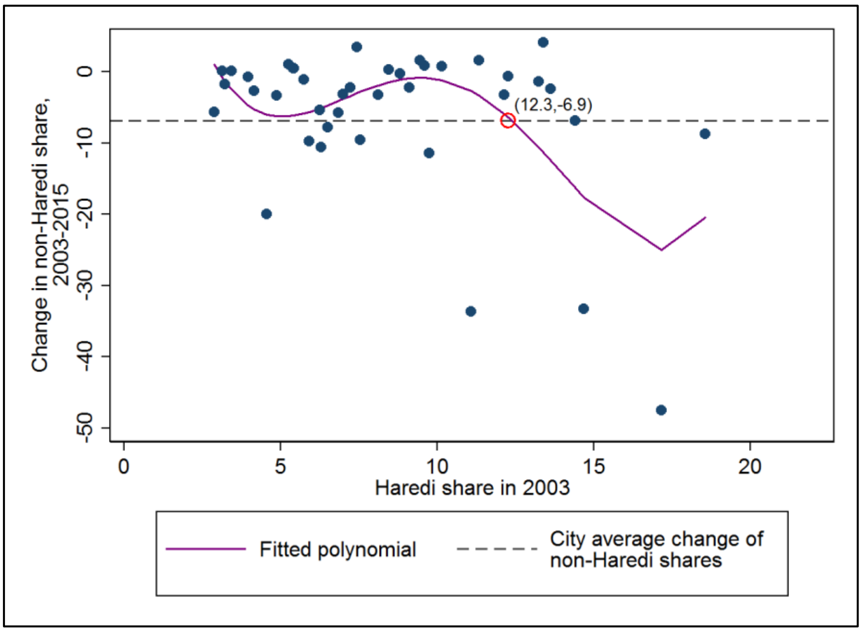
$$\Delta NUO_{s,2015-2003} = \alpha_0 + \alpha_1 \frac{UO_{s,2003}}{15} + \alpha_2 \left(\frac{UO_{s,2003}}{15}\right)^2 + \alpha_3 \left(\frac{UO_{s,2003}}{15}\right)^3 + \alpha_4 \left(\frac{UO_{s,2003}}{15}\right)^4 + \epsilon_s \qquad \text{(B.1)}$$

I fit $\Delta NUO_{s,2015-2003}$ for each point and choose the point in which the fitted value crosses the city's average. I then run a similar regression using only observations that are less than 10 percentage points away from the first root, and I find a second local root that represents the candidate "tipping point", which is suspected as a point of discontinuity. Figure B.2 illustrates the actual values and the fitted values which are

[38] The regressions are based on Card et al. (2008). NUO stands for non-ultra-Orthodox (non-Haredi) and UO stands for ultra-Orthodox (Haredi).

based on Equation B.1. $UO^{*}_{2003} = 12.3$ is the point in which the fitted polynomial crosses the city's average (the dashed horizontal line of -6.9 percentage points) - this is candidate tipping point . This is the initial share of Haredi residents that predicts ex-post the city-specific average change in non-Haredi share over the next twelve years. In the search sub-sample, every point below 12.3 percent predicts a smaller than average decline in the share of non-Haredi residents, and every point above 12.3 percent predicts a bigger than average decline in the share of non-Haredi residents.

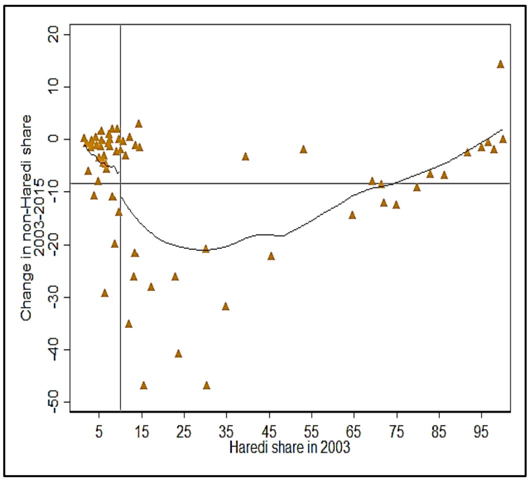
Figure B.2: The First Stage of Finding a Potential Tipping Point by Using the "Fixed Point Procedure"



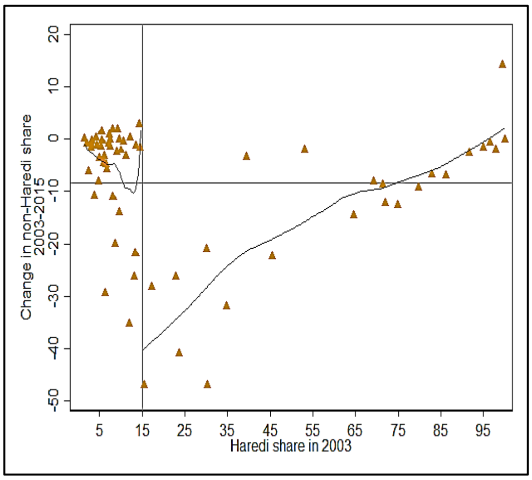
Appendix C: Sensitivity of the Second Stage Results to the Candidate Tipping Point

**Figure C.1: The Change in non-Haredi Share,
Below and Above Different Thresholds**

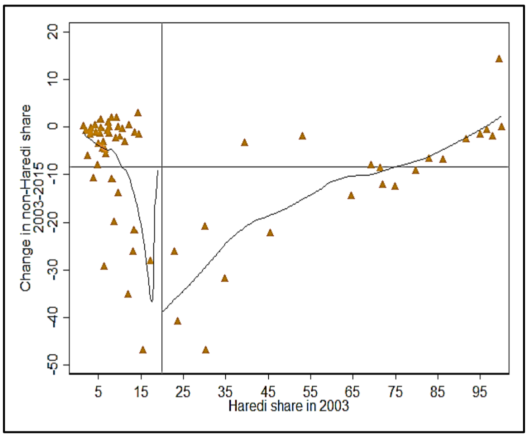
A. UO_{2003}*=10%



B. UO_{2003}*=15%



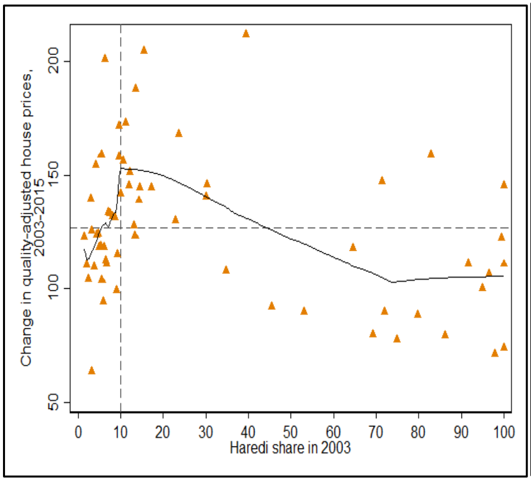
C. UO_{2003}*=20%



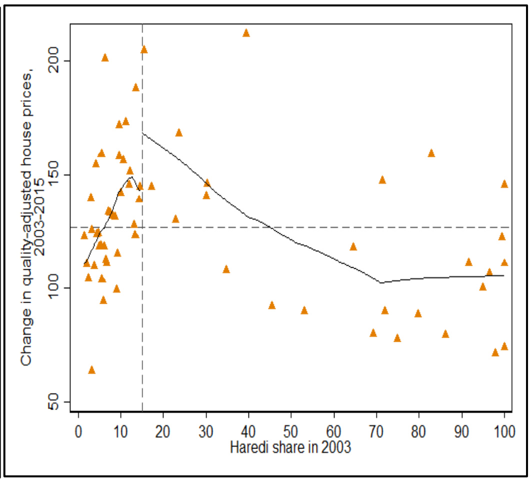
Notes: In each of the figures the horizontal line is the city's simple average of the change in non-Haredi share and the vertical line shows the arbitrary candidate threshold. The triangles represent second stage neighborhoods sub-sample and the solid lines are two local linear regressions, using Epanechnikov kernel and estimated separately on each side of the vertical line.

Figure C.2: The Change in House Prices,
Below and Above Different Thresholds

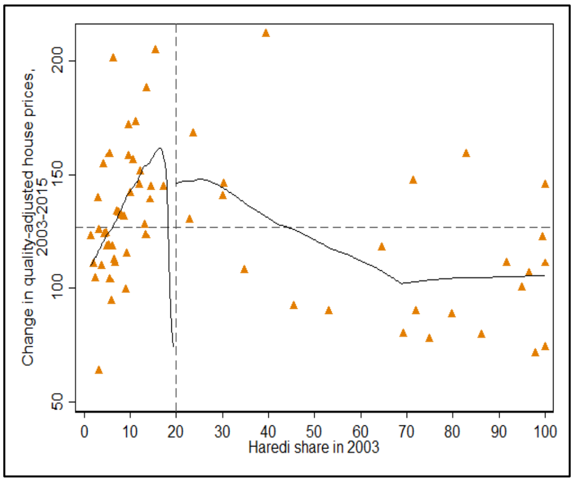
A. UO_{2003}*=10%



B. UO_{2003}*=15%



C. UO_{2003}*=20%



Notes: In each of the figures, the dashed horizontal line is the city's simple average of the quality-adjusted change in house prices and the dashed vertical line shows the arbitrary candidate threshold. The triangles represent second stage neighborhoods sub-sample and the solid lines are two local linear regressions, using Epanechnikov kernel and estimated separately on each side of the vertical line.

Table C.1: The Numeric Proximity to the Arbitrary 15% Tipping Point and the Change in non-Haredi Share

	All Neighborhoods		Neighborhoods with less than 60 percent Haredi residents in 2003	
	(1)	(2)	(3)	(4)
$Past_{s,2003}$	-28.51***	-27.78***	-27.16***	-28.75***
	(5.93)	(6.13)	(6.72)	(6.82)
$\delta_{s,2003}$	0.24	0.23	-0.14	-0.17
	(0.22)	(0.22)	(0.31)	(0.32)
$\delta^2_{s,2003}$	0.00	0.00	0.03***	0.03***
	(0.00)	(0.00)	(0.01)	(0.01)
log($population_{2003}$)		-3.47		-3.63
		(3.31)		(4.41)
Housing $stock_{2003}$		0.00		-0.00
		(0.00)		(0.00)
Average log $price_{2003}$		5.29		1.91
		(4.28)		(5.26)
Number of neighborhoods	65	61	46	46
Adjusted R^2	0.47	0.47	0.52	0.54

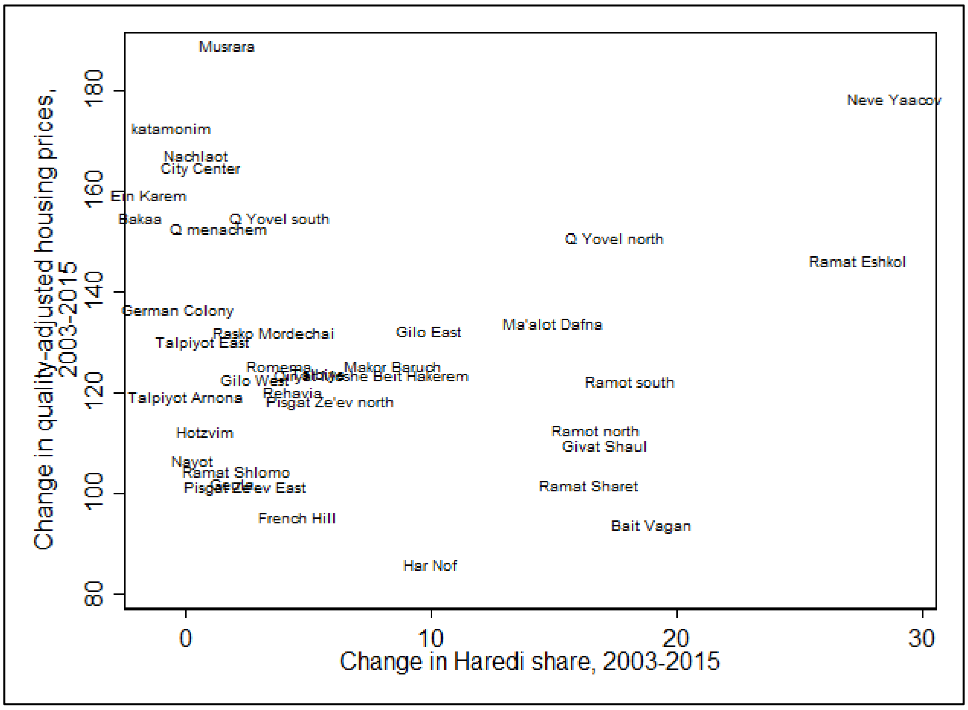
Table C.2: The Numeric Proximity to the Arbitrary 15% Tipping Point and the Change in House Prices

	All Neighborhoods		Neighborhoods with less than 60 percent Haredi residents in 2003	
	(1)	(2)	(3)	(4)
$Past_{s,2003}$	-2.15	17.69	-24.72	10.03
	(16.21)	(12.70)	(16.52)	(12.38)
$\delta_{s,2003}$	0.37	-0.13	2.82***	1.08*
	(0.58)	(0.45)	(0.76)	(0.57)
$\delta^2_{s,2003}$	-0.01	0.00	-0.09***	-0.03**
	(0.01)	(0.01)	(0.02)	(0.02)
log($population_{2003}$)	-2.15	-32.37***		-47.13***
		(6.55)		(7.06)
Housing $stock_{2003}$		0.02***		0.03***
		(0.01)		(0.01)
Average log $price_{2003}$		-73.35***		-70.13***
		(8.28)		(8.37)
Number of neighborhoods	125	123	93	93
Adjusted R^2	0.05	0.45	0.16	0.58

Notes: The unit of observation is a neighborhood in 2003 and 2015. The dependent variables are the change in share on non-Haredi residents (Table C.1) / quality-adjusted change in average house price (Table C.2). The quality-adjusted average change in prices is partialled out of apartment attributes. The regression is estimated using all of the neighborhoods with sufficient number of transactions.

Appendix D: Additional Figures

Figure D.1: Change in House Prices and Haredi Share by sub-quarter, 2003-2015



Source: See Figures 2 and 3.
Notes: The unit of observation is a sub-quarter in 2003 and 2015. All Jewish sub-quarters are included in the plot.

Figure D.2: Graphical Illustration of the Gravity Pull Index by Last Election Year

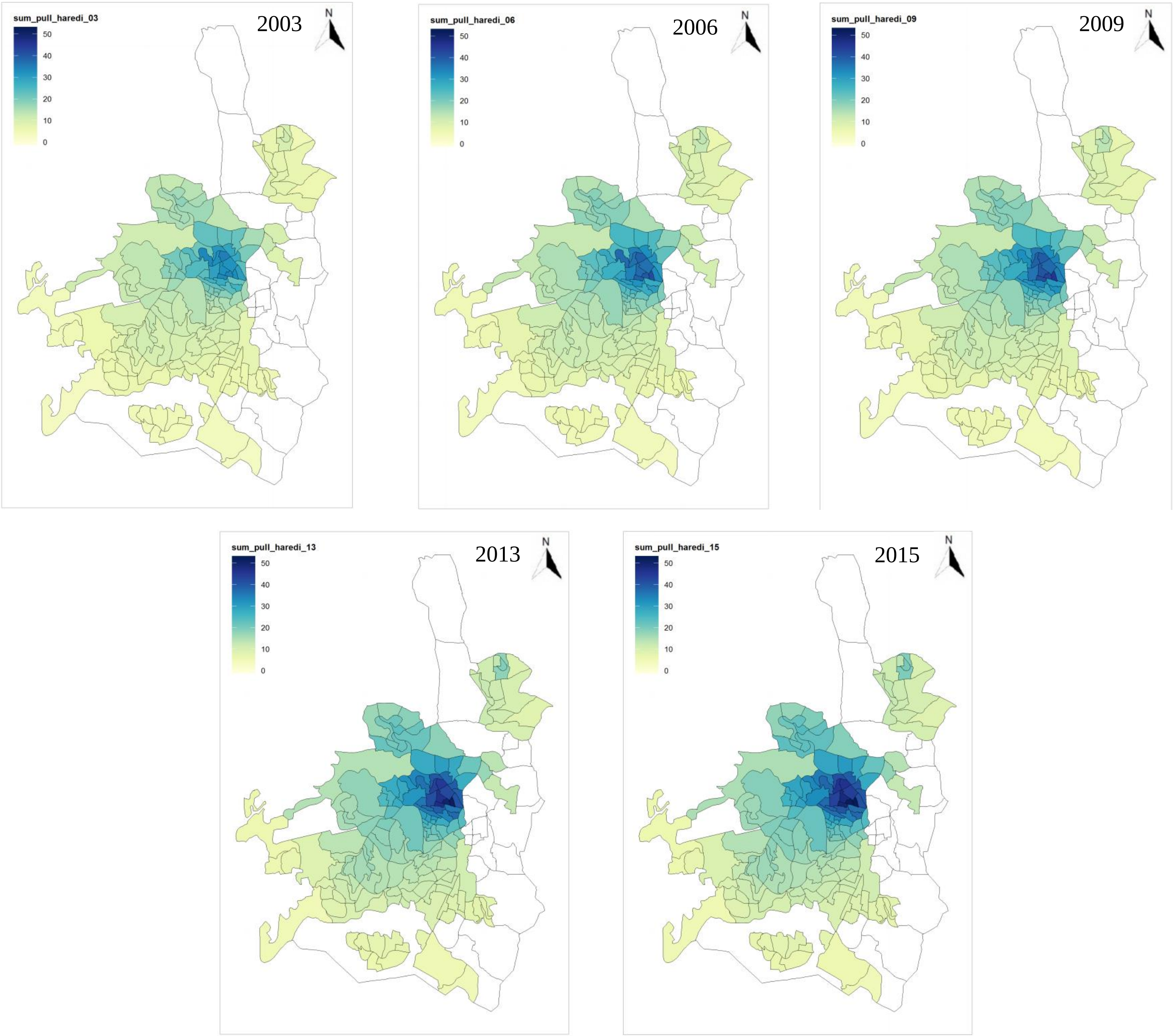


Figure D.3: Graphical Illustration of Gravity Pull Index$_t$ X (1-Share of Gimel Voters$_{last}$) by Last Election Year