# CHAPTER 4

# MULTIGROUP SEGREGATION PATTERNS AND DETERMINANTS: THE CASE OF IMMIGRANTS IN AN ITALIAN CITY

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## ABSTRACT

*Models of race-based segregation establish that individual characteristics or housing market attributes are complementary causes of the observed level of races' concentration inside an urban space. The goal of this work is to establish which variables, and in which order of magnitude, among individual characteristics, housing features, and local amenities correlate with immigrants' segregation, in the case of and consistent within-city immigrants' mobility. We capture the degree of segregation for different immigration groups by a local concentration statistics that is directly obtained from segregation curves, and we use data on the Verona Municipality as a case study. We find strong evidence in favor of the role of the housing market and housing ownership distribution across city areas.*



**Keywords:** Segregation measures; local sorting; immigrants segregation; housing

**JEL classifications:** J15; R23; I31

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## INTRODUCTION

Residential segregation is a particular *pattern of spatial distribution* of *social groups* in a *geographical environment*. The extent of segregation can be measured in different ways, accounting for a-spatial or spatial dimensions, as pointed out by Massey and Denton (1988) and Reardon and O'Sullivan (2004). A-spatial dimensions capture, for instance, the evenness in distribution of groups in an urban area, or the probability of interaction between members of different social groups. Spatial analysis also takes into account the distance between locations. In this paper we analyze segregation patterns of different groups of immigrants in exogenously partitioned subareas of Verona urban space, using a-spatial measures. The analysis of segregation measures suggests that a concentration statistics, identifying the slope of the segregation curve at a given point, should be considered a good *local* measure of immigrants' segregation.

The goal of this work is to establish which variables, and in which order of importance, among individual characteristics, housing structure, and local public goods correlate with immigrants' segregation, under substantial within-city immigrants' mobility. We capture the degree of segregation for different immigration groups by a local concentration statistics that derives from segregation curves, and we use data on the Verona Municipality as a case study. In the Italian panorama, Verona has behaved in the last two decades as a central attraction pole for immigration, although recently urban congestion has dramatically shortened the immigration flows from outside the city.[1] As a result, we find evidence in favor of housing market effect and housing ownership distribution across areas as the major sources of covariance with local immigrants' concentration.

The result fits the predictions of the *Space Stratification Models* (Charles, 2003) in the case of *decentralized* discrimination (Cutler, Glaeser, & Vigdor, 2008a, 2008b). The model posits that segregation is a result of the free individual behavior in social and market interactions. For instance, natives may pay a premium to move away from a neighborhood where they observe increasing concentration of individuals belonging to different immigration groups (see Saiz & Wachter (2006) for a discussion and an empirical application on US data).[2] Conversely, *centralized* segregation is the consequence of individual- and institutional-level actions explicitly hindering immigrants' freedom in location choice (screening of new people entering in a neighborhood by neighbors or racial laws neglecting equality in access to certain locations). Other types of models are often advocated in the literature: the *Spatial Assimilation Model*[3] and the *Tiebout-type*

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*Sorting Models*,[4] although none of them can be directly tested, since the phenomenon of individual discrimination is not observable in the Italian case, and there is not enough variation across urban areas in terms of tax schedules to generate sorting incentives based on preferences over public good provision and financing.

The paper contributes in two directions. Firstly, we analyze the informative content of segregation curves, and we derive a local concentration statistics that measures the degree of concentration of one immigration group that lives in a given urban section compared to the remaining population in the same section. This statistic is nicely related to the majority of a-spatial indices and by studying its changes across time we can spot urban section that behaves as sources of immigrants segregation, in the sense of the segregation curve. Using data on Verona municipality, we identify immigrants location choice variation between 2000 and 2005 and we spot some clusters of sections that behave as attraction poles for immigrants concentration.

The second contribution of the paper is to exploit the determinants of immigrants segregation inside the city, by looking at the separated effect of housing features and population characteristics. We exploit the statistical information given by a very detailed micro-level census database on the resident population in Verona in one given year. A preliminary analysis on the segregation patterns in the period from 2000 to 2005 is reproduced, such that we can pin down the direction of the changes in segregation and spot the areas of the city that are more interested in immigrants concentration phenomena.

Our empirical strategy consists in regressing, for each immigration group separately, a concentration index computed at section level (which is the slopes of the *segregation curve* for a given group computed in correspondence to the urban section analyzed) on the characteristics of the whole population living in that area and the characteristics of the buildings of the same urban region. Cautiously, we prefer to interpret our results only in terms of association rather than causation, as segregation may of course determine the spatial distribution of several variables used in estimation, which are indeed related to individual economic outcomes (Cutler et al., 2008a, 2008b). The econometric model tries to reproduce for immigrants groups the results for race-based segregation in (Bayer, McMillan, & Rueben, 2004).

We stress here a few empirical issues. Firstly, in our regression analysis we use microdata at family level for the whole population living in the city, and for each family we collect information on the attributes, rather than outcomes, of both families heads and for the houses where households are

located. Two factors may convince the reader that the issue of reverse causation (the fact that immigrants concentration explains the distribution of family head or household attributes) is not as important as in Bayer et al. (2004) for the scope of our analysis. On the one hand, many characteristics are predetermined, such as household head education, family composition, or housing features, and they would be better explained by past, rather than current, immigrants' segregation patterns. On the other hand, the aggregated statistics show that the massive immigration flows in the city have occurred in the last decade of the twentieth century, thus showing that in the city there is no significant phenomenon of past segregation that may affect recent immigrants' urban segregation patterns.

Secondly, our work is differentiated from the strand of literature on the effects of segregation on outcomes, well summarized in Cutler et al. (2008a, 2008b). Our scope is to determine whether (and which type of) demographic and housing market information observable to the city planner may explain (or should be considered as a reliable indicator for) unobservable immigrants' location patterns in an environment characterized by high immigration flows. This can be done by exploiting information at the household level or averaged at census tract level. We use the former setting in the optic of the central planner who is interested in understanding how individual location choices and the relative distribution of attributes may explain the degree of immigrants' concentration.

Finally, we regress each of the six immigration group-specific models on the whole household head population, rather than on the corresponding immigrants' subgroup population under analysis. This is motivated by the fact that the concentration statistics of a given immigration group captures the information about the distribution of that group versus the distribution of the remaining population.

The organization of the paper is as the following: in Section "Data: immigrants in Verona" we describe the type of microdata we use; in Section "A model for segregation patterns" we motivate the use of a concentration statistic directly connected to the segregation curve and the econometric strategy we adopt; in Section "Results" we present the results of our analysis, while Section "Conclusions" concludes.

## DATA: IMMIGRANTS IN VERONA

The analysis of the paper is based on a dynamic comparison of the patterns of segregation of immigrants inside the city and a static regression model on

a variety of population measures. We use two different databases, both published by ISTAT, the Italian Bureau of Statistics. The first type of questions is addressed with the analysis of vital statistics of the resident population in the city, while the econometric analysis exploits census data for the year 2001.

We exploit immigration segregation changes by using vital statistics for the years 2000 and 2005. The dataset provides information on nationality, family affiliation, and other demographic features of each inhabitant in the municipality of Verona. Information about individual spatial location is available for different partitions of the urban space: an individual can be associated either to one of the 1940 "Census Sections" (CS) or, alternatively, to one of the 80 "Homogeneous Territorial Zones" (HTZ) in which the municipality territory is partitioned (each HTZ gathers together, on average, 130 census sections).[5] We partition the immigrants' population into six groups using nationality codes, making use of the World Bank definition[6]: East Europe, UE 2001, Africa (North and Middle East, Sub-Saharan Africa), Asia, Latin America, and a remaining group that collects all individual with non-Italian citizenship. For Asia, two groups for China and Sri Lanka are also formed, given their relative importance in Verona urban space. Table 1 reports the absolute and relative presence of the selected groups in Verona in the years 2000 and 2005. The illegal immigration is not considered in the analysis.[7]

***Table 1.*** Immigrants in Verona in 2000 and 2005 with Regard to Group Distinction.

| k | 2000 | | 2005 | |
|---|---|---|---|---|
| | *a* | *b* | *a* | *b* |
| Immigrants (total) | 4.91 | 100 | 8.91 | 100 |
| UE 2001 | 0.58 | 11.93 | 0.89 | 10 |
| East Europe | 0.83 | 16.98 | 2.38 | 26.7 |
| Africa | 2.06 | 42.4 | 2.52 | 28.39 |
| *North Africa* | *0.76* | *15.5* | *1.04* | *11.7* |
| *Sub-Saharian Africa* | *1.3* | *26.9* | *1.48* | *16.6* |
| Asia | 0.99 | 20.2 | 2.3 | 25.7 |
| *China* | *0.17* | *3.58* | *0.33* | *3.78* |
| *Sri Lanka* | *0.66* | *13.58* | *1.64* | *18.44* |
| Latin America | 0.34 | 7 | 0.76 | 8.6 |
| Other | 0.12 | 1.27 | 0.5 | 2.21 |

*Note*: % Shares of total population (b) and total number of immigrants (b).

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***Table 2.*** Mean Levels and Range of Variation of Family Head and House Characteristics.

| Observations | Italians | Immigrants | | | | | | Range |
|---|---|---|---|---|---|---|---|---|
| | | Total | East Europe | North Africa | Sub-Saharan Africa | Asia | Latin America | |
| | 102,025 | 6,152 | 1,003 | 857 | 1,544 | 1,421 | 490 | |
| *House features* | | | | | | | | |
| (1) Conservation | | | | | | | | |
| Very good | 0.308 | 0.198 | 0.232 | 0.16 | 0.151 | 0.193 | 0.247 | {0, 1} |
| Good | 0.557 | 0.545 | 0.55 | 0.502 | 0.552 | 0.556 | 0.602 | {0, 1} |
| Bad | 0.126 | 0.22 | 0.196 | 0.248 | 0.261 | 0.213 | 0.141 | {0, 1} |
| Very bad | 0.009 | 0.036 | 0.022 | 0.09 | 0.035 | 0.037 | 0.01 | {0, 1} |
| (2) Age | | | | | | | | |
| <1919 | 0.116 | 0.195 | 0.19 | 0.16 | 0.191 | 0.237 | 0.145 | {0, 1} |
| 1919–1945 | 0.088 | 0.117 | 0.102 | 0.138 | 0.114 | 0.116 | 0.112 | {0, 1} |
| 1946–1961 | 0.201 | 0.26 | 0.23 | 0.308 | 0.285 | 0.259 | 0.235 | {0, 1} |
| 1962–1971 | 0.251 | 0.241 | 0.242 | 0.204 | 0.264 | 0.237 | 0.288 | {0, 1} |
| 1972–1981 | 0.157 | 0.104 | 0.117 | 0.1 | 0.095 | 0.093 | 0.116 | {0, 1} |
| 1982–1991 | 0.112 | 0.049 | 0.066 | 0.054 | 0.028 | 0.037 | 0.057 | {0, 1} |
| >1981 | 0.076 | 0.035 | 0.053 | 0.037 | 0.023 | 0.021 | 0.047 | {0, 1} |
| (3) Title of enjoyment | | | | | | | | |
| Owner | 0.653 | 0.125 | 0.131 | 0.104 | 0.064 | 0.124 | 0.148 | {0, 1} |
| Rent | 0.285 | 0.835 | 0.8 | 0.87 | 0.923 | 0.817 | 0.819 | {0, 1} |
| Other | 0.062 | 0.04 | 0.069 | 0.026 | 0.013 | 0.059 | 0.033 | {0, 1} |
| (4) Property | | | | | | | | |
| Natural person | 0.909 | 0.934 | 0.919 | 0.865 | 0.946 | 0.968 | 0.953 | {0, 1} |
| Firm | 0.015 | 0.019 | 0.029 | 0.016 | 0.012 | 0.015 | 0.018 | {0, 1} |
| Co-op | 0.005 | 0.005 | 0.001 | 0.02 | 0.005 | 0.001 | 0.002 | {0, 1} |
| Public | 0.004 | 0.001 | 0.001 | 0.002 | 0 | 0 | 0 | {0, 1} |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Municipality | 0.025 | 0.016 | 0.02 | 0.046 | 0.011 | 0.003 | 0.012 | {0, 1} |
| Welfare institution | 0.006 | 0 | 0 | 0 | 0.001 | 0 | 0.002 | {0, 1} |
| Housing projects | 0.023 | 0.008 | 0.009 | 0.022 | 0.008 | 0.004 | 0.002 | {0, 1} |
| Other | 0.013 | 0.017 | 0.022 | 0.029 | 0.017 | 0.01 | 0.01 | {0, 1} |
| (5) Floors | 4.199 | 4.065 | 4.209 | 3.761 | 3.822 | 4.203 | 4.431 | [1, 17] |
| (6) Internals | 20.081 | 19.233 | 22.027 | 17.991 | 16.459 | 19.474 | 23.118 | [1, 351] |
| (7) Rooms | 3.417 | 2.664 | 2.693 | 2.477 | 2.543 | 2.749 | 2.713 | [1, 28] |
| Sqm | 95.789 | 78.851 | 79.635 | 73.433 | 72.727 | 83.837 | 80.563 | [14, 929] |
| (8) Kitchen | 0.737 | 0.662 | 0.635 | 0.642 | 0.676 | 0.675 | 0.65 | [0, 2] |
| *Household head characteristics* | | | | | | | | |
| (9) Sex F | 0.324 | 0.293 | 0.354 | 0.099 | 0.338 | 0.193 | 0.514 | {0, 1} |
| (10) Age | 56.303 | 36.452 | 35.625 | 36.895 | 34.612 | 35.89 | 36.132 | [17, 102] |
| (11) Education (years degree) | | | | | | | | |
| 0 | 0.025 | 0.047 | 0.016 | 0.121 | 0.042 | 0.051 | 0.039 | {0, 1} |
| 5 | 0.271 | 0.084 | 0.043 | 0.143 | 0.103 | 0.089 | 0.073 | {0, 1} |
| 8 | 0.284 | 0.438 | 0.315 | 0.478 | 0.485 | 0.594 | 0.4 | {0, 1} |
| 11 | 0.079 | 0.109 | 0.203 | 0.068 | 0.111 | 0.06 | 0.102 | {0, 1} |
| 13 | 0.205 | 0.19 | 0.264 | 0.14 | 0.17 | 0.128 | 0.25 | {0, 1} |
| 16 | 0.013 | 0.028 | 0.035 | 0.011 | 0.02 | 0.017 | 0.049 | {0, 1} |
| 18 | 0.092 | 0.081 | 0.108 | 0.033 | 0.062 | 0.043 | 0.075 | {0, 1} |
| >18 | 0.03 | 0.022 | 0.016 | 0.006 | 0.006 | 0.019 | 0.012 | {0, 1} |
| (12) Job | | | | | | | | |
| Employed | 0.336 | 0.676 | 0.674 | 0.703 | 0.752 | 0.713 | 0.574 | {0, 1} |
| Self-employed | 0.153 | 0.167 | 0.184 | 0.159 | 0.113 | 0.178 | 0.223 | {0, 1} |
| Unemployed | 0.511 | 0.158 | 0.142 | 0.138 | 0.135 | 0.109 | 0.202 | {0, 1} |
| *Household characteristics* | | | | | | | | |
| (13) No. of underage | 0.335 | 0.468 | 0.511 | 0.543 | 0.466 | 0.462 | 0.413 | [0, 9] |
| (14) No. family members | 1.282 | 1.047 | 1.057 | 1.175 | 0.879 | 1.226 | 0.941 | [0, 12] |
| (15) Partner works | 0.534 | 0.336 | 0.336 | 0.346 | 0.257 | 0.451 | 0.226 | {0, 1} |

*Notes*: Mean values for household head and house characteristics from Census Data 2001, Verona Municipality. Mean values are conditioned to immigration group and for Italians. The range of variation is also reported for each variable.

The econometric analysis exploits ISTAT Census microdata for the year 2001. Census database provides information about buildings, households, and individuals living in 2001 in the Verona municipality. We use a restricted access version of database that provides the full census survey of the 253,208 inhabitants of the Verona municipality, organized in 109,786 families with 2.27 individuals per family, while more than 4,000 individuals live in communities. Moreover, we are able to link observations to the census section (and HTZ) where they live in, up to the civic number level.

Table 2 highlights the differences between immigrants and Italians, and among immigration groups. Concerning the housing structure, no substantial variability is observed between immigration groups. Compared to Italians, immigrants live in older buildings (31.2% lives in a house built before 1946, while the corresponding figure for italians lowers down to 19%) of lower quality (26% of immigrants versus 13% of italians) and smaller size (the difference is of the magnitude of 17 sqm), and they face a lower accessibility to housing projects (0.8%). Buildings ownership rate ranges between 6% and 13% among immigrants, while it grows up to 65% among natives. The demographic characteristics of the population follow the same pattern across groups. Immigrants are younger, less educated and more active in labor market than natives. We will exploit these differences, and their variability in space, in our econometric model.

## A MODEL FOR SEGREGATION PATTERNS

Let a metropolitan area be partitioned into $T$ sections and the city population comprising $K$ groups with $k = 1, \ldots, K$. A two-dimensional study of residential segregation is developed. The distribution of each group is analyzed and compared with the distributions of the other $K-1$ groups. Let $x_k^j$ be the number of individuals belonging to group $k$ living in section $j$, with $j = 1, \ldots, T$; then $X_k := \sum_{j=1}^{T} x_k^j$ is the total number of individuals in group $k$, while $X$ defines the total population in the city and $X_{-k} := X - X_k$ denotes the number of individuals who do not belong to group $k$. We also define $X_j := \sum_{k=1}^{K} x_k^j$ as the total population that lives in section $j$. Let $s_k^j := x_k^j / X_k$ denote the proportion of all individuals belonging to group $k$ living in section $j$. A similar definition holds for group $-k$.

Given the $K$ vectors of $2T+2$ dimensions $[s_k^j, s_{-k}^j, X_k, X_{-k}; j = 1, \ldots, T]$, containing the shares $s_k^j$ and $s_{-k}^j$ for all $T$ sections and the total number of persons belonging to groups $k$ and $-k$, it is possible to obtain a first measure of residential segregation, the *Concentration Index* $Q_k^j$, which measures the

relative concentration of group $k$ with respect to group $-k$ for every urban section $j$. It is expressed as:

$$Q_k^j := \frac{s_k^j}{s_{-k}^j}$$

and takes values $0 \leq Q_k^j < 1$ if in section $j$ the group $k$ is underrepresented or absent; while $Q_k^j = 1$ if the presence of group $k$ in the section perfectly reflects its presence in the city; $Q_k^j > 1$ if the group is concentrated in the section.

As a local measure of segregation, this index has a variety of properties and possible applications:

- The local concentration for urban area $j$ varies across time and between immigration groups. We can therefore assess which group is more concentrated in $j$ as well as in which sections the statistic grows more through time.
- The concentration statistic is not sensitive to the absolute size of the groups: if every group $k$ is replicated $\rho_k$ times in every section $j$, the index does not change. If the population in a section is replicated for a factor that is constant across groups, the concentration index does not vary. Moreover, it is not additive with respect to urban space decomposition, so it must be computed independently for every different partition.[8]
- Once sections have been ranked in increasing order of magnitude of $Q_k^j$, for every group $k$ it is possible to derive the relative *segregation curve* (see Duncan & Duncan, 1955; Flückiger & Silber, 1999; Hutchens, 1991, 2001; Reardon & Firebaugh, 2002). The curve starts from the (0,0) origin and ends in (1,1) and it connects all the points whose coordinates are the cumulative sum of $s_k^j$ on the horizontal axis and the cumulative sum of $s_{-k}^j$ on the vertical axis. By construction $Q_k^j$ is the slope of the segregation curve in the point corresponding to section $j$.

If the segregation curve associated to the distribution $Y$ lies no point above and some point below the segregation curve associated to distribution $Z$, then any measure of segregation consistent with Transfer Principle[9] will record higher segregation for $Y$ than for $Z$. Conversely, when segregation curves intersect, unanimity in ranking distributions is lost and the choice should be made according to a cardinal comparison of segregation indices. In our analysis, we make use of the *Dissimilarity Index*, the *Gini Segregation Index*, and the *Entropy Index* as well as a-spatial *Interaction (Isolation) Indices* (see, for instance, Hutchens, 2001).

We construct the segregation curves at CS level to model the segregation patterns of the total immigrants group and other immigration subgroups, each compared with the remaining population. We propose a robustness check by comparing the two distributions under the courser HTZ partition.[10] Moreover, the analysis of the dynamic across time of the concentration statistics allows us to pinpoint the macroareas of the city that behave as attractors for immigrant's concentration.

The empirical analysis serves as an introductory description for the econometric model. We consider the finer partition given by census sections. For each CS $j$, we compute the concentration statistics $Q_k^j$ for a set of population groups defined by nationality: total immigrants, East Europe, North Africans, South Africans, Asians, and South Americans. For each of the six groups indexed by $k$ (five immigration groups plus the total immigrants), we construct a regression model where the variability of $Q_k^j$ is regressed on a set of characteristics of the households residing in section $j$.

We do not restrict model $k$ to be estimated on the subpopulation of group $k$, but rather on the population as a whole. This choice is motivated by the fact that segregation is a global phenomenon that involves the location choices of individuals in group $k$ as well as the remaining population. The joint variability of the two subpopulations is captured by the statistic $Q_k^j$ in the form of a ratio of two distribution functions of group $k$ and $-k$ across regions. The variability of $Q_k^j$ across the $j$ sections is therefore jointly explained by the variability in the overall population living in the area and not by just a subgroup.

In the model we face three dimensions to control for: households, groups, and sections. For the $i$-th household living in section $j$ and for each immigration group $k = 1, \ldots, 6$ separately, we specify our model in a linear additive form as:

$$Q_k^j = \alpha_k + \beta_k X_i^j + \delta_k Y_i^j + \gamma_k Z_i^j + \lambda_k W_i^j + \pi_k S^j + \varepsilon_{k,i}^j$$

where $Q_k^j$ is our local concentration index, specific for each census section of the urban environment and repeated for each observation living in the area $j$. We capture its mean variability by a linear function defined on $X_i^j$, the set of dummies for the residential area in which the family lives; $Y_i^j$, the vector of structural characteristics of the houses (quality, age, property, rent, housing project, number of rooms, dimension, kitchen); $Z_i^j$, the vector of socioeconomic characteristics of the household head (sex, age, education, working status) and family (number of children, head partner works); $W_i^j$, a set of dummies for the group of immigration to which the observed

family head belongs and $S^j$ is the vector of section-specific characteristics, common to all families living in the same section (the percentage of commercial buildings, the share of buildings used for community purposes). The term $\varepsilon^j_{k,i}$ is the individual- and group-specific residual.

## RESULTS

In Fig. 1 we report segregation curves for the years 2000 and 2005 associated to distributions of resident immigrant groups in Verona, compared according to the CS partition. In Fig. 2 we perform the same analysis according to the HTZ partition of the urban space. In both cases we consider the following groups: (a) total immigrants, (b) East Europe, (c) Africa, and (d) Asia, which represent the most important communities in the city (see Table 1). As a first result, the curves suggest an uneven distribution of immigrants in Verona in both years. Considering the CS partition, segregation curves of all groups considered are nonintersecting, identifying for each immigration group a slight increase in evenness in 2005 with respect to 2000, though the population of immigrants (total and for each group) remains segregated.

The segregation curves reported in Fig. 2 intersect in at least one point for all groups. The test on the coarser HTZ partition is a robustness check against spatial clustering. In fact, if the segregation ordering obtained under the CS partition were preserved under the HTZ space partition, then it would have been the case that some census sections, similar in terms of immigrants composition, were also clustered in space. Aggregation in HTZ would have preserved the section ranking, thus smoothing segregation curves while still validating dominance. The curves constructed on the HTZ partition also signal that the segregation ranking is preserved for the section with relative low immigrants groups' concentration, while it should be rejected (or it is reversed) at the top of the curves, corresponding to HTZ with higher immigrants' concentration.

This phenomenon is not captured by the segregation indices reported in Table 3, which point in the direction of decreasing segregation in the city. This assessment is robust to the choice of the index. For instance, the Dissimilarity index $D_k$ and the Gini segregation index $G_k$ are related to the segregation. They correspond, respectively, to the highest vertical distance between the segregation curve and the diagonal, and to double the area between the segregation curve and the diagonal (see Duncan & Duncan, 1955; Hutchens, 2001). Both indexes describe a similar picture: segregation

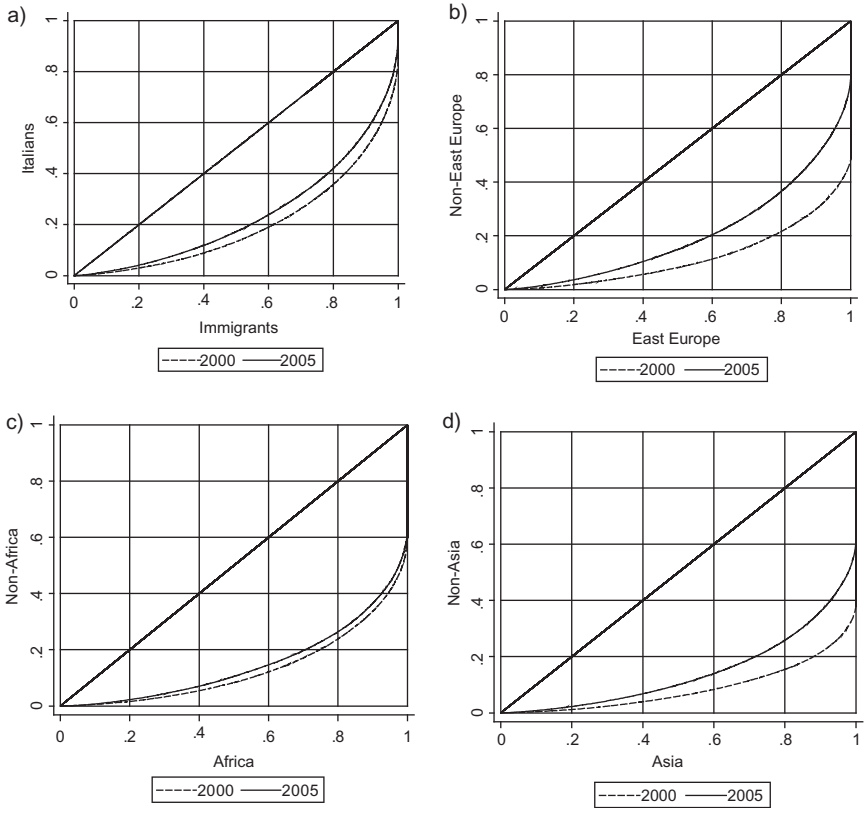


*Fig. 1.* Segregation Curves for 2000 and 2005 of Four Immigration Groups Living in Verona: (a) Total Immigrants, (b) East Europe, (c) Africa, and (d) Asia. Census Sections Partition.

decreases substantially across years for all groups, independently of the partition of the urban space, thus providing evidence against the clustering phenomenon (at HTZ level). The patterns of segregation identified by the entropy index $H_k$, which measure the diversity in neighborhoods' social composition, are substantially identical.

We now analyze the information given by local concentration index $Q_k^j$ in order to detect the spatial units that mostly contribute in determining the variation across periods in immigrants' segregation patterns. We compare index values for different HTZs in the city and extend the analysis in both years considered. Then, we select areas that show particular patterns of

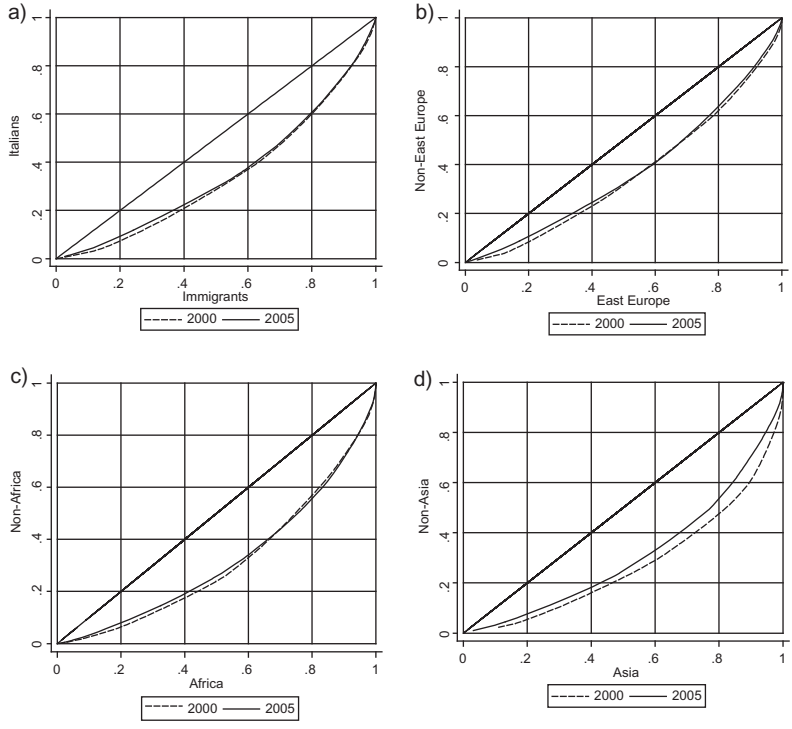


*Fig. 2.* Segregation Curves for 2000 and 2005 of Four Immigration Groups Living in Verona: (a) Total Immigrants, (b) East Europe, (c) Africa, and (d) Asia. HTZ partition.

this local statistic. For each year, we detect two areas in the central part of the city that exhibit sustained high levels of immigrant concentration: the tourist city center area (hereafter identified as CC) characterized also by an intensive presence of tertiary activities, and an area of mainly housing land, Veronetta (see Fig. 3). Comparing the level of $Q_{k,j}$ for 2000 and 2005, we identify also the HTZs that show an increasing immigrant concentration, as captured by the local statistic used. By examining the spatial position on a map of the HTZs characterized by high attractiveness to immigration, we, furthermore, find that these urban units are also spatially concentrated. We name South Area (SA) this new cluster of HTZs.[11]

In Table 4 we report the average and maximum values of the concentration statistics associated to each group, space partition, and year. As

***Table 3.*** Three Indices for A-Spatial Segregation of Different Immigration Groups: Evenness.

| $K$ | Census Tracts (1940) | | | | | | HTZ (80) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $D_k$ | | $G_k$ | | $H_k$ | | $D_k$ | | $G_k$ | | $H_k$ | |
| | 2000 | 2005 | 2000 | 2005 | 2000 | 2005 | 2000 | 2005 | 2000 | 2005 | 2000 | 2005 |
| Immigrants (total) | 0.445 | 0.384 | 0.60 | 0.527 | 0.157 | 0.131 | 0.233 | 0.222 | 0.32 | 0.299 | 0.042 | 0.038 |
| East Europe | 0.6 | 0.435 | 0.76 | 0.59 | 0.203 | 0.131 | 0.189 | 0.192 | 0.282 | 0.258 | 0.026 | 0.022 |
| Africa | 0.56 | 0.542 | 0.738 | 0.703 | 0.22 | 0.201 | 0.27 | 0.261 | 0.374 | 0.36 | 0.049 | 0.045 |
| North Africa | *0.68* | *0.63* | *0.832* | *0.78* | *0.258* | *0.227* | *0.283* | *0.268* | *0.398* | *0.367* | *0.047* | *0.042* |
| Sub-Saharian Africa | *0.64* | *0.61* | *0.802* | *0.771* | *0.257* | *0.235* | *0.291* | *0.296* | *0.405* | *0.398* | *0.054* | *0.05* |
| Asia | 0.68 | 0.546 | 0.827 | 0.71 | 0.263 | 0.199 | 0.324 | 0.276 | 0.452 | 0.377 | 0.062 | 0.048 |
| China | *0.9* | *0.843* | *0.954* | *0.924* | *0.388* | *0.35* | *0.478* | *0.41* | *0.619* | *0.566* | *0.095* | *0.089* |
| Sri Lanka | *0.77* | *0.59* | *0.884* | *0.751* | *0.323* | *0.218* | *0.35* | *0.268* | *0.493* | *0.376* | *0.074* | *0.046* |
| Latin America | 0.69 | 0.56 | 0.832 | 0.723 | 0.239 | 0.174 | 0.315 | 0.263 | 0.435 | 0.36 | 0.052 | 0.036 |
| UE 2001 | 0.62 | 0.556 | 0.746 | 0.718 | 0.182 | 0.176 | 0.258 | 0.241 | 0.354 | 0.33 | 0.033 | 0.03 |
| Other | 0.65 | 0.54 | 0.803 | 0.71 | 0.22 | 0.168 | 0.293 | 0.257 | 0.412 | 0.348 | 0.047 | 0.034 |

*Notes*: Dissimilarity index, Gini index, and Entropy index are reported in order, for years 2000 and 2005 separately for two different partitions of urban space (Census Tracts partition is finer than HTZ one).

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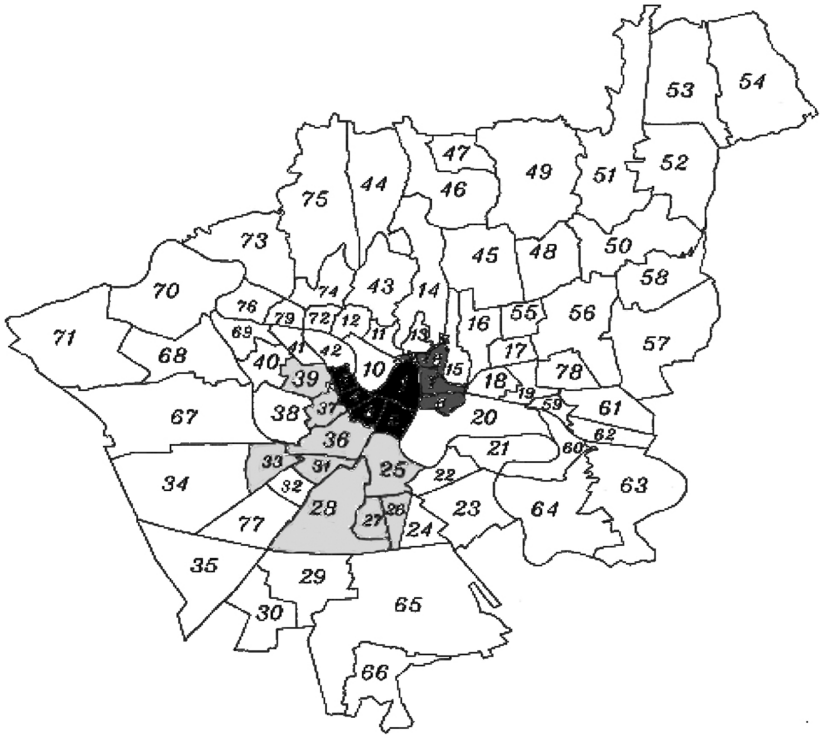


*Fig. 3.* The Spatial Partition of Verona Municipality in HTZ with the Three Areas of Interest. *Note*: The three areas represented are South Area SA Central City CC Veronetta.

shown in the table, CC and Veronetta exhibit high levels of concentration, which decreased substantially in 2005, both in average and for the extreme values. For instance, in 2000 the concentration of all immigrants groups was, on average, between two and three times larger than the expected one, while this figure lowered significantly in 2005. Although the two sections slowly moved toward a balanced composition in the period considered, this is in contrast to what it happened in SA and in the rest of the city. In SA, the immigrants' concentration grew up, on average, well above the expected values in 2005. This phenomenon is not only driven by reallocation of people living in CC and Veronetta, but also by the shift in the composition of the remaining areas of the city (marked as Other in Table 4)

***Table 4.*** Mean and Max Values for Concentration Statistic for Seven Immigration Groups, by Area and Years.

| Group | Central City Area | | | | Veronetta Area | | | |
|---|---|---|---|---|---|---|---|---|
| | 2000 | | 2005 | | 2000 | | 2005 | |
| | Mean | Max | Mean | Max | Mean | Max | Mean | Max |
| Immigrants (total) | 1.330 | 1.944 | 1.195 | 1.465 | 2.742 | 4.022 | 1.938 | 2.992 |
| UE 2001 | 1.758 | 2.736 | 1.540 | 2.037 | 2.205 | 3.735 | 2.099 | 3.679 |
| East Europe | 1.162 | 1.637 | 0.968 | 1.303 | 2.286 | 3.605 | 1.225 | 1.715 |
| Africa | 0.801 | 1.310 | 0.939 | 1.782 | 2.516 | 4.023 | 1.748 | 2.807 |
| Asia | 1.902 | 2.221 | 1.518 | 2.232 | 3.054 | 4.784 | 2.101 | 3.138 |
| Latin America | 2.119 | 7.100 | 1.069 | 1.579 | 2.660 | 3.866 | 2.381 | 4.072 |
| Other | 2.128 | 6.315 | 1.202 | 1.630 | 2.556 | 3.681 | 2.361 | 3.817 |
| Group | South Area | | | | Other | | | |
| | 2000 | | 2005 | | 2000 | | 2005 | |
| | Mean | Max | Mean | Max | Mean | Max | Mean | Max |
| Immigrants (total) | 1.411 | 2.305 | 1.779 | 2.646 | 0.821 | 4.987 | 0.700 | 2.497 |
| UE 2001 | 1.173 | 1.725 | 1.207 | 2.045 | 0.758 | 2.302 | 0.699 | 3.323 |
| East Europe | 1.302 | 1.998 | 1.703 | 2.298 | 0.838 | 3.026 | 0.706 | 3.108 |
| Africa | 1.571 | 2.938 | 1.905 | 3.065 | 1.038 | 9.026 | 0.978 | 8.179 |
| Asia | 1.302 | 1.820 | 1.632 | 2.541 | 0.496 | 3.096 | 0.517 | 2.716 |
| Latin America | 1.286 | 2.257 | 1.669 | 2.651 | 0.525 | 3.907 | 0.487 | 2.024 |
| Other | 1.164 | 1.997 | 1.604 | 2.484 | 0.572 | 3.869 | 0.492 | 1.950 |

*Notes*: The statistics has been computed for each HTZ that is part of the four areas reported, and then the mean and the max value by zone is reported for years 2000 and 2005.

toward natives' concentration (for the area Other, figures are decreasing and below unit in both 2000 and 2005). Hence, SA is relevant for our analysis because it is an attraction pole for immigrant groups.

The changes in the concentration statistics values are mainly generated by internal flows of natives and immigrant groups as well as by new immigrants' arrivals in the city. Table 5 reports the demographic movements of both Italians and immigrants (separately) for the period 2000–2005, between the four areas previously identified. The table reports in the central block (for both groups) the relative number of movements from one area in 2000 (row) to another area (column) in 2005, computed as a share of the total population that decided to relocate *within* the city. The cells identified by the same area in 2000 (row) and 2005 (column) contains the share of people

***Table 5.*** Natives' and Immigrants' Flows Distinctly from 2000 to 2005 as a Share of Total Flows.

| Natives | | | | | | |
|---|---|---|---|---|---|---|
| Within-City Areas 2000 | Within-City Areas 2005 | | | | | Outside |
| | Center | Ver | South | Other | Total | |
| Center | 3.41 | 0.68 | 1.54 | 3.65 | *9.29* | 4.85 |
| Ver | 0.67 | 0.89 | 0.89 | 2.46 | *4.90* | 2.59 |
| South | 0.76 | 0.28 | 10.52 | 8.81 | *20.36* | 10.90 |
| Other | 2.00 | 1.04 | 5.70 | 56.72 | *65.45* | 27.95 |
| Total | *6.84* | *2.88* | *18.64* | *71.64* | *100.00* | *46.29* |
| Outside | 5.60 | 3.48 | 13.34 | 31.28 | *53.70* | |

| Immigrants | | | | | | |
|---|---|---|---|---|---|---|
| Within-City Areas 2000 | Within-City Areas 2005 | | | | | Outside |
| | Center | Ver | South | Other | Total | |
| Center | 1.89 | 1.08 | 2.45 | 5.81 | *11.24* | 1.09 |
| Ver | 1.06 | 0.90 | 1.41 | 3.92 | *7.30* | 1.23 |
| South | 1.21 | 0.44 | 8.43 | 14.01 | *24.09* | 2.69 |
| Other | 3.19 | 1.65 | 9.07 | 43.47 | *57.37* | 4.62 |
| Total | *7.35* | *4.08* | *21.36* | *67.21* | *100.00* | *9.63* |
| Outside | 9.43 | 5.86 | 22.45 | 52.64 | *90.38* | |

*Notes:* Bordered block, for each group, reports the within-city flows from one area to other or inside the same area, as a percentage of total within city movements from 2000 to 2005. Row "Outside" reports movements by 2000 from outside the city into the different areas; column "Outside" movements from the different areas away from the city till 2005. Both values expressed as a percentage share of total outside-city movements.

moving inside the same section. The row and column named "Outside" contain the relative shares of people leaving (by row) and entering (by column) the specified areas of the city, obtained as a fraction of the total of movements to/from *outside* the city. Due to data shortage, we cannot observe whether individuals leave the city definitively or if they decide to move to suburban areas (not considered here), nor we can address the causes (job shifts, the decision to commute, housing decisions and so on). We can, nevertheless, highlight some patterns of within-city movements by comparing the two periods under analysis.

First, a remarkable difference in the dynamic of people moving into/out of the city from abroad depends on their group of nationality. While

immigrants are only 5% of the population remaining in the city between 2000 and 2005, the group represents 14% of within-city movers in the same period. More interestingly, immigrants correspond to the 29% of newcomers till 2005 and only 10% of leavers by 2000. Moreover, the shares of Italian leavers and comers are roughly equal in total (54% and 46% respectively) and with respect to areas, while we observe a strong displacement for immigrants: only 9.6% of immigrant movements are due to people leaving the city from 2000 to 2005, while the 90.4% are due to new arrivals, manifesting a strong tendency to spatial stabilization.

Looking at within-city flows, we immediately see that relative movements inside the same area are less sustained for immigrants, denoting a natural tendency to stabilize in the initial space, giving support to the global results of increased exposure to natives as captured by the indices. These results do not translate in a dramatic shift of immigrants from the Veronetta area to SA, but rather in a new composition of the social structure of the areas due to joint location decisions of all groups considered.

Table 6 reports the estimated marginal effects of the census variables considered in our regression analysis on the variability of the concentration statistic, estimated by OLS. Since the dependent variable is a function of simultaneous presence of the group $k$ and $-k$ members in the same section, its variability must be explained jointly considering population from both groups. We use standardized coefficients in order to make marginal effects comparable in magnitude across regressors. The constant terms of each group represent the average population concentration for the reference category living outside the three critical urban subregions: CC, Veronetta, and SA. In this way, we can identify and measure the marginal impact effects on concentration of family-level differences attributable to groups living in other areas of the city. By controlling for the macroarea of residence identified in the previous analysis (CC, Veronetta, and SA), we account for the unobservable dynamic component of the segregation pattern in the city.

Living in Veronetta has clearly a high positive impact on average concentration, twice as much as the effect of SA. This relation is similar for each group, except for East Europe group. This is mainly due to the incisive presence of the East Europe group in various areas of the city. Differently, the concentration statistics in CC does not vary uniformly between immigrants' groups. Once we control for the effects of other covariates, its trend seems not to differ from what observed in other areas of the city. We immediately notice that the area SA in 2001 does not show a particularly high level of concentration (in fact, the relevance of this area emerges from

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***Table 6.*** Regression Results of House and Household Head Characteristics on Concentration Statistic for Six Immigration Groups.

| | (1) Immigrants | (2) East Europe | (3) North Africa | (4) Sub Saharan Africa | (5) Asia | (6) Latin America |
|---|---|---|---|---|---|---|
| Area: CC | −0.033 | −0.145 | −0.497 | −0.917 | 0.588 | 0.631 |
| | (0.019)* | (0.024)*** | (0.041)*** | (0.037)*** | (0.030)*** | (0.084)*** |
| Area: Veronetta | 2.055 | 1.311 | 1.282 | 1.571 | 3.097 | 2.447 |
| | (0.046)*** | (0.034)*** | (0.097)*** | (0.059)*** | (0.060)*** | (0.116)*** |
| Area: SA | 0.507 | 0.524 | 0.400 | 0.320 | 0.758 | 0.656 |
| | (0.010)*** | (0.012)*** | (0.022)*** | (0.021)*** | (0.016)*** | (0.028)*** |
| *House characteristics* | | | | | | |
| Quality: good | 0.041 | 0.072 | 0.257 | −0.053 | 0.350 | −0.598 |
| | (0.032) | (0.047) | (0.094)*** | (0.060) | (0.058)*** | (0.080)*** |
| Quality: bad | 1.005 | 1.051 | 1.730 | 0.965 | 0.444 | −0.820 |
| | (0.314)*** | (0.168)*** | (0.228)*** | (0.305)*** | (0.229)* | (0.126)*** |
| Quality: very bad | 0.889 | 0.547 | 2.712 | −0.443 | 2.853 | −1.059 |
| | (0.244)*** | (0.603) | (0.754)*** | (0.093)*** | (0.663)*** | (0.104)*** |
| Age: <1919 | 0.532 | 0.379 | 0.144 | 0.783 | 0.755 | −0.345 |
| | (0.034)*** | (0.039)*** | (0.058)** | (0.055)*** | (0.067)*** | (0.112)*** |
| Age: 1920 – 1945 | 0.396 | 0.253 | 0.489 | 0.770 | 0.540 | −0.156 |
| | (0.035)*** | (0.041)*** | (0.069)*** | (0.067)*** | (0.060)*** | (0.127) |
| Age: 1946 – 1970 | 0.368 | 0.292 | 0.126 | 0.767 | 0.512 | −0.350 |
| | (0.017)*** | (0.023)*** | (0.034)*** | (0.038)*** | (0.030)*** | (0.054)*** |
| Age: 1971–1991 | −0.009 | −0.019 | −0.176 | 0.110 | 0.089 | −0.413 |
| | (0.013) | (0.020) | (0.028)*** | (0.022)*** | (0.023)*** | (0.046)*** |
| Rent | 0.125 | 0.166 | 0.204 | 0.309 | 0.262 | 0.187 |
| | (0.012)*** | (0.013)*** | (0.038)*** | (0.024)*** | (0.017)*** | (0.034)*** |
| Housing project | −0.431 | −0.348 | 0.060 | −0.569 | −0.769 | −0.946 |
| | (0.021)*** | (0.019)*** | (0.043) | (0.061)*** | (0.026)*** | (0.042)*** |

**Table 6.** (*Continued*)

| | (1) Immigrants | (2) East Europe | (3) North Africa | (4) Sub Saharan Africa | (5) Asia | (6) Latin America |
|---|---|---|---|---|---|---|
| *Immigration group* | | | | | | |
| East Europe | 0.928 | – | 0.298 | 0.018 | 0.158 | 0.502 |
| | (0.109)*** | | (0.363) | (0.103) | (0.070)** | (0.170)*** |
| North Africa | 2.405 | 0.094 | – | 0.308 | 0.112 | −0.040 |
| | (0.383)*** | (0.067) | | (0.203) | (0.086) | (0.150) |
| Sub Saharan Africa | 2.034 | 0.242 | 0.282 | – | 0.362 | 0.513 |
| | (0.099)*** | (0.053)*** | (0.141)** | | (0.081)*** | (0.131)*** |
| Asia | 1.114 | 0.174 | −0.421 | 0.038 | – | 0.179 |
| | (0.065)*** | (0.059)*** | (0.141)*** | (0.101) | | (0.139) |
| Latin America | 0.441 | 0.093 | −0.274 | −0.130 | 0.201 | – |
| | (0.163)*** | (0.177) | (0.260) | (0.267) | (0.273) | |
| *CS average attributes* | | | | | | |
| % of industrial buildings | 1.582 | 1.198 | 1.992 | 3.773 | 0.538 | −1.201 |
| | (0.123)*** | (0.114)*** | (0.191)*** | (0.327)*** | (0.145)*** | (0.170)*** |
| % of public use buildings | 2.139 | 7.366 | −11.874 | 3.237 | 8.750 | −2.267 |
| | (0.873)** | (0.961)*** | (2.425)*** | (1.578)** | (0.840)*** | (1.968) |
| Constant | 1.145 | 1.058 | 1.984 | 2.123 | 0.887 | 1.255 |
| | (0.061)*** | (0.056)*** | (0.187)*** | (0.126)*** | (0.070)*** | (0.137)*** |
| Observations | 109242 | 109243 | 109243 | 109243 | 109242 | 109243 |
| *R*-squared | 0.17 | 0.08 | 0.05 | 0.06 | 0.15 | 0.03 |

*Notes*: Robust standard errors in brackets (***significant at 1%). The benchmark family characteristics are: very good house conservation, age >1991, owner; household head is man, with average education level with unemployed partner. Unit of analysis is household head. Regressions also control for interaction between age and global quality of the house, number of rooms, dimension; family had attributes: sex, age, education, job position, and number of sons.

a time comparison) but already incorporates some attractive components with respect to the reference area.

We also introduce dummy variables for immigration groups in order to capture interaction between groups. Among all immigrants, Africans show a significantly positive effect on the concentration of all other immigrant groups. This result confirms previous findings of a sustained level of interaction of Africans with other immigrants, but less intensive interaction with natives.

In the analysis, we also control for the spatial variability in the typology of buildings. For all groups, the model predicts a significantly positive effect of the share of commercial buildings and a moderately lower, but still positive, effect of the share of schools and community buildings on immigrants concentration. This effect is, nevertheless, negative for the concentration of North Africans, more inclined to live in housing projects (see Table 2). An immediate interpretation is that housing prices in more industrialized areas are likely to be lower than the average price level in the city (even conditional on housing attributes), thus making such houses attraction for immigrants. Conversely, the lower percentage of commercial buildings in residential areas, jointly with a widespread housing ownership, imply the lower level of concentration in such areas.

The space stratification model posits that household characteristics are good predictor of immigrants' concentration across areas. Our results indicate, for the total immigrants group, that individual characteristics like sex, education, or job position of the family head, have a negligible and statistically insignificant marginal impact on immigrants' concentration variability across spatial units. Moreover, the *F*-test indicates that the lack of joint significance of marginal effects for total immigrant group cannot be rejected. On the contrary, the joint effect of household head characteristics is significant, when the analysis moves to single immigration groups' concentration patterns. Our interpretation is that single family attributes lose explicative power when we combine together different immigrants' sorting patterns, while they have a consistent joint effect for each immigrant group separately. This fact is surprising if we observe Table 2 and other average statistics. For example, the average immigrant is 20 years younger than the average Italian, explaining why only 15% of immigrants are currently not working. Although the proportion of self-employed is greater for each group of immigrants than it is for Italians, the disproportion is even more sensible looking at employees. Differences in such covariates are significant between immigrants and natives, but they reduce or disappear within immigrants of different groups.

A different picture emerges by looking at house characteristics. We find that housing features, like age, preservation,[12] number of rooms, dimension, presence of a kitchen, have a predominant (and significant) role in explaining the variability of $Q_k^j$. The patterns, dimensions, and signs of the marginal effects are the ones expected. For example, we expect that houses with more rooms are inhabited by larger families, which are more likely to occur in the native group, as Table 2 reports. As a consequence, an increasing number of rooms are associated with a significant negative effect on immigrants concentration, since a lower number of immigrants are expected in the sections with larger houses. Moreover, living in a housing project significantly decreases expected concentration, since the number of immigrants having access to the program is very limited, compared to natives, and houses are likely to be evenly distributed in the territory. Since prevalently Italian families live in housing projects (incidence is three times higher for italians than it is for immigrants), it is expected a higher degree of concentrations of natives in those sections were housing project buildings are concentrated. The North Africa groups are an exception: since North Africans have the same access rate of natives to housing projects (2.2% versus 2.3% of italians), it is expected that the housing project participation does not lead to significant changes in this group concentration, as reported in Table 6.

Is there a possible new interpretation for these estimation results, and in particular for unusual findings on individual family characteristics? We assert that, in general, it is not the single attribute of a resident family that has the power to explain immigrants' concentration, but rather a combination of different attributes. OLS coefficients show that section averaged estimations lead to nonsignificant marginal effects. This can happen if the aggregation of information by section (we used mean) does not account for some unobservable relations between variables. In this sense, we can read stereotyping not in terms of single attributes, but rather in terms of households types, each corresponding to a particular combination of attributes. If families sort in space according to their type (rather than according to single attributes), then only a combination of their characteristics may be a good predictor of the level of segregation observed. A similar result is also supported by the study of Bayer et al. (2004) on American data.[13]

We find another interesting issue related to housing characteristics, especially relevant in environments characterized by increasing immigration flows: the concentration of home-ownership matters. For all groups and on a homogeneous scale, we find positive and significant effects of renting

on the local concentration of immigrant groups. Looking at the data, we find a disproportionally high share of rented houses in our selected areas, from 40% of SA to more than 50% in Veronetta, double the average value observed for the other areas. As a possible future research issue, we state that areas where renting – and natives' renting – is more common,[14] are good candidates for attracting immigrants. As a policy issue, major integration through other channels than working place or linguistic homogeneity is needed. High polarization in housing property, some opportunistic behavior of renters, and lack of controls leave room for the formation of heterogeneous communities inside the same city environment, transforming some areas in potential traps for immigrants' concentration.

## CONCLUSIONS

Census data suggest that immigrants sort themselves in poor-quality housing units with low rate of housing ownership, thus hindering sustained internal mobility within the city. We control for macroareas fixed effect to take into consideration not only the dynamic patterns of immigrants' segregation but also the fixed unobservable characteristics of such areas. We find that characteristics of housing markets have strong predicting power over the concentration of different immigrant groups: ownership and characteristics of the houses' marginal correlation with the CS-level variability of the concentration statistic largely overcome the effect of household characteristics.

The result is a first attempt to relate variability of a concentration statistics, which constitute the basic information exploited in the construction of the segregation curve, with microdata on the characteristics of individuals and houses. A promising direction of research would consist in exploiting the housing market information (prices, rents) to obtain measures of local quality of life and relate them with population groups' relative concentration. Moreover, the study clearly points where the local policy maker should intervene or monitor in an environment characterized by strong immigration flows and rapidly changing immigrants' segregation patterns.

## NOTES

1. In recent years, the immigration flow to the city has been sustained: from 2000 to 2011 the share of immigrants almost triplet and currently represents the 13.8% of

the resident population in Verona, compared to a share of 7.5% at national level (ISTAT). Although the demographic balance of the immigrant (foreign) population is still positive in the city (the arrivals over departure rate of registered immigrants is 1.32 in 2010 and the annual immigrants growth rate is 4%), the new flow seems to be directed toward other regions of Italy (where immigrants population grew by 8% in 2010), thus signaling that population congestion phenomena seem to take place in Verona. A proof of that is also confirmed by natives' flow from the city: the natives' net migration flow (relative to overall population) has steadily decreased from 1.2% in 2002 to −0.05% in 2010, while the residents flow to other municipalities has increased from 1.7% in 2002 to 2.3% in 2010. A projection by the local office for immigration studies, CESTIM (Center for Studies on Immigration), reveals that the share will rise to 20% of the total urban population before the year 2020. This feature allows us to treat Verona as a research field where to study immigrant location choices and segregation patterns.

2. See Yinger (1995) for a review of the main empirical results based on audit studies.

3. The *Spatial Assimilation Models* posit that cultural, linguistic, and social differences between immigrants and natives can be good predictors of segregation outcomes observed at the citywide level. The closer is the ability of immigrants to speak the local language and integrate in the labor market, the higher the probability to share the same urban space with the native community. Cultural differences also matter for informal insurance models, which consider segregation as the result of immigrants' cost-minimizing behavior (where costs are mainly related to specific ethnic goods or access to host country-specific information on housing and job opportunities).

4. In recent empirical works on US data, Hoyt and Rosenthal (1997) and Rhode and Strumpf (2003) show the importance of public good provision in determining the sorting paths of different communities, assuming that a racial component is embedded in preferences toward public goods and relying on some sustainable Tiebout's assumptions (i.e., people sort in space according to preferences toward quantity and quality of public goods consumption, spatial heterogeneity in public goods provision, and limited movement costs). Cutler et al. (2008a, 2008b) find significant association between spatial dissimilarity in public transit supply and increasing segregation. Our analysis is unfortunately not related to local public finance, as in the restricted geographical environment under analysis we do not observe significant spatial differences in levels or quality of public goods provision.

5. On average we count 137 individuals and nearly 70 households living in each census section. However, the demographic dimension of the sections is highly variable in the urban space, from 5 to more than 1,000 individuals.

6. The reference is to the system of classification of countries used by World Bank for geographical aggregates. See, for example, ''WB, World Development Indicators, 2004.''

7. For our empirical analysis based on a-spatial indices, we are forced to impose partitions exogenously and we therefore face two potential problems: the *Modifiable Areal Units Problem (MAUP)* and the so-called *Checkerboard Problem*. The first problem arises since the definition of spatial units of the urban area is imposed exogenously and does not necessarily correspond with a meaningful definition of the urban organizational units. The checkerboard problem arises because, using a-spatial measures, the proximity between neighborhoods is neglected and we

cannot measure spatial correlation between observed group frequencies across sections. In order to verify the robustness of our findings, we compare the results of indices under (the finer) CS or (the coarser) HTZ partitions.

8. Although this may seem a problem, in fact it represents a desirable property, as the statistic is not sensitive to the density of residents and the dimension of the sections considered. In alternative to $Q_k^j$ one could use another location index as the *location quotient* $LQ_k^k := p_k^j / p_k$. However, notice that when the focus of the analysis is on comparisons between sections of the concentration of each group, then for every two sections $j$ and $i$, the following condition holds: $Q_k^j \geq Q_k^i$ if and only if $LQ_k^j \geq LQ_k^j$. Thus, the two indices convey the same ordinal information. This is not in general the case when we compare different groups $k$ and $h$ belonging to the same section, unless $p_k = p_h$.

9. The Pigou–Dalton Transfer Principle (P7 in Hutchens (2001)) takes place when the distribution of a group $k$ across urban sections is obtained by another through a "regressive transfer" such that, for any two areas $i$ and $j$ with $Q_k^i < Q_k^j$, we move group $k$ members from $i$ to $j$.

10. We expect that the ranking produced by segregation curves changes when moving from the CS to the HTZ partition, since the coarser HTZ partition is obtained from the finer CS partition by aggregating the CS-level group counts within each HTZ into a single population count associated to the corresponding HTZ. If groups are uniformly distributed within HTZ, this operation preserves the segregation curves (and therefore the ranking of distributions). Otherwise, the ranking may vary according to the compositional similarity of the census sections which belong to the same HTZ.

11. In Fig. 3, a map of the city and the spatial position of the three areas to figure out the dimensions of the space portion considered is given.

12. Interaction between age and preservation is also considered. In fact, we argue that the effect of increasing preservation on the value of a house increases with the age of the building, so we also expect fewer immigrants to live in such kinds of houses. Though we still find positive but decreasing effects of both condition and age on concentration, the interaction of the two variables gives significantly negative marginal effects for all groups.

13. Using micro data at family level, the authors find that *together* income, education, language, and immigration status explain high shares of different immigrant groups' segregation, whereas these variables have a much lower predictive power for explaining race-based segregation phenomena. We suggest that the spatial stratification assumption must be reformulated in the immigration framework by incorporating the role of family types.

14. For example, in SA area 40% of Italians live in a rented house, though this percentage decreases dramatically to 24% in the rest of the city.

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