# Endogenous Segregation Dynamics and Housing Market Interactions: An ABM approach

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## Abstract

Ethnocentrism is a widely observed phenomenon, which arises from the belief that the affiliation into one's own ethnic group is rather preferable. Schelling provided a well-known model, which focuses on the noneconomic motivation of changing a person's residential situation under the assumption that people have a mild preference for "being close to people of your own kind". In this matter, a lot of research has been done using Schelling's research as basis with respect to changes in sizes, shapes and forms of cities and neighborhoods, as well as extensions from two to more ethnicities and migration strategies with different tolerance thresholds.

However, the literature usually assumes that tolerance levels are exogenously given, which typically refers to personal characteristics such as skin color. By assumption, these thresholds are supposed to hold for all agents in the system, which may be a strong assumption when considering great diversity in metropolitan areas. Furthermore, the literature extending the original Schelling model usually does not consider economic factors and their interaction with residential decisions influenced by ethnicity factors.

In my model, I hypothesize that residential segregation behavior does not only result from an individual's perception of different ethnicities in a particular neighborhood, but is rather influenced by socioeconomic factors, as well. The idea behind this is that agents in a society probably compare themselves not only by skin color, but as well by status related attributes. I assume that i.e. higher educated individuals rather tend to live in neighborhoods, where the majority of inhabitants has a higher education, too. The same may hold for individuals with different income classes. Following these assumptions a system with a higher degree of heterogeneity comes up. Therefore, I

implement an agent-based model in which agents are endowed with different attributes, like a certain level of education and income, as well as a time of being unemployed, which counts for 5% of the population. These attributes are supposed to influence an agent's tolerance. In order to do so, the individuals form indices to norm the values of their attributes between 0 and 1. The concept here is to create a variable for tolerance, where the agent is rather intolerant, if the value becomes close to 0 and is rather tolerant, if the value evolves towards 1. Using a weighted sum of these indices and in combination of an index for base intolerance, the agents determine their tolerance level in each period endogenously. Since the model contains a housing market as well, the base intolerance, further, is influenced by affordability problems of a new home and the suffering of economic loss, both in case that the agent made the decision to move into another neighborhood in last period. These modelling assumptions are based on empirical ground work conducted at an earlier stage, which states that tolerance is affected by the above mentioned variables significantly.

The conventional Schelling approach is extended by another important fact, which is missing in the literature. In Schelling's segregation model and in any other computational modifications agents can move to any random spot, if they feel "unhappy" in their current neighborhood. These frameworks, accordingly, show no importance of house prices for any accommodation. Thus, the models do not contain any consideration of housing affordability or even a housing market. Previous research has shown that there are many agents, who suffer an economic loss, if they are house owners and have to move elsewhere, because they feel unhappy in their current neighborhood. These issues raise important questions in the context of residential segregation:

- What is the actual location choice of agents, if their decision criterion is connected to housing affordability?
- Is there any other pattern, how agents cluster under consideration of ethnicities and socioeconomic status?
- What are the economic and social driving forces for the segregation pattern on the macro-level?
- Do market processes reinforce segregation?
- Can there be a lock-in effect for certain agents in the sense that they decided to move, but cannot afford it? How does this affect individual tolerance levels?
- How severe does economic loss affect different households?

In order to analyze these questions, my agent-based model has several features, which to the best of my knowledge have not been considered in the literature so far: an endogenous tolerance function, a multidimensional dissimilarity index and the consideration of a housing market in an ABM approach. The model works as follows: agents determine their individual tolerance according to assigned attributes like income and education. Afterwards, they determine their dissimilarity by comparing themselves to their direct neighbors in a Moore neighborhood. This is based on income levels, education levels, house price relations and skin color. In consideration of individual degrees of tolerance and dissimilarity, agents compute their own happiness, which serves as determinant for the actual decision of moving elsewhere and as input factor for the personal house price perception. If agents decide to leave their current neighborhood, they search for other accommodations, which they can afford. If a suitable spot was found the agent moves. The ability or disability of moving elsewhere might lead to further segregation outcomes and thus, to other incentives for segregation behavior.