# Urban Conventions and Residential Location Choice

## Exploring a Heterodox Perspective of Urban Economics with a Spatially-Explicit Simulation Model

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**Keywords:** urban simulation model, residential location choice, heterodox urban economics

## Introduction

Since the 1960s, an increasing number of studies have focused on investigating the determinants of urban residential location choices and their influence on the emergence of spatial patterns that are able to affect the daily life of urban inhabitants. The theoretical basis of the current mainstream approach to urban residential location has its roots in models developed in the beginning of this period by Alonso [1], Muth [2] and others. Following the principles advocated by these neoclassical models, a unique and efficient order is achieved through residential choices that balance a trade-off between housing consumption and commuting costs to work.

Despite the valuable contribution of these pioneer studies to the development of urban and spatial economics, many researchers have doubted its applicability to the real world, criticizing some of its simplified assumptions (e.g., lack of interdependence of location choices) and, most important, the underlying idea that the spontaneous action of market forces promotes higher levels of consumer satisfaction and efficiency of resource use [3,4,5].

Contributing to this debate, this paper presents a spatially-explicit simulation model built to explore an alternative perspective to the one provided by neoclassical models of urban economics. This perspective is based on the theoretical framework proposed by the economist Pedro Abramo in his book "The Kaleidoscopic City" (*La Ville Kaléidoscopique*), first published in French in 1998. Considering the city as a setting for disputes between heterogeneous agents with asymmetric power over the market, the author builds on the heterodox economic literature to develop a new interpretation of how residential choices are made. In this paper, we present simulation experiments that explore the role of entrepreneurs' actions in influencing the residential location choice of families and the emergence of different global and local residential patterns in the city.

Following this introduction, the paper is organized as follows: First, we provide an overview of the theoretical framework that underlies our model of residential location. Second, we introduce the goal and specification of the model, which is called *Kaleidoscopic-City* as a reference to the title of Abramo's book. Then, a series of experiments that explore the relations between entities described in the theoretical framework is presented. Finally, we conclude with some final remarks.

## Crucial Decisions and Urban Conventions: An Alternative Perspective to Urban Residential Location

Instead of considering the trade-off between space and accessibility, Abramo assumes that families choose their location based on *neighborhood externalities*, i.e., they prefer places where lower-income families are not present. According to his approach, the residential location choice represents an investment choice, where, for instance, parents can invest in the family's human capital by offering good neighborhood relations and educational opportunities to their children [3].

While making their decisions, families perceive the urban space as a mosaic of neighborhood externalities and, consequently, evaluate locations that are being constantly modified by their own actions. However, because families' decisions are simultaneous and decentralized, no one can know in advance where each family will decide to live. This uncertainty about the future can become particularly critical when a family decide to make an *opportunistic decision* of investment and move to a location with richer neighbors. This sort of decision may disturb some wealthier residents already established in the location, motivate them to move out, and initiate a transformation in the social composition of the neighborhood [3, p.57]. Therefore, an opportunistic decision, seen as "non-rational" by the orthodox theory, has the potential of becoming a *crucial decision*, able to lead the future residential order to an unexpected configuration and, therefore, establish a context of *radical urban uncertainty* [3, p.58-59].

The state of radical urban uncertainty can be also (and especially) promoted by another type of agent whose actions are essential to configure the urban order: the capitalist-entrepreneur. Based on the Schumpeterian view of entrepreneurship, Abramo emphasizes how entrepreneurs are able to make profits through the *practice of innovation*. By building dwellings that are more innovative and attractive than the existing ones, entrepreneurs avoid competition with old housing stocks and redirect the demand to the locations where their newly built properties are offered. Thus, entrepreneurs are able to modify the urban order by promoting a *fictitious depreciation* of old housing stocks [3, p.71], which does not represent a physical depreciation of properties, but a depreciation in the social status of residents living in the location. This sort of decision made by innovative Schumpeterian entrepreneurs becomes, therefore, a crucial decision that is able to lead to a context of radical urban uncertainty.

Even in this context of uncertainty, market participants need to make their decisions based on a game of cross-anticipation, where each agent must anticipate the location choices of other agents and the neighborhood externalities emerging from them. To address this decision-making problem, Abramo relies on techniques suggested by Keynes [6], which indicate that, more than considering their own preferences, agents try to guess and imitate the choice of other decision-makers [3, p.112]. This mimetic behavior can converge to an *urban convention*, which is a collective conviction regarding the type of family that is going to live in a particular location (neighborhood externality) [3, p.287].

By adopting a mimetic behavior, agents need to identify who is better informed and should be imitated. In this context arises the figure of the Keynesian speculator, whose task is to predict the psychology of the market [3, p.137]. Abramo argues that, in the residential market, the Keynesian speculator and the Schumpeterian entrepreneur are merged into a single figure. Since Schumpeterian entrepreneurs are the only able to promote innovations that depreciate existing residential areas, they seek to assign themselves the role of emitting signals that announce changes in the residential market [3, p.139-140]. Considering the entrepreneurs as better-informed agents, families take these signals into consideration while making their residential location choice. Thus, the urban convention becomes an element of spatial coordination that results from a mimetic speculative process where families elect the entrepreneurs' actions as source of information.

However, if on one hand the entrepreneur sends signals that lead to a spatial order (urban convention), on the other hand they introduce innovations that lead to a fictitious depreciation of housing stocks and the end of the convention. There is, therefore, a tension between the order promoted by urban conventions and the disorder introduced by crucial decisions. According to Abramo, this order-disorder tension is what reveals the context of radical urban uncertainty and kaleidoscopic spatial order that characterizes the market coordination of the urban space [3, p. 143].

## The Kaleidoscopic-City Model

The ordered-disordered dynamic described above, which is quite different from the stable and efficient process advocated by the neoclassical approach, is explored in this paper through the Kaleidoscopic-City model. By simulating the interdependence between the decisions of heterogeneous agents (families and entrepreneurs) and the neighborhood externalities emerging from these decisions, the model seeks to investigate how crucial decisions made by entrepreneurs (innovation) contribute to change the urban spatial order and the lifecycle of different regions in a city.

## Agents and Environment

The model presents two types of agents: families (consumers) and entrepreneurs (producers).

*Families* are spatially explicit agents hierarchized by their *income level*. They are constantly evaluating urban locations and deciding whether to move to a different place. In this evaluation, they take two aspects into consideration: the income level of neighbors (neighborhood externality) and the innovation degree of dwellings.

*Entrepreneurs* are agents responsible for producing dwellings. They are not spatially situated, although their actions are constantly affecting the urban space. They are characterized by a *producer profile*, which can be innovative or imitative.

*Innovative entrepreneurs* produce dwellings with the highest degree of innovation and always in the region recognized by the current urban convention as the one where the richest families are going to live. If convenient, they can establish a new convention by introducing innovations in a different region of the city. *Imitative entrepreneurs*, on the other hand, do not have the ability of establishing new conventions, since the innovation degree of the dwellings they produce simply follows standards already set. Also, they may build in any region of the city, although they have a higher probability of choosing the region that represents the current urban convention.

The *urban environment* that is constantly being perceived and modified by both types of agents is represented by a grid of cells and subdivided in different regions. Each *region* is composed by a set of cells and can, temporarily, be recognized by the urban convention as the region where the richest families are going to live. For simplification, we call this region as "urban-convention region", since this paper only addresses explicitly the anticipation regarding the location of the wealthiest families.

The *cells* can be urbanized or not. Once urbanized, they can accommodate one or more dwellings, depending on the maximum density allowed in the region where they are situated. The dwellings located in a cell are characterized by a certain degree of innovation and can be occupied by family agents.

## Process Overview

The Kaleidoscopic-City model was implemented in Netlogo 5.0 [7] and its simulation schedule is summarized in Figure 1.

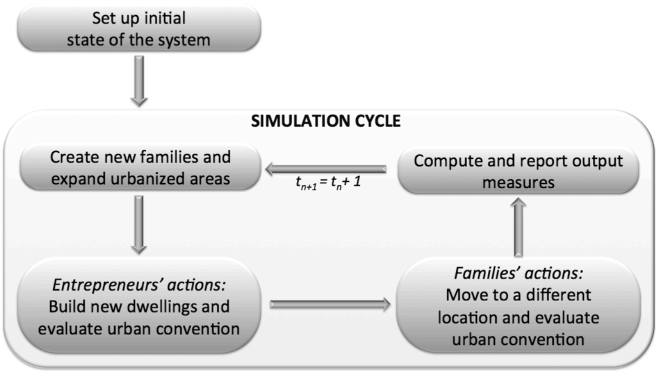


Figure 1: Simulation schedule

### Initial state of the system

The environment is composed by a finite number of cells ($N$ = 1254) and subdivided in 12 different regions. A small number of cells, located within a radius $r$ ($r_0$ = 5 units/cells) from the center of the grid, are already urbanized before the beginning of

the simulation. Figure 2 represents the 12 regions in different shades of gray and the central urbanized area in a lighter shade.
An initial number of dwellings ($d_0$ = 20) with equal degree of innovation are randomly located within the urbanized area. Each dwelling is occupied by a family agent (Figure 2). Families have their income level defined according to a power law distribution.
Entrepreneur agents are also created in the initialization phase. Their producer profile (innovative or imitative) is defined according to a user-defined probability.

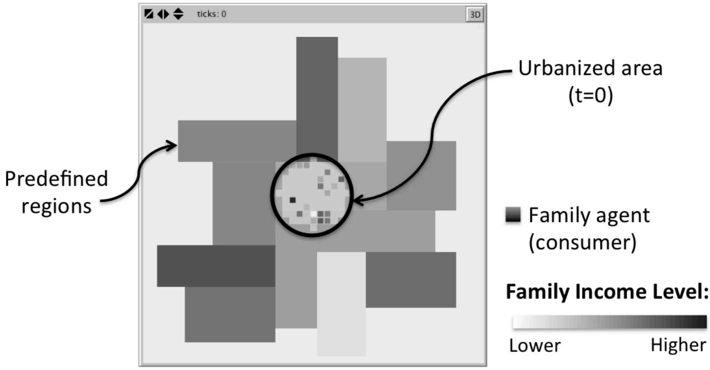


Figure 2: Configuration of regions and family agents' distribution within the initial urbanized area

**Create new families and expand urban areas**

In the first phase of the simulation cycle (Figure 1), *n* new family agents are created (*n*=15). These new families, which are not yet assigned to any location of the environment, represent a new demand for dwellings and urbanized areas during the current time step. Addressing this demand, an expansion of the urbanized radius will occur in case the total number of families exceeds a predefined threshold.

**Entrepreneurs' actions**

In this second phase of the simulation cycle, the model simulates the entrepreneurs' actions, which are responsible for supplying the demand for new dwellings. For that, it executes the procedures summarized in Figure 3.
The first procedure consists on selecting one of the existing entrepreneurs, which can be an innovator or imitator. Afterwards, the entrepreneur will choose a region to build the new dwellings. An imitative entrepreneur can select any region of the city, with a higher probability (50%) of choosing that region that represents the current urban convention. An innovative entrepreneur, on the other hand, will always build at the urban-convention region. Nevertheless, innovative entrepreneurs can evaluate whether it is convenient to maintain the current convention or not. According to Abramo [3], as the housing density of a region increases and approaches the desired density for the place, the greater the chances that an innovative entrepreneur will

attempt to establish a new urban convention (greater uncertainty). In the model, the maximum density allowed for a region is set as the "desired density".

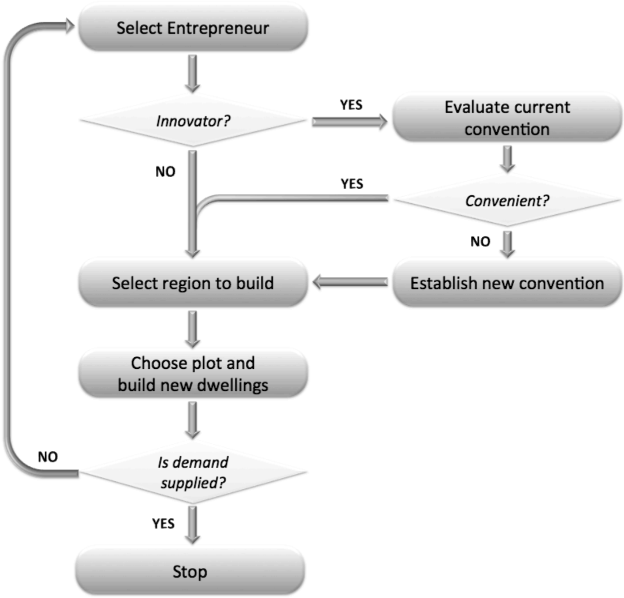


Figure 3: Entrepreneurs' actions

Once the innovative entrepreneur decides to establish a new convention, the region chosen to become the new destination of wealthy families starts a new phase of development: its maximum density allowed increases by 1, all of its cells are urbanized (in case they were not already) and, most important, the innovation level of the new dwellings built in the region will be the highest of the city.
After selecting a region, the entrepreneur agent will choose a plot and build new dwellings. This process, which starts from the selection of an entrepreneur and finishes with the construction of new dwellings, is repeated until the total number of dwellings meets the demand.

**Families' actions**

In this phase, family agents decide whether to move to a different residential location or not (Figure 4). Families that are already living in the city may want/need to move for different reasons:

- They are unhappy about their neighborhood externality (neighbors' income is lower than desired);
- They are attracted to dwellings with a higher degree of innovation;

- The region where they live received investments that promoted the arrival of new and wealthier residents. Consequently, the region's price is no longer compatible with the family income level (gentrification).

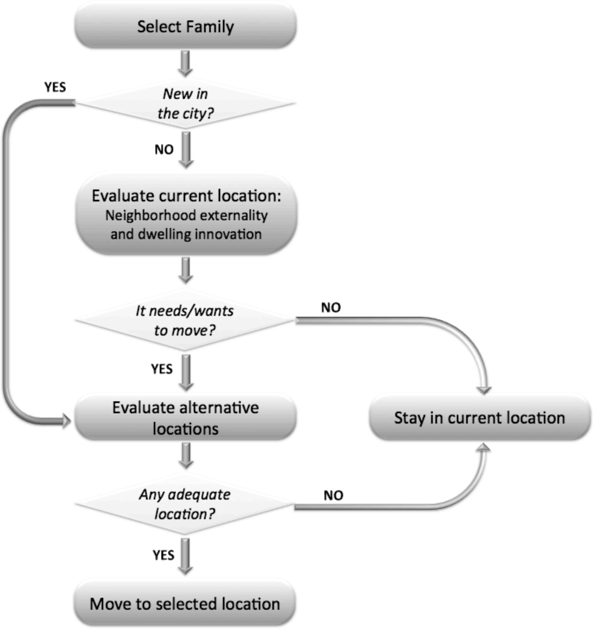


Figure 4: Families' decision-making process

Families who need/want to move will evaluate up to *n* alternative locations (*n*=20). In this evaluation, families search for an available dwelling that meets the following requirements:

- Those who are dissatisfied with the innovation degree of their dwellings will look for dwellings whose innovation degree is *within a range* that is compatible with their income.
- Those who are already satisfied with the innovation degree of their dwellings, but dissatisfied with the neighborhood externality of their current location, will look for a place where the average neighborhood income is *higher than the average income* of their social group.

Families who find a dwelling that meets the pursued requirements, will then move into the chosen location. Otherwise, they stay in their current dwelling.
Unlike innovative entrepreneurs, families are not able to intentionally destroy or establish an urban convention. Nevertheless, events that are able to disturb rich residents who are living at the urban-convention region may motivate them to move

out and initiate a process that encourages innovative entrepreneurs to establish a new urban convention. At the end of a simulation cycle, the model represents this process by measuring how satisfied the urban-convention region's residents are regarding their neighborhood externality. The lower the satisfaction is, the higher is the chance that an innovative entrepreneur will decide to establish a new urban convention.

**Output measures**

At the end of each cycle, two different output measures are computed to monitor the dynamics of urban regions: (a) density of dwellings in each region, and (b) average income of the residents in each region (proxy of land value).
In addition, the spatial distribution of wealthy families is monitored through an urban segregation index that measures the spatial isolation of this income group [8].

## Simulation Experiments and Discussion

This paper presents experiments that explore the *role of crucial decisions made by innovative entrepreneurs* in shaping the residential order of cities. It investigates how the *practice of innovation* and its ability to establish new urban conventions can affect the residential location choice of families and the configuration of different global and local residential patterns in a city.
To test the impact of innovation and urban conventions, we simulated and compared the emergence of residential patterns under two different conditions: one *without* and the other *with* innovative entrepreneurs.
In the first scenario, without innovation, entrepreneurs are not able to interfere on the establishment of urban conventions, as there is no differentiation among the dwellings they produce and offer to the families. In this case, the only aspect considered by the families while choosing a residential location is the income composition of families living in the neighborhood (neighborhood externality).
In the second scenario, 10% of entrepreneurs have an innovative profile. These entrepreneurs can, therefore, assume an active role on establishing (and destroying) urban conventions. By building innovative dwellings in a certain region of the city, entrepreneurs avoid the concurrency with old housing stocks and can emit signals about the future residential order in the city.
Figures 5 and 6 show the *location of families with different income levels* and the *local isolation index of wealthy families* along the simulation of both scenarios (t=0, t=50, t=100 and t=150). Through the comparison of these two figures, it is possible to observe the *aggregate outcome of the practice of innovation*.
The scenario *without* innovation (Figure 5), where families' residential decisions are only influenced by the social composition of the neighborhoods, the residential dynamics are characterized by a higher degree of inertia, which results in an *increased stability of neighborhood externalities*. As the population of the city increases, families tend to occupy the urban space in a uniform manner and progressively define the regions characterized by the presence of each social group.
The scenario *with* innovation (Figure 6), on the other hand, reveals a situation with a much higher level of uneasiness and uncertainty, characterized by a greater mobility

of families in terms of residential location, which is exactly what ensures higher profits for developers.

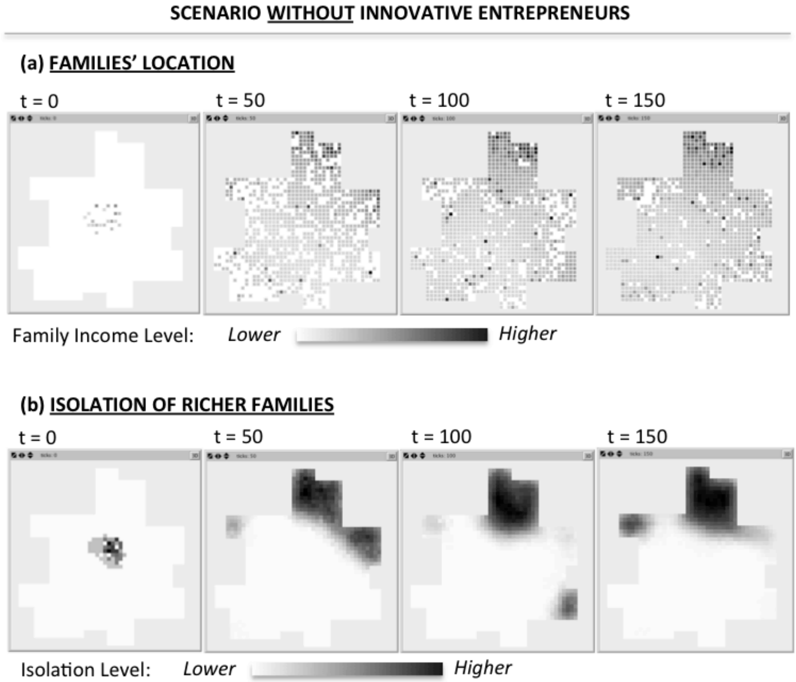


Figure 5: Simulation **without** innovation: (a) families' location and (b) isolation of richer families

The maps showing the isolation of richer families exemplify this difference between both scenarios: while in the first scenario, the wealthiest neighborhood was mainly kept at the same place during the simulation (Figure 5b), the introduction of innovations in the second scenario was constantly modifying the urban conventions and, therefore, promoting a frequent change in the places where the richest families live (Figure 6b).

It is also important to remind that the practice of innovation simulated in this experiment, which aims at moving the wealthiest families to new locations, promotes a fictitious depreciation of older housing stocks. In turn, this depreciation intensifies the urban uncertainty by subverting the conventions that prevailed for other social groups and giving rise to a chain of displacements of families with different income levels.

This process results in what Abramo [3] described as the image of a mosaic of neighborhood externalities in constant mutation or, in other words, the *image of a kaleidoscopic residential order*.

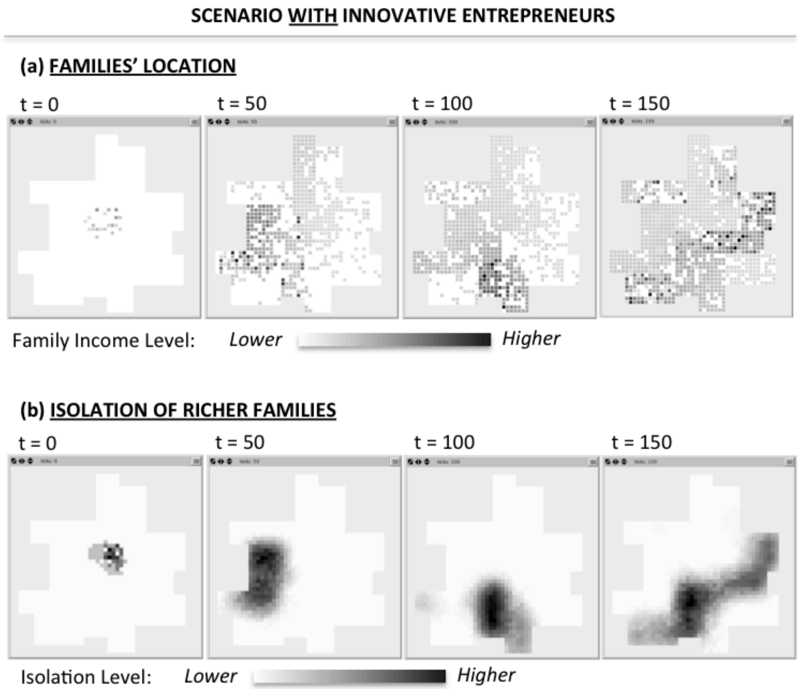


Figure 6: Simulation **with** innovation: (a) families' location and (b) isolation of richer families

The graphs presented in Figures 7 and 8 illustrate these considerations by comparing the evolution of local residential patterns in both scenarios. In these graphs, each line represents the trajectory of an urban region. Two output measures are used to monitor these trajectories:

- density of dwellings, which illustrates how intensive are the investments in a region (Figure 7);
- mean income of families, which is here considered as a proxy of the land price in a region (Figure 8).

In the first simulation experiment (without innovations), the density of dwellings increases uniformly in all regions of the city (Figure 7a). This pattern is very different from the one obtained in the experiment with innovations (Figure 7b), where most regions have periods of accelerated increase in density (when set as the convention region), alternating with periods of stagnation.

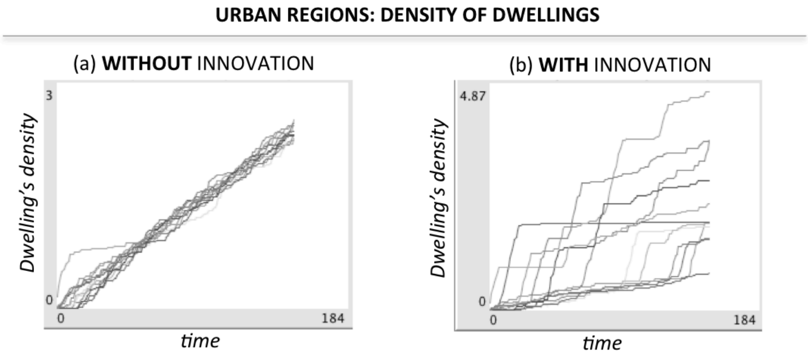


Figure 7: Density of dwellings in the urban regions: scenarios **without** and **with** innovation. Each line describes the density of a region.

Regarding the mean income of families (Figure 8), it is possible to observe how the variation of this attribute is much smaller in the first scenario (without innovations). The graph in Figure 8a shows that, after an initial instability associated to small population sizes, regions tend to present a relatively stable neighborhood externality (and, therefore, land price). On the other hand, because the innovations introduced in the second scenario promote a constant restructuration of the existing neighborhood externalities, Figure 8b shows patterns characterized by "peaks and valleys".

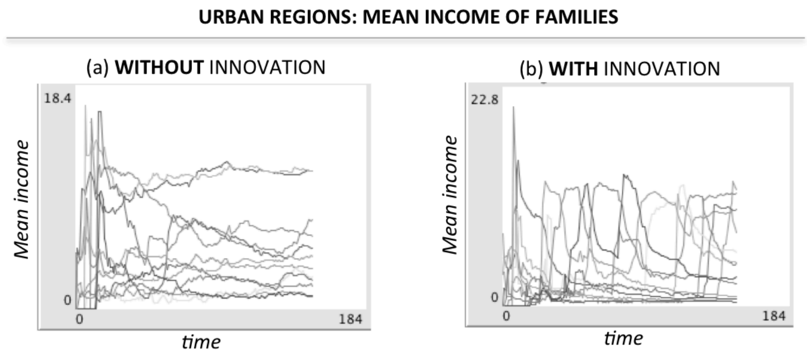


Figure 8: Mean income of families in the urban regions (proxy of land price): scenarios **without** and **with** innovation. Each line describes the average income of families living in a region.

The local outcomes of the practice of innovation can be seen in more detail in Figure 9, which shows the trajectory of urban conventions (Figure 9c) and its impact on the development of urban regions (Figure 9a and 9b). In Figure 9a, each line describes the dwelling's density of a region, while in Figure 9b each line describes the average income of families living in a region.

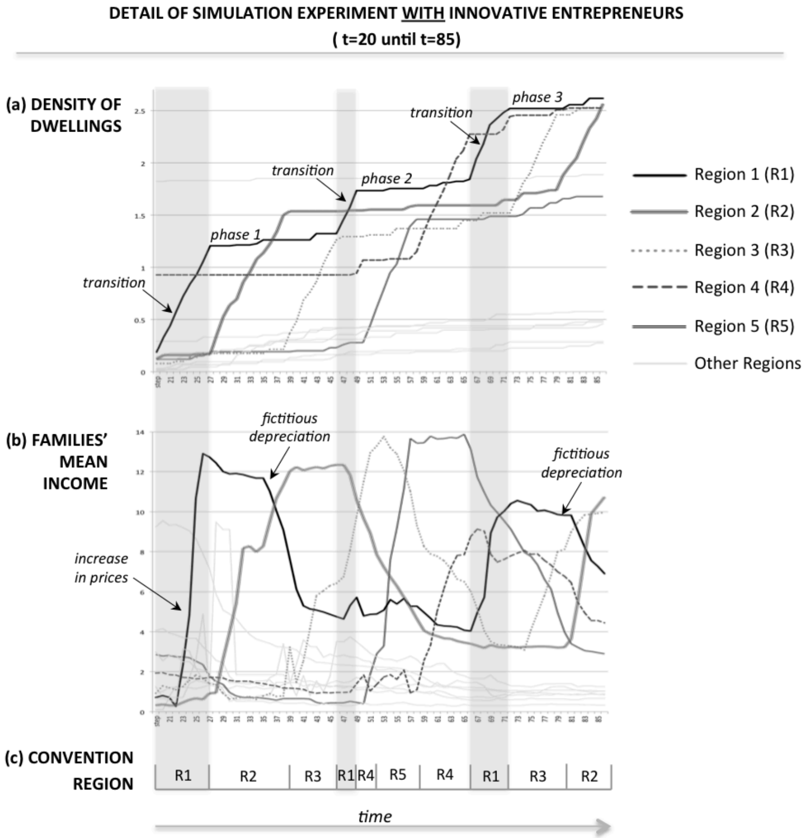


Figure 8: Urban conventions and regions' life cycles.

Taking the example of Region 1 (R1), which is represented by the black line, we can see that in periods when this region is the current urban convention (highlighted with a gray shadow in Figure 9), the place enters a transition period, characterized by intensive investments and a sudden increase in dwellings' density (Figure 9a). At the same time, the region becomes more attractive to richer families and a strong increase in prices takes place (Figure 9b). This transition period ends with the emergence of a new urban convention. Then, the investments in region 1 cease and the density of dwellings is kept almost constant (phases 1, 2, 3). With the most innovative dwellings of the city being now located in a different region (new urban convention) richer families feel motivated to move out from region 1 and are substituted by families with lower income. This process causes a fictitious depreciation in region 1 (Figure 9b): the housing dwellings remain the same, but the social status of families living in the region (neighborhood externality) decays.

By observing and comparing the different sort of information provided in Figure 9, it is possible, therefore, to see how the succession of urban conventions traces the life cycles of urban regions, including their history of housing stocks and neighborhood externalities. In these life cycles, *transition periods* characterized by the construction of innovative dwellings and increase in prices are separated by *in-between phases* where the housing stock is preserved, but different configurations of neighborhood externalities take place (fictitious depreciation). These dynamic processes, here demonstrated through simulation experiments, are theoretically described in Abramo's book [3].

## Final Remarks

This work presents a spatially-explicit simulation model that explores the heterodox perspective of urban economics proposed by Abramo [3]. Unlike the orthodox school, Abramo's approach assumes that the residential location is not an individual and independent process. Instead, it emphasizes the interdependence between agent's decisions and the spatial externalities emerging from them.

In this paper, we particularly focused on the impacts of entrepreneurs' decisions. While in the neoclassical view entrepreneurs assume the neutral position of price-takers, the Kaleidoscopic-City model emphasizes their active role as price-makers. In the pursuit of higher profits, they can try to manipulate the sovereignty of consumers through the practice of innovation.

This alternative way to envision the residential market has implications for the future urban order and, consequently, for the development of urban policies. The approach explored in the Kaleidoscopic-City model is built on the Keynesian speculative-financial paradigm, and not on the neoclassical exchange paradigm. Studies and policies developed under this perspective should, therefore, do not rely on economic predictions, but on the historical process of urban development and the possibility of having economic agents making crucial decisions that redefine the course of history.

## Acknowledgments

This work is financially supported by the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP, grant 2010/06532-6).

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