

# Agent-Based Simulation of Short-Term Peer-to-Peer Rentals: Evidence from the Amsterdam Housing Market (Article Abstract)\*

Neil Yorke-Smith[0000–0002–1814–3515]  
[n.yorke-smith@tudelft.nl](mailto:n.yorke-smith@tudelft.nl)

Delft University of Technology, The Netherlands

**Abstract.** The full article published in Environment and Planning B studies the effect of a range of possible municipal policy measures on the peer-to-peer short-term rental market. The case study is the city of Amsterdam. A spatial agent-based simulation indicates that more lower income citizens remain in the city centre when regulation of the market is stronger, and that banning the touristic market restrains the overall increase in house prices, compared to the business-as-usual scenario. However, the feasibility of enforcement of regulation, and its libertarian consequences, must be considered.

## 1 Motivation and Approach

The full article by Overwater and Yorke-Smith [6] recognises that gentrification, displacement and social exclusion are hot topics of debate in the city of Amsterdam, the Netherlands. A current phenomena is short-term rentals of private homes. In its peer-to-peer form, this phenomena has grown sharply, facilitated by services such as Airbnb. Its growth has caused controversies among communities in touristic areas of Amsterdam, since it contributes to a changed social fabric, increased housing prices and overall gentrification [3, 11]. In the Netherlands and elsewhere, municipal and national policy makers are interested to regulate short-term rentals [2].

The article's methodological lens to study the 'Airbnb effect' on Amsterdam – and to provide insights into qualitative policy effects on the regulation of short-term rentals – is a micro-level agent-based simulation. The agent-based model (ABM) developed is grounded in data. In contrast to Vinogradov et al. [10] the model is geographically accurate, and is based on Smith's rent-gap hypothesis rather than a real estate market model.

The spatial agent-based model captures two types of agents: city residents and visiting tourists. The article builds upon an extant ABM of urban residential dynamics [7, 9] that combines Smith's rent-gap theory [8] and Axelrod's cultural

---

\* This is an extended abstract of [6].

2 N. Yorke-Smith

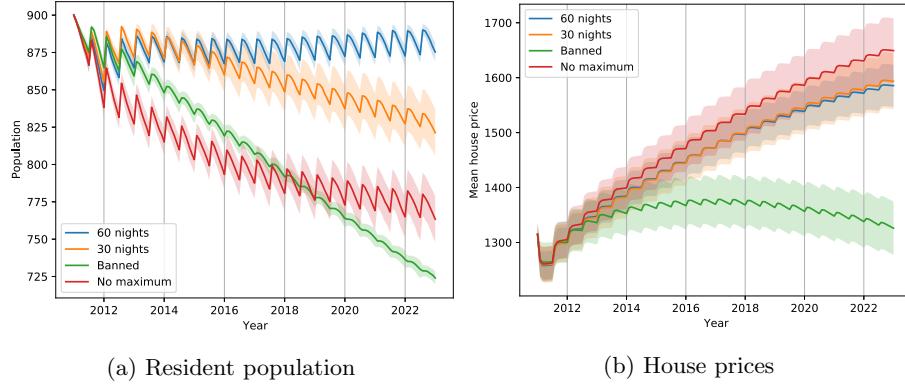


Fig. 1: Comparison of four regulation scenarios

exchange theory [1], adapting it significantly to model the touristic rental market. It captures private and social housing, and residents' propensity to rent their dwelling, under the cases where it is and is not permitted by contract. While calibrated on data from Amsterdam and the Dutch legal setting, the modelling approach presented in the article is generic.

## 2 Results and Discussion

Simulation analysis shows that the tourism market has caused considerable changes in housing prices and population development. As an example of the article's results, Figure 1 shows population and house prices under four regulation scenarios: no regulation, 60 nights rental per property per year, 30 nights, and a complete ban. The simulation proceeds from a start year of 2011 for ten years.

The article finds that more lower income citizens will live in the city when regulation of the market is stronger. Banning the touristic market restrains the overall increase in house prices, compared to the business-as-usual scenario. However, the feasibility of enforcement of regulation [5], and its libertarian consequences [4], must be considered. Indeed, a complete ban would not align with the 'tolerant' Dutch culture. Thus the main conclusion for the case of Amsterdam is that tighter limits, on the amount of nights a property can be listed on Airbnb, is preferable to an outright ban.

A future enrichment will be to survey residents in order to better characterise their attitude to restrictions and touristic rentals, and their propensity to ignore rules and contracts [5]. The interplay of the short-term and long-term rental markets deserves further study using agent-based simulation.

**Acknowledgements** Thanks to Jan Kwakkel and Stephen van der Laan, and the E&PB reviewers. This research was partially supported by TAILOR, a project funded by EU Horizon 2020 programme grant number 952215.

## References

- [1] Axelrod, R.: *The Complexity of Cooperation*. Princeton University Press (1997)
- [2] Furukawa, N., Onuki, M.: The design and effects of short-term rental regulation. *Current Issues in Tourism* (2019), e-print
- [3] Henley, J.: Overtourism in Europe's historic cities sparks backlash. *The Guardian* (25 jan 2020)
- [4] Kadi, J., Musterd, S.: Housing for the poor in a neo-liberalising just city: Still affordable, but increasingly inaccessible. *Tijdschrift voor Economische en Sociale Geografie* **106**(3), 246–262 (2015)
- [5] Leshinsky, R., Schatz, L.: “I don't think my landlord will find out”: Airbnb and the challenges of enforcement. *Urban Policy and Research* **1146**, 1–12 (2018), ISSN 0811-1146
- [6] Overwater, A., Yorke-Smith, N.: Agent-based simulation of short-term peer-to-peer rentals: Evidence from the amsterdam housing market. *Environment and Planning B: Urban Analytics and City Science* p. 23998083211000747 (2021), <https://doi.org/10.1177/23998083211000747>
- [7] Picascia, S., Yorke-Smith, N.: Towards an agent-based simulation of housing in urban Beirut. In: Post-proceedings of AAMAS'16 Workshop on Agent Based Modelling of Urban Systems (ABMUS'16), LNCS, vol. 10051, pp. 3–20, Springer (2017)
- [8] Smith, N.: Gentrification and capital: theory, practice and ideology in society hill. *Antipode* **11**(3), 24–35 (1979)
- [9] Termos, A., Picascia, S., Yorke-Smith, N.: Agent-based simulation of west asian urban dynamics: Impact of refugees. *Journal of Artificial Societies and Social Simulation* **24**(1), 2 (2021), <https://doi.org/10.18564/jasss.4472>
- [10] Vinogradov, E., Leick, B., Kivedal, B.K.: An agent-based modelling approach to housing market regulations and Airbnb-induced tourism. *Tourism Management* **77**, 104004 (2020)
- [11] Wachsmuth, D., Weisler, A.: Airbnb and the rent gap: Gentrification through the sharing economy. *Environment and Planning A: Economy and Space* **50**, 1147–1170 (2018)