Minoru OSAWA

Curriculum Vitae (Last updated: October 27, 2025)

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Education

Ph.D. in Information Sciences, Tohoku University	September 2016
M.A. in Information Sciences, Tohoku University	March 2014
B.A. in Engineering, Tohoku University	March 2014
Born:	March 1990

Academic Employment

Assistant Professor, Kyoto Institute of Economic Research, Kyoto University	April 2020 – Present
Assistant Professor, School of Engineering, Tohoku University	October 2016 – March 2020

Research Interests

Urban and Regional Economics; Transportation Science; Evolutionary Game Theory.

Big Picture

Spatial phenomena such as population concentration, congestion, and urban land use arise as aggregate outcomes of many individual decisions. I study these patterns through the theory of large-population games, focusing in particular on spatial agglomeration models that characterize clustering and dispersion across multiple locations.

For a long time, spatial theory has relied on stylized settings, such as two regions, which are insufficient for capturing multi-centric spatial configurations exemplified by the very existence of cities. Quantitative spatial models accommodate heterogeneous many-location geographies, but their intrinsic properties in the presence of multiple equilibria often remain unclear. As a result, it is difficult to identify which mechanisms have meaningful implications for policy evaluation.

My broader goal is to develop a comprehensive theoretical foundation for spatial agglomeration models that can robustly inform policy even when multiple equilibria exist. To this end, I propose new analytical tools for many-location settings, such as "potential game" theory, and derive general insights that goes beyond specific modeling assumptions.

RESEARCH

Selected Discussion Papers

1. "Spatial scale of agglomeration and dispersion: Number, spacing, and the spatial extent of cities," with Takashi Akamatsu, Tomoya Mori, and Yuki Takayama. 2025. (AMOT25)

   Overview. This study offers a theoretical framework to distinguish between two types of dispersion forces in spatial models: "local" dispersion forces acting *within* cities, and "global" dispersion forces acting *across* them. The distinction leads to a systematic classification of spatial models into a few fundamental types, each entailing different spatial patterns and comparative statics in response to transport cost changes. The framework serves to reconcile empirical findings and clarifies how spatial outcomes of transport policies can depend on the relevant dispersion forces.

2. "Origin of power laws and their spatial fractal structure for city-size distributions," with Takashi Akamatsu, Tomoya Mori, and Yuki Takayama. 2024.

   Overview. This paper shows that industrial location patterns form a spatial fractal hierarchy: more localized industries cluster in larger cities, which serve as hierarchical centers across scales. We further demonstrate that a model with heterogeneous scale economies can replicate both this pattern and the city-size power law.

Refereed Publications

1. "Harris and Wilson (1978) model revisited: The spatial period-doubling bifurcation in an urban retail model," with Takashi Akamatsu and Yuki Takayama.
   Journal of Regional Science, **57**(3), 442–466, 2017.

   Overview. Harris & Wilson model (Environment and Planning A, 1978) is a spatial framework often used in urban planning but largely overlooked in economics. I clarified its connection to "new economic geography" models and showed that both frameworks generate similar mathematical structures and implications for the evolution of spatial agglomeration. This interesting correspondence motivates the classification exercise in AMOT25.

2. "First-best dynamic assignment of commuters with endogenous heterogeneities in a corridor network," with Haoran Fu and Takashi Akamatsu.
   Transportation Research Part B: Methodological, **117**, 811–831, 2018.

   Overview. This paper examines a Vickrey-style bottleneck commuting model with multiple commuter types to reveal spatio-temporal sorting properties, using an analytical framework that is equivalent to the bid-rent approach in the monocentric city setting.

3. "Equilibrium refinement for a model of non-monocentric internal structures of cities: A potential game approach," with Takashi Akamatsu.
Journal of Economic Theory, **187**, 105025, 2020.

Overview. This study shows that Fujita and Ogawa's (1982) seminal model of polycentric urban formation can be reformulated as a large-population "potential game." This provides a systematic method for equilibrium refinement and resolves the long-standing issue of equilibrium stability. The model's potential function reflects the underlying economic forces: commuting costs serve as a co-agglomeration force between firms and households, while also acting as a "global" dispersion force for firms. Although the analysis focuses on a stylized setting, the potential-game formulation also opens up promising avenues for future quantitative applications.

4. "Break and sustain bifurcations of S_N-invariant equidistant economy," with Kiyohiro Ikeda, José Maria Gaspar, and Hiroki Aizawa.
International Journal of Bifurcation and Chaos, **30**(16), 2050240, 2020.

Overview. This paper develops a general mathematical framework for spatial agglomeration in an equidistant setting, where all regions are symmetrically accessible to one another. This setting can be interpreted as a modest generalization of the small open economy framework.

5. "Perturbed pitchfork bifurcation in a population game: Application to economic geography," with Kiyohiro Ikeda, José Maria Gaspar, and Yuki Takayama.
Journal of Regional Science, **62**(4), 961–980, 2022.

Overview. This study analyzes cusp catastrophes in two-strategy population games with exogenous locational asymmetries and applies the framework to spatial models. We derive two tractable approximations, showing that any number of regional asymmetry parameters can be approximated by just three composite parameters, enabling analytical treatment. The general form uncovers a previously unexplored hysteresis pattern.

6. "Time Evolution of City Distributions in Germany," with Kiyohiro Ikeda and Yuki Takayama.
Networks and Spatial Economics, **22**, 125–151, 2022.

Overview. This exploratory study investigates whether spatial agglomeration patterns predicted by static spatial models are reflected in population data for Germany between 1987 and 2011, covering both pre- and post-unification periods. To detect characteristic evolutionary patterns (modes), we propose a group-theoretic double Fourier spectrum analysis as a systematic tool for uncovering latent spatial regularities.

7. "Model-based analysis on social acceptability and feasibility of a focused protection strategy against the COVID-19 pandemic," with Takashi Akamatsu, Takeshi Nagae, Koki Satsukawa, Takara Sakai, Daijiro Mizutani.
   Scientific Reports **11**, 2003, 2021.

Working Papers

1. "Most likely retail agglomeration patterns: Potential maximization and stochastic stability of spatial equilibria," with Takashi Akamatsu and Yosuke Kogure. 2020.

   Overview. We revisit the urban spatial structure model of Harris and Wilson (1978). A known limitation of this model is its multiple locally stable equilibria, causing predictions to hinge on initial conditions. We address this issue by applying stochastic stability, exploiting the fact that the model constitutes a large-population potential game whose stochastically stable states correspond to global potential maximizers. This refinement yields a unique prediction for urban spatial configurations.

2. "Innovation, spillovers, and economic geography" with José Maria Gaspar. 2025.

   Overview. This study analyzes a two-region model with vertical innovations that improve the quality of horizontally differentiated manufactured varieties. We examine how knowledge diffusion and increasing returns in manufacturing jointly shape spatial equilibria. Innovation occurs with a probability driven by interregional interaction among mobile researchers. The model shows that when interaction with foreign scientists plays a relatively stronger role in innovation, economic activity re-disperses after an initial phase of agglomeration as transport costs fall.In this sense, knowledge spillover produces net "local dispersion force" in the terminology of AMOT25.

3. "Production externalities and dispersion process in a multi-region economy," with José Maria Gaspar. 2020.

   Overview. We study an economic geography model with two distinct interregional proximity structures: one for goods trade and another for production externalities. We examine how the latter influences the timing of endogenous agglomeration and the spatial distribution of workers. As transport costs fall, the economy transitions from monocentric agglomeration—when trade and externalities are costly—toward uniform dispersion as distance loses relevance, as in Helpman (1998). In multi-region settings, however, the network structure of production externalities plays a key role in shaping spatial outcomes. When externalities decay purely with geographic distance, monocentric distributions arise. However, if distant regions are tightly linked through production networks, a multicentric distribution can persist.

RESEARCH GRANTS (PI ONLY), HONORS, AND FELLOWSHIPS

1. Grant-in-Aid for Scientific Research (C) (22K04353), Japan Society for the Promotion of Science (April 2022 – March 2026).

2. Grant-in-Aid for Early-Career Scientists (19K14735), Japan Society for the Promotion of Science (April 2019 – March 2023).

3. Grant-in-Aid for Young Scientists (B) (17K14735), Japan Society for the Promotion of Science (April 2017 – March 2019).

4. Grant-in-Aid, Joint Usage and Research Center, Institute of Economic Research, Kyoto University (April 2017 – March 2018).

5. Research Fellowship for Young Scientists (DC1), Japan Society for the Promotion of Science (April 2014 – September 2016).

6. 2017 Kometani–Sasaki Award (for doctoral theses), Institute of Systems Science Research.

7. 2016 Doboku Gakkai Ronbun Shourei Shou, Japan Society of Civil Engineers.

8. 2014 Doboku Gakkai Ronbun Shou, Japan Society of Civil Engineers. (Joint with T. Akamatsu, T. Nagae, and H. Yamaguchi)