Extending continuous time microsimulation by rules of intergenerational transmission: An illustrative application to homeownership

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October 31, 2025

1 Introduction

Social mobility is driven by intergenerational transfers. These include but are not limited to wealth, education, health, and other demographic components. Questions of social mobility have been tackled by continuous time microsimulations (or discrete event simulation) for a long time. However, continuous time microsimulation has not yet been expanded to handle complex rules to govern intergenerational transmission. Our objective is to design intergenerational rules that can be implemented into continuous time microsimulation.

To achieve this, we first build on the capabilities of the existing MicSim package (Zinn et al. 2025). Already implemented is the functionality to link individuals together by creating matches between potential partners (Zinn 2011). To this foundation we add the possibility to link generations together, with attributes of the previous generation being able to affect the next. Thereby, we can simulate vertical as well as horizontal linkages. This is the core piece of functionality we present in this paper: continuous time microsimulation with linked lives, an extension to MicSim.

We apply MicSim to examine how the persistence of homeownership is affected by mechanisms of intergenerational transmission affected by demographic changes and the housing market in Europe. Our hypothesis is that the families housing history becomes increasingly more relevant for children as a pathway to homeownership. This might reinforce intergenerational persistence to the detriment of those with a renting history. Furthermore, as housing markets are likely to have a strong influence on pathways to homeownership, we will add scenarios examining this effect.

2 Methodology

Continuous time microsimulation affords the possibility to develop different scenarios and change specific conditions while holding all else equal, giving us the ability to examine counterfactuals. In the social sciences, microsimulation is used to study — among others — the effects of policies, demographic changes, and inequality (Zagheni 2015).

Our continuous time microsimulation consists of multiple individuals, represented by A to C in Figure 1. They are each made up by previously defined attributes (portrayed by the circle, rectangle, and triangle in Figure 1). These attributes can take on different states as defined by the researcher as an individual experiences events over their lifetime. A person can transition from having no children, to having one, to having two. These transitions are governed by transition rates, which describe the propensity by which an individual can transition from the state of an attribute they are in to the next.

Currently, when an individual experiences an event that causes the birth of a child, this child will then be linked to its parents by an ID. A review of the literature did not produce any microsimulation that would go beyond this functionality and introduce the inheritance of states from the mother (or father) to the child. This feature of inheritance is one of the key innovations of this project, illustrated in Figure 1 by the bold line. In this way, transition rates governing the current generation can be affected by the state attributes of previous generations.

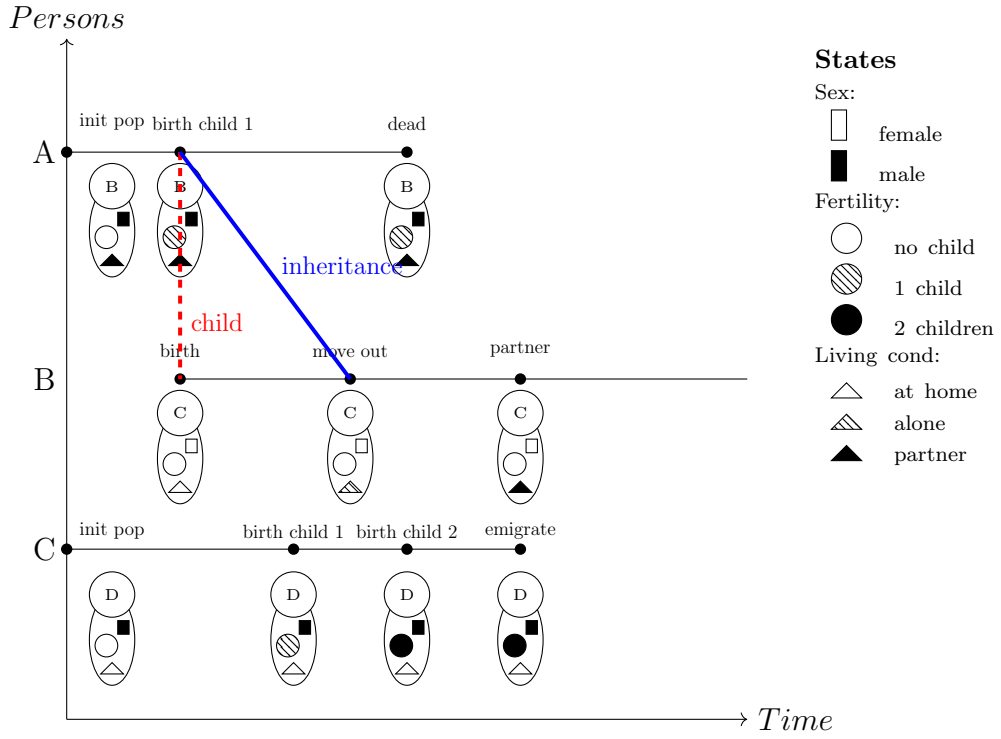

Figure 1: Simplified depiction of how MicSim models the lifecourse
Note. "Init Pop" denotes individuals who are present since simulation start.

3 Application

The novel instrument approach introduced above offers immense potential for studying and identifying contextual factors and complicated scenarios of intergenerational transmission. With this extension of microsimulation, we can offer a new method to study the complex relations between individuals and inheritance. We apply MicSim to examine the intergenerational transmission of homeownership, a topic still underresearched in wealth inequality but which our international research team in the DECIPHE project studies.

How does the transmission of homeownership from one generation to the other change over time? Which contextual factors play a role when it comes to transfers between one generation and the next?

Children of renters are less likely to become homeowners themselves, which reduces social mobility and increases generational inequalities in post-industrial societies (Hubers et al. 2018; Mulder et al. 2015). There is further evidence that intergenerational persistence of homeownership has become stronger over time (Blanden et al. 2023), though recent evidence also shows contracting results (Bedük et al. 2025). Due to the rising difficulties of younger cohorts to attain homeownership (Benassi and Bedük 2025; Lennartz and Helbrecht 2018), we expect the housing market to play a role in the effects of intergenerational transmission.

We use data from three European countries, Germany, Spain, and Hungary, to account for diverging trends in social mobility and different housing markets. Using continuous time microsimulation, we can test scenarios with different context factors, such as differently made up housing markets. We will examine scenarios of declining transmission of homeownership (see Bedük et al. 2025) and project the current situation into the future.

We plan to validate the results of this illustrative application of MicSim against existing data, simulating scenarios for which data are available. As (Benassi and Bedük 2025) note data availability is an issue when attempting to study intergenerational transmissions, especially for younger cohorts. Often there is a lack of empirical data needed to appropriately quantify results. We aim to show that MicSim can be used to answer questions where data availability is otherwise an issue.

We hope to show that our approach to continuous time microsimulation with linked generations not only works but can be used for other application settings. It is our goal to keep our model general enough to be a feasible research method for many potential questions. As such, it is a priority that MicSim stays as freely accessible software in the R language for researchers to use.

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