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Using dynamic microsimulation to understand professional trajectories of the active Swiss population

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1 Introduction

Within the social and economic sciences and of particular interest to demographers are life course events. Looking at life sequences we can better understand which states, or life events, precede or are precursors to vulnerability (Marshall, 2011). A tool that has been used for policy evaluation and recently has been gaining ground in life course sequence simulation is dynamic microsimulation. Within this context dynamic microsimulation consists in generating entire life courses from the observation of portions of the trajectories of individuals of different ages.

A more general, and perhaps technical, definition would be that microsimulation uses micro-data collected on micro-units and, based on a set of rules (models) which are estimated, simulates the outcomes of these micro-units within a given system (Orcutt, 1957). To better illustrate this concept, lets take an example. An example of micro-data could be longitudinal data collected on individuals (the "micro-units") within Switzerland (the "system"). Assume there are longitudinal labour market data on these individuals and that the goal is, within the Swiss context, to project the labour market outcome for these individuals over time. The first step is to determine if an individual employed at the current time period would be more likely to remain employed in the following time period. In other words, what is the probability that this individual remains employed? What is the probability that this

individual from being employed transitions to unemployment? Conversely, what is the probability that an unemployed individual remains unemployed? Or that from unemployment she or he transitions into employment? These questions concern transition probabilities, and such transition probabilities would need to be estimated from the data using probability models. So the "rules" in this case would be transition probabilities, which would be estimated using probability models. The estimated transition probabilities could then be applied to simulate the future labour market outcomes of these individuals.

In this work, we aim to use dynamic microsimulation in order to analyse individual professional trajectories with a focus on vulnerability. The primary goal of this analysis is to deepen upon current literature by providing insight from a longitudinal perspective on the signs of work instability and the process of precarity.

An interesting feature of microsimulation is that it extends the range of possible uses of existing data. This is particularly important because within data collection funding is often an issue. As a consequence sample size as well as the time frame of data-collection are often limited. Additionally, the issue with data-collection is that oftentimes the data are used for a specific purpose by a research team and then are of limited use to other researchers. These reasons motivate the secondary goal of this work which is to show how, by using microsimulation, data collected for one purpose can be analysed under a different scope and used in a meaningful way.

The data to be used in this analysis are longitudinal and were collected by NCCR-LIVES IP207 under the supervision of Prof. Christian Maggiori and Dr. Grégoire Bollmann. Individuals aged 25 to 55 residing in the German-speaking and French-speaking regions of Switzerland were followed annually for four years. At the initial time period there were 2469 participants and the sample was roughly representative of the active Swiss population with women and the unemployed slightly over represented (Maggiori et al., 2014). These individuals were questioned regarding, *inter alia*, their personal, professional and overall well-being. At the end of the fourth and final wave, there were 1131 individuals who had participated in all four waves. The sample remained representative of the Swiss population with women and the unemployed slightly over represented.

Using the information collected from these surveys, we use simulation to construct various longitudinal data modules where each data module represents a specific life domain. The demographic module for instance would consist of: age, marriage, children, etc., whereas the education module would consist of: primary education, secondary education, tertiary education. We postulate the relationship between these modules and layout a framework of estimation. Within certain data modules a set of equations are created to model the process therein. For every dynamic (time-variant) data module, such as the labour-market module,

the transition probabilities between states (ex. labour market status) are estimated using a Markov model and then the possible outcomes are simulated.

The benefit of using dynamic microsimulation is that longitudinal sample observations instead of stylised profiles are used to model population dynamics. This is one of the main reasons large-scale dynamic microsimulation models are employed by many developed nations (such as the USA, Canada, Australia, the UK, France, the Netherlands, Sweden, Japan, etc.); thorough reviews of such models can be found in O'Donoghue (2001), Zaidi and Rake (2001), Cassells et al. (2006), Li and O'Donoghue (2013). There has been limited use, however, of such approaches with Swiss data. This work contributes to the analysis of professional trajectories of the active Swiss population by utilising dynamic microsimulation methods.

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