DEMUS-FLANDERS, a micro-macro dynamic simulation model for the 'Flemish municipal demographic forecasts

The poster presents the methodology of the micro-macro simulation model DEMUS-FLANDERS developed for the 'Flemish municipal demographic forecasts 2023-2045'. The model estimates the population by age, gender and household position, as well as the number of households by size and composition for the 300 cities and municipalities of the Flemish Region. DEMUS-FLANDERS model is based on the open source dynamic simulation platform Liam II (De Menten et al., 2014). The results will be published in May 2024 and made available on the website of Statistics Flanders (https://www.vlaanderen.be/statistiek-vlaanderen). The microlevel simulated data can be requested and used as input for other projection and simulations.

We dispose of exhaustive pseudonymized National Register data for Belgium. For each year between 1989 and 2023, on January 1, we have the age, gender, municipality of residence, household identifier, kinship relationship of each person with the reference person in the household and the LIPRO household classification developed for the Belgian National Register data. In addition, for each of the individuals and for each year since 1992, we have the date of birth, death, childbirth, immigrations, emigrations and internal moves between Belgian municipalities.

The baseline population for the projections is the population on January 1, 2023. Based on the kinship relationship with the reference person and the LIPRO classification, the relationships between each pair of individual within the household is identified. Table 1 illustrates the information for each person in the database.

Table 1. Illustration of kinship relationships between persons

ID	Age	Gender	Partner-ID	Mother-ID	Father-ID	Household-ID	Municipality-ID
1	20	F	2			1	1
2	21	M	1			1	1
3	2	F		1	2	1	1

The specificities of our model are :

1. It models processes of household formation at a very detailed level

   We simulate the following household transitions: partner formation, partner dissolution, leaving the parental home, leaving a household where one is cohousing, moving back into the parental home, moving into cohousing, and the transition to and from a collective household. Transition are identified by comparing partner- and parent-ID's between two consecutive observation years. For example for partner dissolution: if ego had(?) a partner-ID in year t and no (or a different) partner-ID in year t+1 and this partner neither died nor emigrated, then the partnership between ego and his/her partner was dissolved between both calendar years.

2. It models processes simultaneously at the municipal level, the household level and the individual level

   Liam II allows features to be simulated at different levels simultaneously. Persons, households and municipalities can evolve over time, both independently and in interaction with each other. Some processes are simulated at the individual level, some at the household level. For example, leaving the parental home is simulated at the personal level, Migration in contrast, is simulated at the household level: all individuals in the same household migrate together. Note however

that transition probabilities on the individual level take into account household characteristics and vice versa.

3. It takes into account simultaneously spatial dynamics and household dynamics

The link between spatial processes and household formation is most clear for the processes internal migration and partner formation. Partner formation happens across municipal borders and hence leads to an internal migration. We will show how we deal with this intertwining by creating fictitious households identification numbers and simulating partner formation within a pool of potential internal migrants.