9^{th} International Conference on Computational Social Science IC^2S^2
July 17-20, 2023, Copenhagen, Denmark

Higher educational decisions: an agent-based model of comparison between Italy and Germany

Keywords: higher education, educational decisions, agent-based modelling, Italy, Germany

Extended Abstract

In 2021, the Council of Europe approved a resolution setting an EU-level target for higher education to be achieved by 2030. The goal is to reach the share of 45% of 25-34 year-old with tertiary educational attainment. While almost half of the EU Member States have already reached the target for 2030, there is a group of countries still far from the target as well as from the current EU average (41.2%). Among these countries, Germany has a share of 35.7% while Italy performs only better than Romania with a share of 28.3% aged 25-34 with a higher education degree.

The Italian context presents several concerns. Italy has one of the highest share of NEETs among EU countries and its educational system is unattractive. Literature suggests that the growing distrust of Italian families towards investment in higher education may be affected, among other factors, by low returns to education (Viesti, 2018; Naticchioni, Raitano and Vittori, 2016).

Germany, on the other hand, presents a much smaller share of NEETs, and higher job returns even at labour-market entry (Becker and Blossfeld, 2022). However, its secondary and vocational educational level is much more fragmented than the Italian one, and this may account for the low share of graduates in strictly tertiary education.

This research aims at exploring and comparing tertiary educational choices in Italy and Germany by adopting an agent-based model. While the computational approach contributes to overcome the limitations posed by standard literature, allowing for the analysis of educational decisions with a multidimensional approach, it also permits to consider agents' heterogeneity, social interaction, and exchange of information. The spread of agent-based models has gone hand in hand with the progress and diffusion of computational technologies in sciences. However, their adoption is still scarce in educational studies (Manzo, 2013; Maroulis et al., 2014; Diaz et al., 2021).

We adapt the model developed by Leoni (2021) initially designed for the Italian context, and we calibrate it by using comparable statistics for Italy and Germany retrieved from Eurostat and OECD. We assume that individual preference to enrol at university depends on (i) economic motivations, represented by expectations on future income; (ii) influence from peers; (iii) individual effort to obtain a university degree. What is the effect of the adoption of a scholarship in the two educational frameworks on the enrolling rate? Are there any differences attributable to the socioeconomic contexts of Italy and Germany?

Preliminary results are presented in Table 1 and Figures 1 and 2. We simulate the model for 100 time steps in NetLogo for both countries. However, more complete results and Monte Carlo experiments' outcomes will be shared at the conference.

For the Italian case, the model realistically reproduces the enrolling rate observed by the OECD; however, there is a considerable gap between the simulated and observed values for Germany. The model outcome shows a higher average enrolling rate for Germany, however this presents a small difference to the Italian case with respect to the gap observed in the real

Table 1: Average values obtained from one simulation over 100 time periods, and OECD enrolling rate to tertiary education.

	Simulation results				OECD 2017-2019	
	Italy		Germany		Italy	Germany
	mean	sd	mean	sd	mean	mean
Enrolling rate %	54.17	9.32	55.59	10.01	57.42	69.98
Enrolling rate from skilled %	40.1	14.78	40.04	15.95		
Enrolling rate from unskilled %	59.9	14.78	59.96	15.95		

world. In both cases the majority of those enrolling in higher education comes from an unskilled family, coherently with what observed in Leoni (2021).

Data used to calibrate the model are quite different in the two cases: Germany has higher average incomes, lower tuition fees, higher levels of scholarships, smaller dropout rates, and higher levels of endowment coming from higher saving rates. However, we observe only a small difference in the results for the two countries considered. We hypothesise three possibilities. First, the gap between average skilled and unskilled income may not be high enough to encourage those coming from skilled families to enrol in higher education. A second possibility for this trend to convergence may reside in the demographic dynamics implemented in the model. Despite these do not serve the purpose of realistically reproducing actual population dynamics, they may still affect convergence to a stable result as population grows until reaching a carrying capacity. Third, the model assumes no unemployment: any agent dropping from education is immediately assigned with an income and does not face any unemployment period for the rest of his/her working life. Differences in the unemployment rate of Italy and Germany may contribute to produce a more realistic outcome, once this is taken into account in the model.

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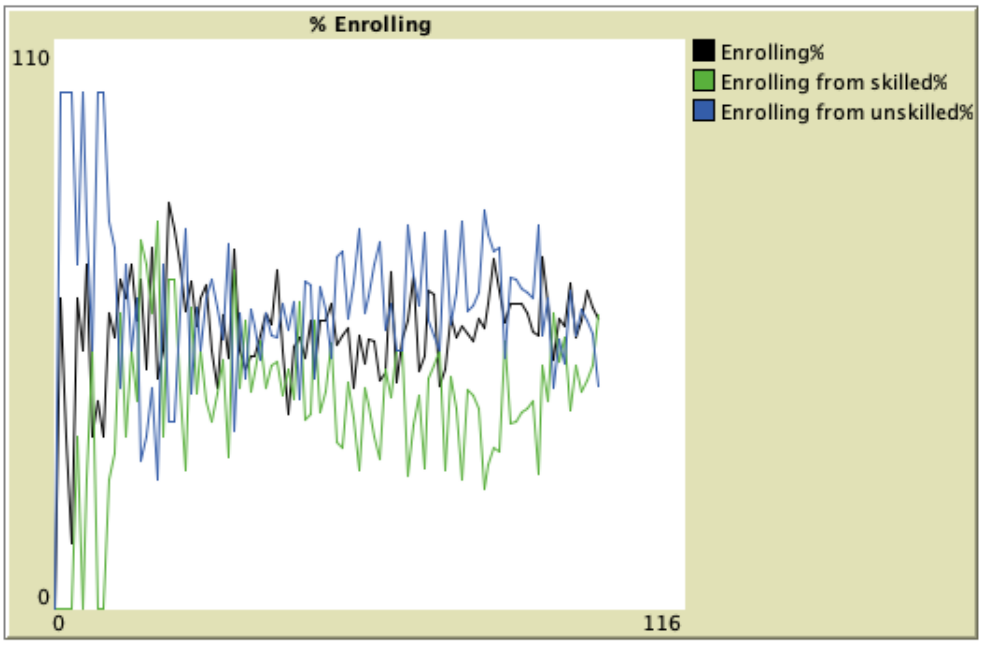

Figure 1: Average enrolling rate plotted over 100 time unit for Italy

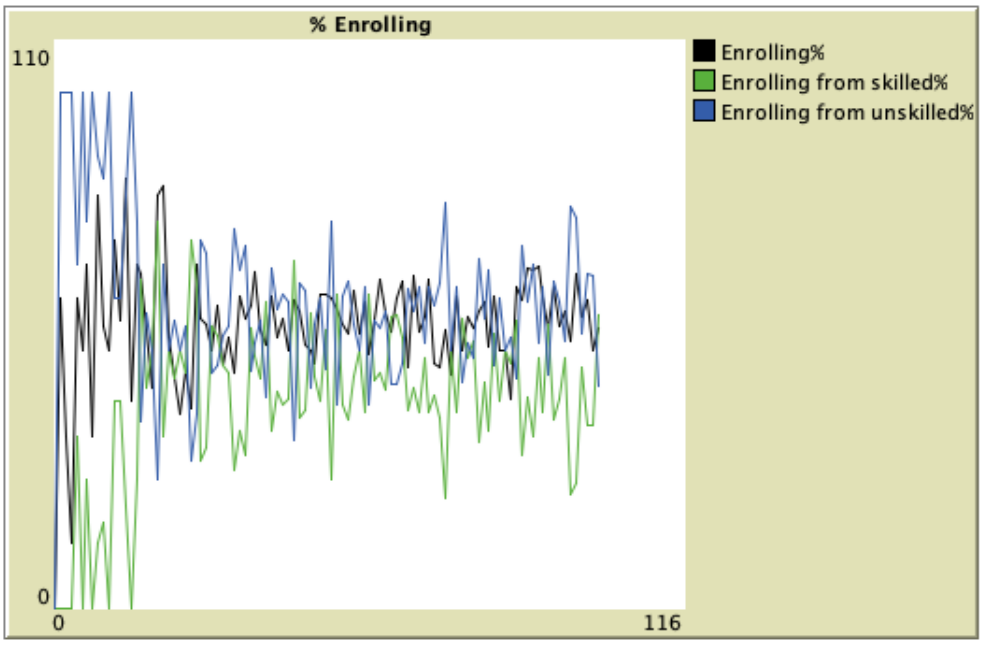

Figure 2: Average enrolling rate plotted over 100 time unit for Germany.