Report on the outcomes of a Short-Term Scientific Mission[1]

Action number: CA16228

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Details of the STSM

Title: Dynamic matching models

Start and end date: 07/02/2022 to 07/04/2022

Description of the work carried out during the STSM

Description of the activities carried out during the STSM. Any deviations from the initial working plan shall also be described in this section.

We have worked on a dynamic model for a matching market. As planned at the beginning of this mission, we have:
1. Revised the literature on dynamic stable matchings,
2. Developed the formal mathematical model,
3. Studied different benchmarks leading to different notions of stability and their respective existence,
4. Implemented our work on Python

Unlike what we planned at the beginning; we did not consider a repeated game setting and we did not seek for a characterization of the stable outcomes through a Folk theorem. Instead, we have used a stochastic setting in which agents arrive to and quit the market according to given distributions and get matched according to a stable matching policy (e.g. Male-optimal Gale-Shapley). This approach resembles a birth-death model, allowing us to exploit the tools of queuing theory. The interesting point of our problem is given by the matching policy considered, the one affects the rate at the one agents go out of the market. Given a stable matching policy we can obtain a Markov process representing the number of agents present in the market. We have studied the properties of these processes as, for example, the existence and computation of stationary distributions.

Different matching policies define different benchmarks. We have studied the social-welfare achieved by each of the sides of the market and compared our results against a full-information setting.

Description of the STSM main achievements and planned follow-up activities

Description and assessment of whether the STSM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the STSM. Agreed plans for future follow-up collaborations shall also be described in this section.

The current Python implementations do not consider the possibility that agents take actions at the same time of getting matched. However, the generalization to this setting is not a difficult task as it only requires considering a matching policy that allows to the agents to play strategies. In other words, it is enough with replacing the current Gale-Shapley algorithm used for computing stable matchings by the algorithms of static matching games designed during the first years of this PhD thesis.

Many steps can be done in the future:
1. To study the loss of stability (number of blocking pairs obtained) between different benchmarks with respect to the fully informed setting.
2. To compare the loss of stability with the welfare.
3. To continue studying the Markov process that underlies the matching market given a matching policy for generalizing the empirical results
4. To apply our model to an electricity market in which consumers and producers arrive and leave the market.