Epidemic control: individual and governmental perspective

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In this talk, we consider the control of the COVID-19 pandemic from two point of views: individual and governmental. In the first part, through a standard SIR compartmental model, we assume that the control is induced by the aggregation of individuals' decisions to limit their social interactions: when the epidemic is ongoing, an individual can diminish his/her contact rate in order to avoid getting infected, but this effort comes at a social cost. If each individual lowers his/her contact rate, the epidemic vanishes faster, but the effort cost may be high. A Mean Field Nash equilibrium at the population level is formed, resulting in a lower effective transmission rate of the virus. We prove theoretically that equilibrium exists and compute it numerically. However, this equilibrium selects a sub-optimal solution in comparison to the societal optimum (a centralised decision respected fully by all individuals), meaning that the cost of anarchy is strictly positive. This lead us to consider, in the second part, the governmental point of view. In this model, the population is considered as a single agent, but the government can put into place incentive policies to encourage the lockdown. In addition, the government may also implement a testing policy in order to know more precisely the spread of the epidemic within the country, and to isolate infected individuals. Numerical results confirm the relevance of a tax and testing policy to improve the control of an epidemic.

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