Epidemics from the economic theory viewpoint

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Mathematical Population Studies (MPS) has been devoting special interest and significant publication space to the study of epidemics from its first volumes. In particular, research on the HIV/AIDS epidemic has been extensively published in the journal. An entire issue (Volume 3, Issue 3) has been devoted to the demographic modelling of this epidemic in 1992. See, for example, Blythe (1992) and Brouard and Bonneuil (1992). Since then, MPS has served as a important outlet for research in this topic. More recent highly cited related papers are Morris and Kretzschmar (2000) and Korenromp et al. (2000), among others. Research on other infectious diseases (malaria, tuberculosis, hepatitis...) has also been recurrently published in MPS. The last special issue of the journal (Volume 18, Issue 2) has focused on mathematical immunology of infectious diseases (see for example Niger and Gumel, 2011, on malaria dynamics).

In contrast to demography, the economic literature of epidemics is definitely thinner. This said, economists' interest in epidemics has drastically increased since the HIV/AIDS epidemic started. This is notably true for economic theorists. Basically, three sets of questions have been suggested by the AIDS crisis. A first set of questions raised from the beginning of this crisis, development-economics-oriented, concerns its consequences on the development process in the regions massively affected like Sub-Saharan Africa. Early contributions to this topic use simple economic growth models, slight adaptations of well-known canonical models, as in the 1994 seminal Cuddington and Hancock's article (see also Boucekkine et al., 2008, for a survey of this generation of epidemiological economic growth models). A subsequent literature has attempted to build up more specific economic growth models of HIV/AIDS capturing, among others, the implications of such epidemics for the level of savings (and thus for investment in both physical and human capital) through original mechanisms (see for example Corrigan et al., 2004). A second set of economic questions, more in the public economics area, is connected with health economics considerations, and includes both private and public health issues. The latter encompass a wide range of topics, from regulatory interventions (for example, the design of subsidies to change sexual

behavior) to public finance (like the overall fiscal cost of AIDS or the redistributive factor in public policy toward AIDS). A nice introduction into research on this second set of questions is given by Philipson and Posner (1993). Last but not least, an important part of the related economic literature is devoted to the analysis of the effect of epidemics like HIV/AIDS on fertility, a hot topic in economic demography. The key theoretical question turns out to be whether a mortality shock like epidemics does significantly alter fertility behavior through identifiable economic mechanisms. Two views are opposed in this respect. On one hand, Young (2007) has claimed that a massive mortality shock like AIDS should lower fertility: the shock markedly pushes down labor supply, inducing a large increase in wages and a rise in female participation in the labor market, which ends up lowering fertility. Kalemli-Ozcan (2011) has rather put forward a hoarding effect: increasing uncertainty following big mortality shocks is likely to trigger an insurance mechanism leading households to increase fertility. In between, Boucekkine et al. (2009) have argued that the effect of mortality shocks on fertility ultimately depends on the age profile of mortality: within a canonical model, they have shown that child mortality does increase total fertility but not net fertility, whereas adult mortality lowers both.

This issue of MPS collects three economic contributions to the epidemics multidisciplinary literature. The first one, authored by Jean-Pierre Laffargue, revisits the fertility debate outlined just above. Instead of assuming the typical parental preferences à la Barro and Becker (1988), he assumes that parents maximize the expected parity reaching the age of young adult. Additonally, parents are allowed to substitute a higher level of own consumption to having more children but they would do that only because higher consumption eventually increases survival to reproductive age, therefore improving the possibility of having more children. These preferences induce a novel dynamic theory of fertility behavior in response to epidemiological shocks. In particular, Laffargue shows that if an epidemic decreases the proportion of children surviving to the adult age, the wage rate increases and fertility decreases in the short run consistently with Young's mechanism. However, as fertile people are fewer, the total demand for children is lower, causing the wage rate and the cost of children to drop. As survivors are wealthier, fertility may increase for this generation.

Stefano Bosi and Thomas Seegmuller revisit the Barro-Becker fertility model by explicitly incorporating heterogeneity in households' characteristics. Concretely, the authors account for heterogeneity in capital endowments, mortality, and costs per surviving child. Parents facing a lower survival probability (following an epidemiological shock for example) would like to have less children and make higher bequests. In the terminology of Barro and Becker, this means that these parents tend to substitute quality to quantity of children. This in turn promotes capital accumulation and wage growth whereas fertility goes down, again consistently with Young's prediction. In the next generation, wages are higher and

children are still fewer: child-rearing is time-consuming and has a higher opportunity cost. As a consequence, an increase in mortality enhances economic growth at the expense of demographic growth. The same happens when the mortality differential between dynasties increases as this raises the average cost of rearing children. Economies with more dispersed mortality rates due, for instance, to more unequal access to health services and medical care, would experience higher economic growth rates.

While the first two articles of this issue are more concerned with the fertility debate, the third one, co-authored by Douglas Gollin and Christian Zimmermann, is one of the earliest economic papers on the effect on global climate change on epidemiological dynamics. If warmer temperatures are likely to expand the geographic area in which tropical diseases (like malaria) are endemic, their actual effect does depend on the economic capacity of the populations affected to take actions against the diffusion of these diseases. Therefore, a proper analysis of the potential endemic effect of global climate change should account for the economic constraints faced by the economies and their ability to conduct efficient disease eradication campaigns. Gollin and Zimmermann perform the analysis using a fully specified and micro-funded general equilibrium model. Therefore, they do account for general equilibrium effects which may be quantitatively sizeable as higher prevalence rates also affect healthy individuals through prices and exposure to diseases. After calibration of their general equilibrium model, they find that a 3°C increase in temperature is likely to have a relatively modest effect on disease prevalence and output.

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