
Multi-scale approach to the emergence of technological innovation waves during the early Spanish industrialization

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Abstract

The importance of technological change for economic growth explains the huge attention received in Economic History literature and Economic Sciences in general. Among all the possible elements to consider, here we focus on spatio-temporal diffusion of technology. In Economic History this sort of dynamics are usually approached from a mean-field, macroscopic perspective. In this contribution, we complement this approach by addressing them from a micro-to-macro perspective. Specifically, we centre on the mechanisms underlying the emergence of waves of technical change from individual adoption decisions, and the influence of social structures over such decisions.

Our case study addresses the diffusion of hydraulic turbines during the first steps of the Spanish industrialization from the second half of the 19th century until the arrival of the I World War. Hydraulic turbines played a key role in this period, since they represented an efficient technological solution to the scarcity of cheap coal. Besides, the choice of hydraulic turbines as a case study is supported by the availability of reliable data, since only three firms (Planas, Averly and MTM) produced most of the engines installed in Spain.

In order to address such a case study as an emergent phenomenon, we present a first version of an agent-based modelling framework combining empirical (historical) data, connectivity patterns among agents and social contagion diffusion mechanisms. Besides assessing the influence of each one of these factors on the diffusion dynamics of the model, we compared the simulated results with empirical data on adoption of hydraulic turbines. We obtained a reasonably good fit for the first three decades of the period under study, but are not able to reproduce the behaviour of the latest two. Finally, inspired by a previous work adopting a 'classical' approach in Economic History, we suggest possible extensions of the presented model that could help to solve this gap.

The methodology illustrated in this article could be applied to other historical examples of spatio-temporal waves of technology adoption. By fitting the model to such historical case studies and comparing the resulting parameter values, we could uncover commonalities and differences among them and, thus, learn more about technological diffusion in general.

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