

Diffusion of technological innovation on networks leads to chaotic boom-bust cycles

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1 Introduction

Technological developments and the impact of AI are omnipresent themes and concerns of the present day [1]. Much has been written on these topics [3, 5] but applications of quantitative models for understanding the techno-social landscape has been much more limited [2, 4]. There are four patterns underlying technological development: growth, diffusion, saturation and obsolescence. These can be understood in a unified manner in a mathematical model which can help identify the different regimes the technological landscape evolves in. Specifically, we analyze how innovation diffusion occurs in a network of different technologies.

2 Results

We first propose a three dimensional system of production, demand and investment which shows oscillations emerging if investment is too high into a given technology, product or market. We then add a further variable that quantifies the level of development (or innovation, discovery) potential for a given technology. The potential increases via diffusion from related technologies, reflecting the fact that a technology does not develop in isolation. Hence, the growth of each technology is influenced by how developed its neighboring (related) technologies are. If investment is too high in the network context, chaotic boom-bust cycles can emerge, see Fig. 1. These quantitative considerations have deep implications for the development of AI which we will highlight.

References

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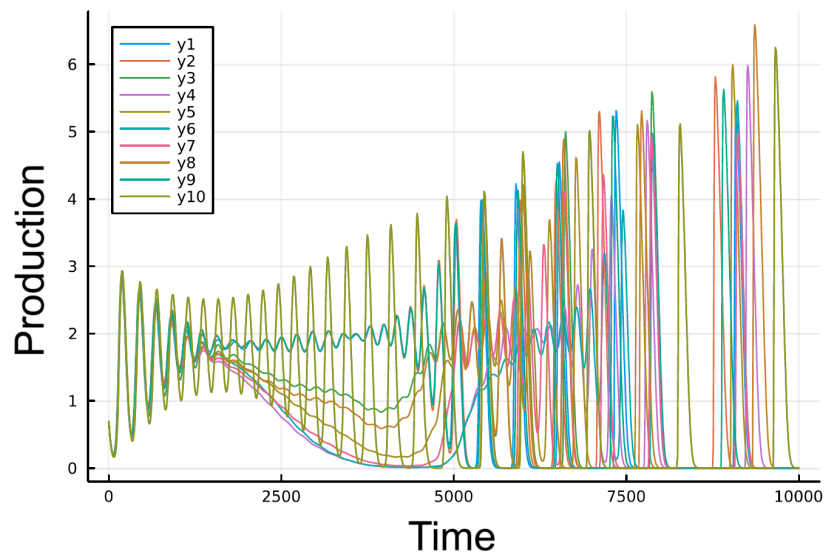


Fig. 1. The emergence of chaos in the production of different technologies that are interrelated via a network. Synchronised business cycles (oscillations) can be seen early on in the time series. However, eventually a chaotic boom-bust pattern appears in conditions of high rates of investment.

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