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Institute for Applied Economic Research

2948 Rio de Janeiro, december 2023

EXECUTIVE SUMMARY

BALANCING SHORT-RUN COSTS AND LONG-RUN GAINS: THE WELFARE IMPLICATIONS OF INVESTING IN NEW TECHNOLOGIES IN DEVELOPING COUNTRIES

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DOI: http://dx.doi.org/10.38116/td2948-eng

One of the major concerns relating to growth for developing economies exists in countries that have faced the so-called middle income trap. Following a certain successful history regarding growth, countries that could have moved on from a very low level of income, became stuck at this intermediate income level. The World Bank and other institutions have recognized this fact and claim that there has been a "practice gap" between the Solow and endogenous growth models.[1] While the former is useful for addressing growth issues and shaping policies in low-income countries, its key feature, the exogeneity of technology, is a drawback for discussing the prospects of middle-income countries. While endogenous growth models delve into technology, they are more focused on creating new technology for advanced economies than on helping middle-income countries adapt and diffuse technology so as to catch up (Gills and Kharas, 2015).

The main proposal of this paper is to address this issue, by building a simple growth model that is able to focus on the adoption and diffusion of new technology in an embodied technology framework. Learning and the slow diffusion from the frontier to laggard firms have been used in the endogenous growth literature to explain the relative stagnation in developed economies (Akcigit and Ates, 2021). Recent, robust empirical evidence has indicated learning and the diffusion of new technologies as being partially responsible for reducing productivity growth among the Organisation for Economic Cooperation and Development (OECD) countries. For example, firms are facing significant costs in order to access digitalization, and the slowdown in diffusion rates plays an important role in explaining the global reduction of growth. Furthermore, the literature has also demonstrated that even if policy makers stimulate the expansion of technological frontiers, diffusion to lagging firms will not necessarily be automatic. In conclusion, it is possible that intervention to promote diffusion and learning in the economy, may enhance productivity, and reduce the barriers to access new technologies (Andrews, Criscuolo and Gale, 2015; 2016). Ferraz et al. (2020) estimated the cost and the willingness to adopt new technologies and digitalization in the Brazilian economies, and demonstrated that digitalization in Brazil moves at a very slow pace, and that a very small number of firms have plans to climb the technological ladder.

1. A particularly good reference along these lines is Acemoglu, Aghion and Zilibotti (2006), even if their focus moves toward the political economy of development and growth strategies.

SUMMARY

The model addresses a gap in the discussion on adopting technology in economies that need to learn and diffuse technology, particularly when technology is embodied in new machines. Technically, we have utilized embodied technology in an AK endogenous growth model and a Nelson-Phelps catch-up equation to demonstrate that the inclusion of adoption costs can result in productivity slowdowns (Nelson and Phelps, 1966; Abramovitz, 1986). The AK structure enables us to fully describe the welfare and link it to policy variables. The model generates intriguing transitional dynamics and displays leapfrogging possibilities, depending on the technology and learning parameters. The convergence of output growth toward the long run may even exhibit nonmonotonic behavior when there is a steep learning and diffusion curve. The model allows for the explicit depiction of capital and consumption dynamics, thereby facilitating welfare analysis. The model incorporates a Nelson-Phelps catch-up equation, yielding some intriguing findings:

- the possibility of catching up and leapfrogging within an AK model framework;
- the potential for a productivity slowdown and a nonmonotonic transition toward a balanced growth path due to adoption costs;
- a shorter duration of the productivity slowdown with higher rates of learning and diffusion, although the impact of technological complexity remains ambiguous; and
- a trade-off exists for economies, whereby adopting a more complex technology enhances long-term growth but results in a short-term reduction in productivity.

The policy implications suggest that, similar to Schumpeterian models, learning and diffusion may be significant drivers of growth and enhance welfare, especially in developing economies. Adopting a new technology may take time to translate into productivity gains, ultimately contributing to long-run growth and welfare, despite any initial delays. Additionally, the level of complexity of the adopted technology may also impact welfare. A U-shaped relationship exists between technological complexity and welfare, in which very simple technology results in lower long-run growth but with lower adoption costs. Thus, economies face a trade-off between higher long-run growth and a short-run productivity slowdown.

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