

ABSTRACT

Externalities versus Technological Complementarities: a model of GPT-driven, sustained growth

by

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In Part 1, we study some of the micro relations that Nelson and Winter argued needed to be established as the basis of a theory of economic change and growth. We concentrate on big technological shocks, known as general purpose technologies (GPTs). We consider five empirical cases in which technological advances induce a complex set of structural and technological changes throughout much of the economy. On the basis of these, we argue that *externalities* as conventionally defined miss many of the interrelationships that are both the cause and consequence of the technological changes that underlie much of economic growth. In their place, we introduce a much wider concept called *technological complementarities*. New GPTs rejuvenate the growth process by creating technological complementarities not measured by externalities. This leads us to argue that the ambiguous measurements of the externalities associated with growth and technical change have been misinterpreted since they are irrelevant to any assessment of the impacts of major technological changes.

In Part 2, we consider the problem of how to build a bridge between the micro behaviour that Nelson and Winter and the present authors have analysed and the kind of macro observations that growth economists seek to explain. We argue that formal aggregation cannot make this bridge if the micro data is at all realistic. So the type of appreciative methods championed by Richard Nelson must be used.

To this end, we present in Part 3 a non-standard aggregate growth model that is consistent with our micro observations. It has endogenous incremental technological changes in applied R&D, which are subject to diminishing returns over time, interrupted by the occasional introductions of new GPTs. The latter are developed by endogenous basic R&D, which has a payoff that is subject to (Knightian) uncertainty with respect to its magnitude and timing. Our model is technically much simpler than those in the volume on GPTs edited by Helpman, and it avoids many of the *ad hoc* assumptions found in these other models. Nonetheless, we argue that our model captures many of the complex inter-relationships involved in the growth process that were suggested by Nelson and Winter but are ignored in standard macro growth models.

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