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Philippe Aghion's paper is a wonderful introduction to some of his contributions in the area of growth theory and empirics over the past 30 years. Everybody knows, of course, that Philippe is a major figure in this field. But even those who have followed his work fairly closely cannot fail to be inspired anew by the ambition, cohesiveness, and ultimate success of his efforts as they emerge from the account he gives in the preceding pages. Indeed, the feeling of awe is only magnified by the knowledge that there are many other important contributions that Philippe has chosen not to discuss here.

The chapter lays out an understanding of the growth process that encompasses a broad set of phenomena, including the role of competition in fostering (or, in some cases, discouraging) innovation; the need for institutions to evolve to keep the growth process going; the implications of innovation and growth for income inequality and for the evolution of the size distribution of firms, and so forth. It is one of the hallmarks of Philippe's work to raise the bar for the set of regularities that a theory of growth should be required to address. In that spirit, while Phillippe's paper rightly and convincingly celebrates the successes of the modern growth agenda, and of his many contributions to it, my brief remarks will try to look at the work ahead. Which challenges, or "enigmas" in Phillipe's parlance, still await growth theory? Think of it as my wish list for Phillipe's next 30 years of work.

With some huge oversimplification, it is possible to create a taxonomy of growth experiences. All parts of the world, as far as we know, experienced many centuries of Malthusian, or near-Malthusian growth. In the Malthusian era, most increases in aggregate output translated into larger populations, resulting in relatively modest (if any) increases in living standards over very long horizons. A plot of GDP per capita against time looks nearly flat. The taxonomy of growth experiences I alluded to before is based on when and whether countries exited the Malthusian regime, and what happened after they left it. It features four groups.

The first category is composed of a small number of economies that experienced an industrial revolution at the beginning of the nineteenth century. After the industrial revolution, the rate of growth in per capita income picked up very markedly and has remained roughly steady, when averaged over decades or twenty-year periods, ever since. In a plot of (log) income per capita against time, we see something of a "kink" at the time of the industrial revolution, and a remarkably straight upward-sloping line ever since. We might call these countries the "pioneers."

A second group is made up of countries that underwent a similar industrial revolution at later dates, and subsequently (broadly) converged to the pioneers. The date at which these later industrializations took place varied enormously, from the mid-nineteenth century for some European countries to the mid-twentieth century for some East Asian ones. However, the common feature is that subsequent to their industrial revolution, these countries experienced a sustained period in which they grew faster than the pioneers, so that eventually living standards became quite similar for the first and second groups. In a plot against time, (the log of) per capita income shows a kink, followed by an upward-sloping, concave trajectory, asymptoting to a straight line that runs close to the straight line of the pioneers. I'll call these countries the "convergents."

In the third bin are countries that, similar to the convergents, experienced industrialization followed by a period of growth exceeding the growth of the leaders, but whose convergence process, unlike the convergents, aborted prematurely. That is, these countries were able to make up some of the income gap with the pioneers, but then their growth rate stabilized at a rate similar to those of the pioneers well before living standards became similar. The plot of their (log) income per capita against time is similar to that of the convergents, except that the linear section is well below the linear path followed by the pioneers. We may refer to this group as the "middle-income trapped."[1]

1. I am implicitly defining the "middle-income trap" in terms of income relative to the pioneers, not in terms of absolute income. The hypothesis of a middle-absolute-income trap does not withstand even a modest amount of scrutiny: Most of the countries cited as poster boys for the middle-income trap (e.g., Brazil, South Africa)

The fourth and final group includes those countries that never underwent a proper industrialization stage. As a result, these countries did not even exhibit the temporary phase of convergence that the middle-income trapped experienced. I do not mean to suggest that most of these countries are still stuck in the Malthusian regime. Some structural transformation from agriculture to services is happening, as is a fair amount of urbanization. Nevertheless, these changes do not seem able to ignite a sustained catching-up process, and as a result, countries in this group tend, at best, to maintain their relative position and, at worst, to diverge from the leaders. Figuratively if not technically, the plots for these countries' GDP per capita never shows the kink. We can call the countries in this group the "poverty trapped."

How well does modern growth theory explain these four types of experiences, individually and collectively? My view is that it gets full marks in some areas, passing marks in some others, and bad fails in a few.

The biggest achievement of modern growth theory is its ability to rationalize the pattern of sustained, steady growth in the pioneers (and in the convergents after the completion of the catch-up phase)—the linear growth in the plots. Steady per capita income growth over the span (in some cases) of two centuries is an astonishing fact, and the success of growth theory in illustrating the mechanisms that make this possible is one of the greatest achievements in macroeconomics. The theory centers on innovation and clarifies the roles of R&D, property rights protection, competition, and many other elements. Needless to say, Philippe has been a key force in developing this body of work.

Another part of the growth landscape that growth theory does pretty well with is the tendency of later industrializers to convergence to the pioneers. The modern understanding still largely builds on the old tradition centered on the "advantage of backwardness," which has been successfully incorporated in contemporary growth models (much as theories of growth at the frontier incorporate older arguments based on creative destruction). In this view, which seems hard to refute, later industrializers can grow faster, because they can imitate and adopt technologies already invented by the leaders.

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have reasonably steady growth rates when averaged over long periods. What they are failing to do is to close the gap with the high-income countries.

Overall, the postindustrialization experiences of the pioneers and the convergents are the areas where modern growth theory deserves full marks. This may be because these are the success stories, and economics often seems to do better at explaining successes than failures.

With the question of why some initially promising catching-up experiences petered out, ending in a middle-income trap, we have some ideas but no consensus and little evidence. Philippe does offer a hypothesis, and others have advanced their own. The good news is that this is an active area of research, and I am optimistic that a greater understanding will emerge in the not-too-distant future.

I would offer a similar assessment on the question of why the industrial revolution happened in the first place (the first "kink"). This is of course a classic question both in macro and in economic history, and countless books and articles have been written about it. Although a consensus account still eludes us, I do sense considerable progress in recent years. The emerging vision features some combination of intellectual developments (scientific discoveries combined with the enlightenment mindset), political developments (particularly in terms of the power relations between landed aristocracy and emerging urban bourgeoisie), and possibly evolutionary forces.

In sum, both on the question of the middle-income trap and on the reasons for the transition from the Malthusian to the modern growth regime, I'd give growth theory a passing mark—for effort if not for success.

And now for the bad fail: the later "kinks" and, in particular, the lack thereof. Why did some countries manage to properly industrialize and others never do so? What is the difference between the convergents and the (eventually) middle-income trapped, on one hand, and the poverty-trapped on the other? I hope I am not too harsh in saying that not only do we not know, but we are not even trying to know. Perhaps, as I mentioned, modern macroeconomics is so bad at explaining failures that we are not even willing to try. But the question of the failure to industrialize is too important to give up on. Our friends on the microeconomic development side know this and are working hard on finding out how individuals in poverty-trapped countries can do a little bit better. We macroeconomists should join them and try to figure out ways in which the whole country can get that "kink."

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