Comment: Aart Kraay

Philippe Aghion's paper for this conference provides a concise and insightful summary of his fundamental contributions to the theory and empirics of economic growth over the past 25 years. It is challenging for Philippe to do justice to such an impressive body of work in the short space of a conference presentation, but he succeeds remarkably in doing so. It is even more challenging to follow Philippe as a discussant, so my expectations for this discussion are appropriately modest.

We have known since the fundamental work of Solow and Swan in the 1950s that, in the presence of diminishing returns, sustained growth in output in the long run requires sustained growth in technology. But it took another 30 years for the profession to begin to articulate theories that spelled out mechanisms through which improvements in technology came about. Philippe Aghion, in work with Peter Howitt, was at the forefront of this movement in the 1980s, formalizing earlier insights from Joseph Schumpeter about the process of creative destruction into well-articulated and elegant models of innovation and growth.

By spelling out the incentives for innovation, these models not only provided a theoretical basis for technology growth, but they also generated a rich set of insights for policy makers contemplating changes to laws and regulations affecting property rights, competition, and firm entry and exit. As discussed in Philippe's paper, the insights of Schumpeterian growth theory also have implications for current debates about secular stagnation, trends in inequality, and much more.

I focus my discussion on the fundamental underlying theme in Philippe's paper—the importance for growth of technology growth and the importance of Schumpeterian creative destruction in generating the innovations

that lead to growth in technology. Given my professional background as a World Bank economist, I want to reflect particularly on the relevance of these themes for policy makers in developing countries. I organize my discussion around three questions: (1) How important are cross-country and over-time differences in technology? (2) What is "inside" the differences in technology that we can isolate at the aggregate level?, and (3) What do the answers to these questions imply for development policy?

How Important Are Differences in "A"?

A basic premise in Philippe's work is the importance of understanding the forces that drive differences across countries and changes over time in the level of technology, conventionally referred to as A in a neoclassical production function $Y=AF(K, H)$, where K and H represent physical and human capital, respectively. Various recent accounting exercises have contributed to the view that cross-country differences in A are large (for example, see Caselli (2005), whose notation I follow here). These typically are based on a decomposition of income differences between rich and poor countries along the following lines:

$$\frac{Y_{RICH}}{Y_{POOR}} = \frac{A_{RICH}}{A_{POOR}} \times \frac{F(K_{RICH}, H_{RICH})}{F(K_{POOR}, H_{POOR})}.$$

Depending on how "rich" and "poor" are defined, one can easily confront the task in such a decomposition of explaining up to 40-fold differences in incomes between rich and poor countries, i.e. $\frac{Y_{RICH}}{Y_{POOR}} \approx 40$. Baseline assumptions that (a) the production function is Cobb-Douglas, (b) physical capital stocks are related to the accumulation of observable past investments, and (c) human capital stocks are some straightforward linear aggregate of workers with productivity differences adjusted for some observed measure of schooling,can be used to evaluate the contribution of cross-country differences in factors of production to these differences.Under these baseline assumptions, it is typically possible to generate something in the range of 5- to 8-fold cross-country differences in the contribution of factors of production to cross-country income differences,i.e. $\frac{F(K_{RICH}, H_{RICH})}{F(K_{POOR}, H_{POOR})} \approx 5-8$ *This in turn implies that cross-country differences in the level of technology A must*

also be in the five- to eightfold range to account for observed cross-country differences in output.

Thus taking the data at face value suggests a very large role for cross-country differences in technology, and therefore a comparably great importance for imposing structure on these differences through theories of innovation that lead to differences in technology levels across countries. Although I do not spell it out in detail here, one can of course perform similar decompositions in countries across time, leading to measures of the growth rate of A in countries over time. Such growth (as opposed to development) accounting exercises often reveal very large cross-country differences in measured growth rates of technology.

However, as with many things, the devil is in the details, and one does not have to go very far into the literature to find careful consideration of measurement issues that, when properly addressed, suggest that we should take a more nuanced view of the importance of cross-country and over-time differences in A. One early and very well-known example comes from Alwyn Young's meticulous growth accounting exercises for rapidly growing East Asian economies, which suggested that once increases in factors of production were more comprehensively measured, the productivity growth underlying the extraordinary output growth in these countries was actually quite ordinary (Young 1995). Perhaps the starkest case is that of Singapore over the 25-year period 1966–1990 studied by Young: Although output grew at nearly 9 percent per year, productivity growth was indistinguishable from zero, once such factors as increasing labor force participation, increased human capital, and a more efficient allocation of resources across sectors were taken into account.

Turning to more recent examples, Jones (2014) and Manuelli and Seshadri (2014) tackle in different ways the question of the contribution of human capital to differences in output per capita across countries. Jones (2014) emphasizes the consequences of considering alternatives to the standard linear human capital aggregator. The standard aggregator plausibly assumes that skilled workers are X times more productive than unskilled woirkers, but it implausibly assumes that skilled and unskilled workers are perfectly substitutable after this rescaling by productivity levels is taken into account—a skilled task can be accomplished by one skilled worker or by X unskilled workers. It does not take much introspection to realize the implausibility of this benchmark assumption, and Jones (2014) spells out a variety

of more realistic human capital aggregators that recognize the complementarity between different skill types. These in turn lead to much greater differences in aggregate human capital across countries, which in turn imply a greater role for cross-country differences in factors of production and a commensurately smaller role for cross-country differences in productivity.

In a related paper, Manuelli and Seshadri (2014) take seriously incentives to invest in human capital. Although their paper is much richer than this, the basic insight is simple—if individuals rationally take into account the quality of human capital formed through investments in education, then low observed investments in education signal not just that the level of human capital is low but also that the quality of human capital is low. Calibrating their model seriously to cross-country data suggests a much larger role for human capital differences to per capita output differences across countries, and therefore again a smaller role for productivity differences.

All of this is not to say that cross-country or over-time differences in productivity are unimportant. Rather, it emphasizes that (1) careful, theory-consistent measurement of factors of production is important, and (2) understanding the forces that create incentives for investments in physical and human capital is at least as important from a policy perspective as is understanding better the incentives for innovation that lead to increases in A.

What Is "Inside" *A*?

As noted above, careful measurement suggests that cross-country differences in A may not be quite as large as a naïve first look at the data might suggest. However, even after careful measurement,they likely are nontrivial and therefore worth understanding more deeply. The literature on Schumpeterian innovation that Philippe has made seminal contributions to has offered an innovation-based view of these differences.But cross-country differences in the abilities of society to allow innovation to take place and bear fruit are not the only reason why *A* may be different. These alternative explanations are worth taking seriously, because they may suggest alternative policy levers to promote sustained growth.

A first set of explanations that has attracted considerable empirical attention over the past decade hinge on misallocation of resources across firms or sectors of the economy, particularly in response to policies that favor

some firms or sectors over others. To the extent that such policies prevent marginal products of factors from being equalized across alternative uses, they can contribute to cross-country differences in A even when measured aggregate factors of production, such as K and H , are the same. In one of the seminal contributions to this literature, Hsieh and Klenow (2009) document differences in marginal products of capital across manufacturing firms in narrowly defined industries. Their results suggest that a country such as China could effectively double its level of aggregate productivity in manufacturing simply by reducing its level of resource misallocation to that observed in the United States.

Another set of explanations for what might contribute to low values of A revolves around managerial incompetence rather than lack of access to the best technology or dulled incentives to innovate at the technological frontier. Bloom et al. (2013) document extremes of mismanagement in a set of Indian firms, such as basic failures to manage inventories and materials, or failures to maintain minimal standards of cleanliness and safety in and around factories. Bloom et al. (2013) go on to show that an experimental intervention that provided management training to firms resulted in a significant improvement in productivity in these firms.

In fairness, misallocation and mismanagement are probably not fully separate causal factors in driving the low levels of A, and indeed, one might argue that they are in part a manifestation of the same lack of competitive pressures that also contribute to low innovation. In an environment with weak competition, the incentives to ensure that resources are efficiently deployed in and between firms may also be weak. However, this is a somewhat different mechanism than the effect of competition on incentives to innovate that is stressed in the Schumpeterian approach.

Finally, although it is perhaps not so surprising that a lack of Schumpeterian innovation may not be the main reason behind low productivity in a developing country, it seems more plausible that it is an important factor in advanced economies. Yet in a recent paper, Garcia-Macia, Hsieh, and Klenow (2016) study the dynamics of innovation at the firm level in the United States and document some patterns that seem at odds with Schumpeterian dynamics. For example, contrary to the Schumpeterian view of "creative destruction," where innovative new firms replace existing firms that fail to innovate, they document that most of growth in the United States seems to come from growth in incumbent firms rather than from

new firms replacing old ones. They also document that much of innovation seems to take the form of improvements in existing products rather than creation of new products. Both of these observations suggest that a more nuanced interpretation of the Schumpeterian emphasis on innovation and creative destruction is in order.

Implications for Development Policy?

Philippe's paper concludes with a set of policy prescriptions designed to unleash Schumpeterian growth. The list is short, sound, and sensible: (1) liberalize entry and encourage competition, (2) liberalize labor markets, (3) promote institutions such as autonomous universities that foster research, and (4) develop a policy framework to encourage equity finance of risky investments in R&D in richer countries near the technology frontier. One does not have to squint very hard at this list to see key elements of traditional policy advice included in the "Washington Consensus," nor is it very hard to provide a Schumpeterian interpretation of key ingredients in the Washington Consensus. For example, classic elements on John Williamson's list—but not on Philippe's list—such as competitive exchange rates, trade liberalization, and deregulation, can all be thought of as fostering competitive pressures that drive Schumpeterian innovation and growth.

In fact, this raises the question of whether the four policy prescriptions in Philippe's paper are uniquely Schumpeterian, or whether they are just plain sensible. For example, liberalization of entry and deregulation of labor markets arguably have direct effects on resource misallocation, which through this channel may raise productivity, even if they do not directly promote competition. Conversely, the emphasis on property rights protection in the Washington Consensus can be interpreted as a key factor in promoting Schumpeterian innovation (because innovators require assurance of their property rights over the new ideas they develop). But at the same time, it is hardly a uniquely Schumpeterian policy prescription—there are many other channels through which the protection of property rights promotes economic growth that do not operate through the channel of innovation.

Another issue raised by Philippe's list is the question of prioritization, particularly when one considers developing countries, and especially those very far below the frontier, who face much more primordial challenges than the lack of innovation. Prescriptions to foster autonomous universities are probably sensible advice for advanced economies and a handful of

emerging economies near the frontier, but they are unlikely to be priorities in the many developing countries that struggle to provide even minimal education and health care to kids.

A final difficult question that merits serious consideration when turning Schumpeterian insights into development policy advice concerns the political feasibility of this advice. Recall that the fundamental Schumpeterian insight is that when firms face competitive pressures, they are forced to innovate to escape these competitive pressures, unleashing a virtuous circle of innovation, competition, and further innovation that raises growth. But the reality, particularly in many developing countries facing governance challenges, is that well-connected firms have at their disposal tools other than innovation to escape competitive pressures, and these tools lead to less virtuous outcomes. There are many such possibilities, but a particularly vivid example comes from recent work by Rijkers, Freund, and Nucifora (2014). They meticulously document the incidence of policy-induced barriers to entry across different sectors in Tunisia and then go on to show that the presence of these barriers is strongly associated with the presence of firms connected to the family of then-President Ben Ali. More generally, how to implement procompetitive Schumpeterian growth policies in environments in which politically powerful incumbents are precisely the ones benefiting from the absence of competition remains a deeply challenging question for development policy makers.

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The State of Economics, the State of the World

Edited by: Kaushik Basu, David Rosenblatt, Claudia Sepúlveda

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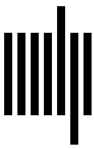

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