Review of "The World Economy: Growth or Stagnation?"

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What drives economic growth, and where is the world economy headed? This book is a tour de force of a search for the sources of growth, covering seven countries or regions and a rich set of factors, including not just productivity growth and gross fixed capital formation, but also investment in human capital, intangibles and information technology (IT). It builds upon and expands the work undertaken by Dale W. Jorgenson and KLEMS teams around the world, and therefore constitutes a great reference for academics and practitioners interested in obtaining an overview of the sources of economic growth across the world.

The book consists of 15 chapters, each focussing on a country, region, or specific topic. The countries covered include not only those already covered by ealier work, like the US or the European Union, but also emerging markets like China, India and Russia. Even the chapters on well-studied economies contain new material, due to the coverage of a longer time period and more sectoral detail. The topics chapters push the frontier of sources of growth analysis, separately probing the importance of intangibles, structural change, and other factors for economic growth. Given data limitations, these chapters are more tentative than the country chapters. At the same time, they constitute the most exciting part of the book, since they advance the research agenda in new directions.

Most chapters have a similar structure, in that the authors compile data on growth in economic output and inputs at the sectoral level over the last several decades using state of the art methods developed and described in the work of Jorgenson and coauthors, in particular in Jorgenson, Ho and Stiroh (2005) and Schreyer ((2001),(2009)), and then perform a decomposition. The book itself is rather short on details of methodology and measurement.

The authors stress several key results, of which I highlight three. First, past growth was mostly driven by "replication", or growth in capital and labor

inputs, and not productivity growth. For example, the growth accounting exercise attributes only around 20% of combined world growth over the period 1990 to 2012 to TFP growth. The lion's share (50 to 60%) is attributed to capital deepening, and the remainder (about 20%) to growth in labor quality and quantity (Figure 1.1). This division closely mirrors the sources of growth in the US (Figure 2.17). While individual country experiences differ, there is no country where TFP dominated the sources of growth (Figures 1.2-1.4). Second, extrapolating recent trends, the authors expect the future to portend growth, not stagnation. This is because global growth will benefit from an increasing weight of fast-growing economies like India and China in world GDP, more than compensating for slowing growth in the OECD. Finally, the performance of individual industries matters, because innovation is concentrated in just a few of them.

The analysis in the book is based on a great data collection effort, which will also be a boon to the work of others. The data also contain some specific gems that receive less attention than the headline results, but which have potential for inspiring future research. A first example is the finding in Chapter 4 by Bas Van Ark and Mary O'Mahony that investment in intangible assets (which is not part of investment in the national accounts) now is around 15% of market sector value added in the US, a similar order of magnitude as the investment/GDP ratio (p. 137). It is substantially lower across the EU, and only half as large as in the US in some European countries. Inklaar, Timmer and Van Ark's (2008) hypothesis that this difference is due to less integrated markets in Europe certainly merits further exploration. Euro Area countries have also been lagging in terms of IT capital. An important related point is that the well-known increase in IT intensity of advanced economies, driven by declining relative IT prices, is much larger when one considers the share of IT capital in capital services, and not the capital stock. Another stimulating result is the finding in Chapter 14 by Robert Inklaar that global convergence in aggregate TFP across countries has been driven exclusively by strong convergence of manufacturing TFP (this echoes earlier findings by Rodrik (2013) and Levchenko and Zhang (2016)), with TFP in market services diverging. Given the reduced importance of manufacturing globally, this may imply much slower convergence for the future.

These results are important on their own. They are also likely to serve as a starting point for future work, and make the book an important contribution in the area of measurement, of interest not only to researchers, but also to policy makers and analysts. At the same time, the book's scope and ambition make it important to comment on three central features of the analysis.

To begin, it is important to realize that the authors' conclusion that re-

cent growth has been driven mostly by factor accumulation ("replication"), with only a small contribution from TFP growth, stands in stark contrast to the consensus in a large literature on growth and development accounting, which for at least 20 years has stressed "that differences in productivity are a dominant source of these differences [in living standards]." (Restuccia and Rogerson (2017), p.15; see also Klenow and Rodriguez-Clare (1997), Hall and Jones (1999) and Caselli (2005)). A similar consensus holds for growth of the frontier (Jones 2016). This consensus has inspired a large literature aiming to find the determinants of TFP differences. Is this consensus obsolete? It turns out that the answer is no. Instead, the apparent discrepancy between this consensus and the book's findings hinges on two differences in how contributions are apportioned to different factors, and only one substantial difference in measurement. First, the recent literature agrees that the object of analysis should be growth in *output per worker*. The chapters in the book in contrast study output growth. This choice implies that out of overall GDP growth of around 3% p.a. in the post-war period in the US, the authors attribute about 1%, or one third, to growth in the labor force. This approach mechanically reduces the potential importance of all other factors, resulting in a TFP contribution to output growth of 20% or less. For growth in *output per worker,* in contrast, the figures from Chapter 2 imply a contribution of TFP growth of 38% for the years 1947 to 2012. Second, beginning with Mankiw, Romer and Weil (1992), it has been standard in the literature to separate contributions to growth into those from TFP and those from the capital-output *ratio,* and not simply the level of capital. In the words of Klenow and Rodriguez-Clare (1997, p.76), this approach "gives A [TFP growth] 'credit' for variations in K and H generated by differences in A." That is, it reflects that TFP growth causes not only growth in output, but also induces growth in the capital stock, which further raises output. This indirect effect should be attributed to TFP growth, and only increases in the capital-output ratio should be interpreted as capital deepening.[1] Again using the figures in Chapter 2, this approach implies a contribution of TFP growth to growth in output per worker of 59% for 1947-2012. This number is of a similar order of magnitude as that of 80% obtained by Jones (2016, Table 3) for the period 1948 to 2013. Only this final difference is due to substantial differences in measurement: In the book, the authors use capital services throughout, which put more weight on faster-growing types of capital, like IT, than capital stocks do. As a consequence, using capital services results in average annual capital deepening of 1.5% per

[1] Note that in principle, the reverse is also possible: increases in the saving rate could raise TFP growth (see for example Aghion and Howitt 2007). Theory matters for measurement.

year. This accounts for most of the remaining growth in output per worker. Taking stock, the book's findings do not overthrow the consensus that most of the growth in output per worker is due to productivity growth.

A second comment concerns forecasts. In their forecasts, the authors follow the typical growth accounting practice from the literature (e.g. Jones 2016) and assume that capital will grow in line with output. Given limited future growth in labor quality, output growth in turn will be almost exclusively driven by productivity growth. This suggests that any growth forecasting exercise would benefit from detailed attempts at forecasting productivity growth at the industry level, in particular in the few highly innovative sectors. Despite the prominent role of forecasts, such an analysis is not a focus of the book. It would also have helped the book to speak to the ongoing discussion on "secular stagnation" (e.g. Gordon 2015). For an interesting attempt, see Byrne, Oliner and Sichel (2013), who also point out the difficulty of the exercise: "Almost all analysts have failed to anticipate the major shifts in growth over the past several decades, and we should not expect better going forward."

Finally, even if growth accounting yielded causal results, it does not give clear policy implications. The authors argue that the large role of replication for past growth implies that policy should focus on investment, not productivity. But the objective of policy should be to undo distortions and to counteract frictions. Past sources of growth cannot on their own identify these. Even if the growth contribution of TFP was indeed low, this could be because of frictions holding back innovation. Similarly, a large growth contribution of replication does not indicate whether past investment was optimal, too low, or even too high.

As a final thought, it is interesting to tie elements from this book to another very active measurement literature. Will a slow-down in productivity growth in advanced economies slow down the rate of skill biased technical change? How will the growing role of fast-growing China and India affect the return to skill in these countries and in advanced economies? The book contains useful inputs for beginning to address these questions.

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