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Economic growth and poverty traps in sub-Saharan Africa: The role of education and TFP shocks ☆

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ABSTRACT

This paper investigates the "*education-total factor productivity trade-off*" in explaining income per worker differences between sub-Saharan (unlucky) and G7 (lucky) economies. First, we examine the dynamics of average years of schooling (i.e. education), capital per worker, income per worker, and total factor productivity (TFP) across sub-Saharan and G7 countries. We confirm that physical capital and education levels partially explain income per worker differences between lucky and unlucky economies. Second, we undertake a novel examination of the impact of technology shocks on income per worker, with the goal of understanding the role of technology variation in causing cross-country income per worker differences, and as a potential contributor to overall slow growth in the sub-Saharan region. In a vector autoregressive (VAR) framework, we show that the impact of "*ad hoc*" TFP shocks on income per worker is larger in unlucky economies than in lucky ones. We observe that average TFP volatility in the "unlucky world" is eight times higher than in the "G7 world". We argue that the order of magnitude of the impact heavily depends on the level of the TFP volatility. Last, we suggest that the documented differences in the amount of physical capital and in the productivity of human capital between these two regions add conceptual support for the existence of poverty traps for sub-Saharan Africa.

1. Introduction

Income per worker varies substantially across countries around the world, and is attributed by much existing work to differences in human capital, physical capital, and total factor productivity (TFP) (see Caselli, 2005; Hall and Jones, 1999). Nevertheless, there is little consensus on the relative importance of each of these baskets of factors, and the role of human capital in promoting the economic development of a country is particularly widely debated. For example, Pritchett (1996) argues that data on the growth of years of schooling provide no support at all for the proposition that more rapid rates of growth in education capital produce greater income growth. He shows that the estimated impact of educational capital accumulation on a widely accepted growth accounting definition of TFP growth is large, negative, and statistically significant. That is, as the labor force becomes more educated, total factor productivity declines. He provides three possible explanations for this counter-intuitive result: (i) perhaps schooling has, on average, created no skills (i.e. no human capital);

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(ii) perhaps the supply of educated people is higher than the demand (iii) perhaps schooling has increased worker intellectual skills, but an ineffective institutional environment provides little opportunity for workers to use these skills in value-added activities (i.e. human capital has been badly invested). In showing that education is not a sufficient condition for growth, Pritchett (1996) does not seek to advance the idea that education is powerless, but instead provides empirical support for a of focus on complementary reforms in non-educational sectors that can facilitate educational investments to pay off.

This emphasis also reflects recent empirical findings supporting the weak explanatory power for education alone as a driver of cross-country income differences. Increasingly, institutions are also conceptualized to play an important role in mediating links between various forms of human capital (such as education) and country growth. North's (1990) broad articulation of institutions as the formal and informal "rules of the game" in a society serves to illustrate their importance. He argues that by encompassing the structural fabric which shapes interactions between people, institutions incentivize societies to behave in certain ways, and as such serve as the underlying determinants of economic performance (North, 1994). Relatedly, Hall and Jones (1999) and Caselli (2005) argue that differences in income per worker might have more to do with differences in social infrastructure across countries, while Shleifer and Vishny (1993), Mauro (1995), and Ehrlich and Lui (1999) argue that corruption hampers economic growth. Hall and Jones (1999) and Acemoglu et al. (2003) both demonstrate the importance of an institutional environment in explaining economic growth by showing that countries with different levels of institutional quality have different economic growth rates.

Other researchers also highlight the complicating role that globalization brings to bear on these dynamics, while the extent to which education comes into play continues to be debated. Mazur (2000) argues that globalization has dramatically increased cross-country income differences. Kremer and Maskin (2003) argue that globalization has marginalized the poor in developing countries and left behind the poorest countries. Clinton (2000), during a session on the Indian parliament, argues that the poor must invest in education to take advantage of globalization. But, related empirical evidence suggest that although the average years of schooling both in primary and secondary school sharply increased in several poor economies over the last 20 years, income inequalities are still high.

Other work focuses more explicitly on technology as the key force behind economic growth. Hall and Jones (1999) show that differences in physical capital and educational attainment can only partially explain the variation in income per worker. They find a large amount of variation in the level of the TFP (i.e. Solow residual/technological progress) across countries, and they also argue that differences in capital accumulation, productivity, and therefore income per worker might be driven by differences in institutions and government policies, which they call social infrastructure. Caselli (2005) also argues that the observed differences in the factors employed in production do not totally explain most of the cross-country variation in income, but claims that human capital measures rather than social infrastructure should account for differences not only in the quality of schooling, but also in the health status of the population, which has accumulated repercussions for worker productivity overall.

In the context of the enduring sub-Saharan growth puzzle, a large part of the literature has focused on the role of institutions and governance as explanatory variables for low economic growth rates, while few works have been devoted to explicitly studying the dynamics of TFP and its impact on cross-country income per worker. However, technology differences are clearly also a plausible driver. For instance, Sachs (2001) presents evidence that production technology in the tropics has lagged behind temperate zone technology in the two critical areas of agriculture and health, and this in turn opened a substantial income gap between climate zones.

Here, we use a development accounting framework to first examine TFP and human capital differences between lucky (G7) and unlucky (sub-Saharan) economies. Second, we analyze the impact of TFP uncertainty shocks on per capita income. Following the growth accounting setup of Hall and Jones (1999) and Caselli (2005), we observe that differences in physical capital and education between sub-Saharan and G7 economies do not fully explain the huge gap in income per worker. Not surprisingly, we find evidence that the TFP plays a crucial role in understanding the existence of a cross-country income puzzle. Unlucky economies' average TFP accounts only for 27% of the US TFP. Our empirical findings in the first part of our analyses confirm existing results on the relationships between physical capital, education levels, and income (see Hall and Jones, 1999 and Caselli, 2005). To better understand the role of TFP in this complex puzzle, we undertake in the second part of the paper a novel examination of the impact of rare events (i.e. TFP uncertainty shocks)—defined as those with TFP growth rate more than 1.43 standard deviations above (below) the Hodrick–Prescott detrended mean of the TFP growth rate series- on income per worker, with the goal of understanding the key role played by technology variation in causing cross-country income differences, and as a potential contributor to overall slow growth in the sub-Saharan region.

The paper is organized as follows. Section 2 describes the data. Section 3, at the country level, in a growth accounting framework, determines the income per worker, education and technological progress, and examines the impact of TFP uncertainty shocks on income per worker. Section 4 discusses the link between our empirical findings, conventional theoretical economic results and poverty in sub-Saharan countries. Section 5 concludes.

2. Data description and preliminary analysis

In 2010, the thirty-two sub-Saharan countries on which we focus on had a combined population of 516 million and an average annual per capita income of $3270.00 (i.e. $9 per day). For comparison purposes, we use the G7 economies as