

Chapter 1

The Relevance of Science in Development:

Scientific Development Favors Economic Prosperity, but Not Necessarily through its Effect on Technological Knowledge in Middle Income Countries

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ABSTRACT

Scientific knowledge and technical expertise promote the wealth of nations. The traditional view is that science allows the expansion of technology, which, in turn, promotes economic development. This chapter shows that: 1) the scientific productivity of a country correlates more strongly with gross national income per capita than its technological sophistication; 2) science is important for economic growth among developed economies, whereas technical complexity is more important for the economic development of poorer countries; 3) scientific productivity of countries correlates more strongly with present and future wealth than indices reflecting its financial, social, economic, or technological sophistication; and 4) middle-income countries with higher relative productivity in basic sciences such as physics and chemistry have the highest economic growth in the following five years compared to countries with a higher relative productivity in applied sciences. No simple direct causal relationship between scientific productivity and economic growth could be detected. The results are best explained by assuming that science favors economic development by providing society with a more rational atmosphere, allowing the implementation of sound policies and institutions, and/or that rational societies with successful economic policies are also the ones giving priority to basic natural sciences.

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INTRODUCTION

Since ancient times both knowledge and wealth have been recognized to be related (Bacon, 1620; Condorcet, 1794; Spencer, 1875; Marshall, 1890). Napoleon said that “*there cannot be a great nation without great mathematics*”. Yet, how this relationship works in the modern world is still a sensitive political issue (Salter & Martin, 2001; Nelson, 1959; King, 2004; Royal Society, 2011). The traditional view is that scientific development is required for technological expansion which affects the productive apparatus of a country explaining a high correlation between scientific research and technological advances (Teitel, 1994; Wang, 2007) explaining why scientific development and the wealth of nations are closely linked (Sachs, 2005).

A significant recent contribution to the debate was made by Hidalgo et al (Hidalgo et al. 2007, Hidalgo & Hausmann 2009, Hausmann et al. 2011) who proposed a novel Economic Complexity Index (ECI) to account for knowledge embedded in society that produces wealth. In their words:

Modern societies can amass large amounts of productive knowledge because they distribute bits and pieces of it among its many members. But to make use of it, this knowledge has to be put back together through organizations and markets. Thus, individual specialization begets diversity at the national and global level. Our most prosperous modern societies are wiser, not because their citizens are individually brilliant, but because these societies hold a diversity of knowhow and because they are able to recombine it to create a larger variety of smarter and better products.

This ECI is based on the relative amount of exports of different products for each country and on an index as to the complexity or difficulty in producing each product. Although ECI reflects many different features of an economy, the authors (Hausmann et al. 2011) maintain that it mainly

reflects the composition of a country’s productive output and its structures, which in turn is a strong reflection of the countries combined productive knowledge.

However, scientific development and the wealth of nations have been postulated to be closely linked. Scientific productivity proved to be a much better predictor of economic wealth of a nation than all educational variables tracked by the United Nations Development Program and the World Bank (Jaffe 2005, Jaffe et al 2013a,b). The research output of a country showed to be a much better predictor of future economic growth than technological complexity of the country as measured with ECI. Scientific development was shown to correlate with tolerance and openness of a society, reflecting the fact that attitudes favoring science are related to valuation of empirical facts over personal convictions, which lay at the base of modern scientific progress (Jaffe, 2009).

The questions in Box 1 are raised by the above research: Do certain areas of science promote economic development more than others? Are more applied sciences better in advancing economic development than more general basic sciences? Does science promotes economic development through its effect on technological development, or does science act through other more general mechanisms?

COMPARING DIFFERENT INDICES OF KNOWLEDGE AND SOCIO-TECHNICAL DEVELOPMENT AS TO ITS CLOSENESS TO GDPC

A large number of indices have been developed to measure different aspects of the social, cultural, political and economic aspects of a nation (see World Bank Data repository). Despite this large number of indices, the Gross Domestic Product per capita (GDPC) is still the most widely used measure to estimate overall development of a country. This is partly due to the fact that GDPC is

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