

## Chapter 12

# Telecommunications Capital Intensity and Aggregate Production Efficiency: A Meta-Frontier Analysis

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### ABSTRACT

*This chapter explores the link between telecommunications capital intensity and aggregate production efficiency in the framework of meta-frontier analysis. The latter makes it possible to compare technical efficiency levels between countries operating under different technological frontiers. The author's analysis suggests that increasing per capita levels of telecommunication capital will push a country towards its local frontier, but it will not decrease much the technological gap with the global meta-frontier. In Africa policies providing incentives for firms and households to purchase more telecommunications equipment appear to be most justified in terms of efficiency gains, while this does not appear to be the case for the OECD countries. The author's general conjecture is, in order to avoid wasting productive resources on increasing the level of telecommunications capital intensity, it is advisable to keep a close eye on the location of a country's aggregate output with respect to both local and meta-frontiers.*

### INTRODUCTION

The focus of this study is on the link between telecommunications capital intensity and aggregate production efficiency in the global meta-frontier framework. Capital intensity in general is measured as a ratio of capital stock to labor. A greater extent of the telecommunications capital intensity is associated with the higher levels of labor productivity

since better communication tools make workers and their management more efficient (Jorgenson & Stiroh, 2000). I attempt to estimate the effects of telecommunications capital intensity on the levels of aggregate production efficiency in a broad range of countries around the world, putting a specific emphasis on the difference between country group and global stochastic production frontiers.

There are several ways in which investments into telecommunications equipment, such as cables and switches, can render production more efficient.

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To a large extent, all of these channels are related to the strong network effects that characterize telecommunications capital goods (Creti, 2001). First, firms that are able to quickly gain access to and process large volumes of information on the prospective suppliers of their intermediate inputs are likely to end up with cheaper inputs of higher quality compared to their counterparts that do not have access to a developed information communications infrastructure. Second, such an exchange of information on inputs and outputs to the various production processes that can only be made possible by means of advanced telecommunications networks increases the extent of competitive pressure, which in turn boosts incentives for the firms to use their inputs more efficiently. Third, the existence of informational superhighways exerts a downward pressure on the time elapsing between conceiving and concluding the deal, urging businesses to act quickly and more efficiently, too.

The main contribution of this study is to employ the meta-frontier framework in order to analyze the link between telecommunications capital intensity as a measure of the informational network effects and aggregate productive efficiency in a worldwide setting. Meta-frontier analysis is different from the conventional stochastic frontier framework in that it allows one to make a distinction between the 'local' stochastic production frontier and the 'global' one (Battese & al., 2004.) The 'local' stochastic production frontiers in my study are defined for the four groups of countries formed according to their geographic proximity, while the 'global' stochastic production frontier is estimated for the whole sample. In contrast to the previous studies on the issue (e.g. Thompson & Garbacz, 2007), I am recognizing the fact that good performance in terms of a 'local' best-practice production frontier is not the same as good performance in terms of the 'global' best-practice benchmark. For that reason the impact of changes in the telecom capital intensity may be different depending on the type of productive efficiency.

I am opting for the telecom capital intensity to represent the extent of development of the telecommunications sector in order to better capture the network effects characterizing the latter. My basic reasoning is, a person who only has access to a land-line phone can communicate less efficiently (and therefore make less use of communication network effects) compared to the person who in addition can use cell phones, fax machines, satellite networks and the Internet. Thus, I believe that a higher level of telecommunications capital per person (higher levels of telecom capital intensity) makes it more possible to exploit the network effects provided by telecommunications networks. In contrast, the level of telecom capital *per se* (whose growth represents telecom capital widening) is hard to interpret without relating it to the number of people who have access to it. The importance of using the concept of capital intensity as opposed to capital widening has been recognized in e.g. Estevao (2004).

I find that higher levels of telecommunications capital intensity are associated with both higher country group efficiency scores and lower technological gap. However, the marginal effect of increased capital intensity is estimated to be far greater in case of increasing the country group efficiency levels as opposed to the case of reducing the technological gap with respect to the global meta-frontier. In terms of the country group differences in efficiency levels, quite expectedly I find the group of OECD countries to exhibit consistently higher local and meta-efficiency levels compared to countries in the Asian, African and Latin American region. Surprisingly, though, I estimate technological gap ratios to be very close to each other.

My policy implications strongly suggest pursuing economic policies to provide incentives for firms and households to purchase telecommunications equipment in the countries where inefficient production practices are not only manifestly present (low technical efficiency levels relative to the group production frontier), but where they

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