Economic Modelling 35 (2013) 51–58

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/ecmod

Are Asian technology gaps due to human capital quality differences?

Elsadig Musa Ahmed *, Geeta Krishnasamy

Economics Unit, Faculty of Business, Multimedia University, 75450 Melaka, Malaysia

ARTICLE INFO

Article history:
Accepted 18 June 2013

Keywords:
Technical efficiency
Technological change
Productivity growth
Asia
Metafrontier
Technology gap
Human capital
DEA
Malmquist productivity index

ABSTRACT

This paper adopts the meta-frontier framework using DEAP software to analyse the technological gap and level of catch-up of the three regions in Asia (namely, Southern Asia, Eastern Asia and ASEAN5) with respect to the Asian technology as a whole for the period 1980–2006. Countries in Eastern Asia displayed a technology gap ratio of 1.000 which posits that this region defines the best practice frontier for Asia. Meanwhile, countries in Southern Asia region displayed an improvement in technical efficiency and productivity relative to the Asian frontier but lagged in terms of technological advancement. All three regions recorded a lag in technological advancement with respect to the best practice frontier. In order to progress technologically, these countries should be equipped with the necessary infrastructure and human capital to encourage foreign investment and growth. The countries in Eastern Asia and ASEAN5 recorded the strongest productivity growth performance as a group when compared to the countries in Southern Asia. In Southern Asia and ASEAN5 region, the technology gap ratio is below 1.000 subsequent to the 1997/98 financial crisis. On the contrary, East Asia kept up with the benchmark frontier during most of the sample period inclusive of the period after the financial crisis.

© 2013 Elsevier B.V. All rights reserved.

1. Introduction

The ASEAN5 economies have recorded impressive economic performance during the past four decades. These countries have received increased international notice for their relatively strong economic growth performance and for their assertion of a collective approach to a range of foreign economic policy issues. The earlier growth and development experiences of the Southeast Asian economies cannot be explained by the ASEAN regional economic cooperation integration schemes per se. The ASEAN regional economic cooperation was initially weak and regional cooperative measures were broadly ineffective, despite ASEAN's existence since 1967. It was only since 1992, following the ASEAN Summit meeting in Singapore, that regional schemes have been strengthened including the adoption of trade liberalization measures that paved the way for the formation of the ASEAN Free Trade Area (AFTA) (Daquila, 2004). The close regional ties and the financial and economic cooperation among the countries in ASEAN5 propels us to investigate the extent of the technological gap or catch-up between the ASEAN5 as a group with the Asian technology as a whole.

In recent years, there has been increased interest in regional economic integration in South Asia. Regional integration in South Asia got the momentum in 1995 when the SAARC Preferential Trading Arrangement (SAPTA) was signed. SAARC stands for South Asian Association for Regional Co-operation and the member nations of SAARC are India, Nepal, Bhutan, Bangladesh, Sri Lanka, Maldives and Pakistan. In early 2004, the SAARC member countries agreed to form a South Asian Free Trade Area (SAFTA). The SAFTA has become a parallel initiative to the multilateral trade liberalization commitments of the South Asian countries. SAFTA has come into force from 1 July 2006, with the aim of boosting intraregional trade among the seven SAARC members. In this context, the aim of this paper is to cluster the selected South Asian countries, namely, Bangladesh, India, Pakistan, and Sri Lanka and compare the performance of this group relative to the Asian technology to identify the extent of the technological gap. Although Afghanistan has joined SAARC in 2005, but it has not included in this study due to unavailable data to be used; besides, this country has been suffering from long war.

The three East Asian Tigers, namely Hong Kong, South Korea, and Taiwan share a range of characteristics with China. An important question is the relevance of the experience of the Hong Kong, South Korea, and Taiwan economies to current economic growth in China. In the 1980s it was argued that the export-centred growth of these three countries was of limited relevance to China because these countries were small and any effort to mimic them would result in more exports than the developed world could handle. This objection was later less often raised since the pattern of economic growth has been for exports to trigger economic growth in the coastal regions, and for these coastal regions to serve as markets and triggers for growth in the interior. Investors from the U.S., Japan, Hong Kong, South Korea and Taiwan established transplants in lower-wage countries like China, Vietnam, and Philippines (Haggard, 1990). Because of

* Corresponding author.
E-mail addresses: elsadigmusa@yahoo.com, asadiq29@hotmail.com (E.M. Ahmed), geeta79@yahoo.com (G. Krishnasamy).

0264-9993/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.econmod.2013.06.032

their geographical proximity, China is grouped with the three East Asian Tigers to evaluate the extent of their catch-up or lagging with respect to the Asian technology as a whole.

All previous studies derived their decompositions under the assumption that all the countries in Asia operated under a common technology. This paper extends previous study by considering groups of countries in Asia which operate under different technologies thus relaxing the common technology assumption, as well as explicitly accounting for temporal effects, which measures productivity and efficiency changes over the period 1980–2006.

In most empirical applications of the metafrontier, grouping of countries is implicit in the problem under consideration. There are no a priori theoretical prescriptions on how countries should be allocated to regions or groups when estimating frontiers. The groupings of countries must largely depend upon the purpose of the empirical analysis being conducted. O'Donnell et al. (2005) grouped countries by geographical regions, while Iyer et al. (2006) grouped countries by income levels.

The disadvantage of income based groupings is that the income level changes over time and by leaving the grouping fixed overtime might bias the shape of the group frontiers and this influence the computed productivity measures. Therefore, in this present study, we have grouped the countries according to geographical regions to analyse the technological gap between each of the regional frontiers within Asia relative to the Asian frontier as a whole. We assume that countries that are in the same region share the same technology.

1.1. Literature review

In recent years, frontier methods have been used in assessing and comparing the performance of different regions and countries. The two principal methods widely used to estimate frontiers are the non-parametric data envelopment analysis (DEA) and parametric stochastic frontier analysis (SFA). The origins of DEA date back to the seminal paper by Farrell (1957), but its current popularity is largely due to the influential work by Charnes et al. (1978). The late seventies also saw the birth of SFA in the works of Aigner et al. (1977) and Meeusen and van den Broeck (1977), among others. Today, the literature of DEA and SFA is voluminous and growing rapidly (see e.g. recent surveys by Cherchye and Post, 2003; Murillo-Zamorano, 2004; Worthington, 2001, 2004).

SFA builds upon the classic econometric regression approaches to production function estimation, which relies heavily on the ex-ante specification of the functional form. The main attention has been in the decomposition of the residual into a non-negative inefficiency term and an idiosyncratic error. Battese and Rao (2002) and Battese et al. (2004) provide frameworks for comparisons when efficiency is measured using stochastic frontier models.

By contrast, DEA has focused on the nonparametric treatment of the frontier, which does not assume a particular functional form but relies on the general regularity properties such as monotonicity, convexity, and homogeneity. Furthermore, DEA attributes all deviations from the frontier to inefficiency, completely ignoring any stochastic noise in the data. In summary, it is generally accepted that the virtues of SFA lie in the stochastic, probabilistic treatment of inefficiency and noise, while the virtues of DEA lie in its general nonparametric frontier (see e.g. Bauer, 1990; Seiford and Thrall, 1990).

DEA has been widely used in benchmarking studies over the last two decades. Charnes et al. (1989) studied the economic performance of China's 28 cities in 1983 and 1984. In a similar study, Chang et al. (1995) used DEA and the Malmquist productivity index approach to study the economic performance of 23 regions in Taiwan from 1983 to 1990. Tong (1996, 1997) applied DEA to investigate the changes in production efficiency of 29 Chinese provinces meanwhile Bernard and Cantner (1997) calculated the efficiency of 21 French provinces from 1978 to 1989. In a recent study, Maudos et al. (2000) analysed the relationship between efficiency and production structure in Spain from 1964 to 1993.

Moreover, countries in different regions face different production opportunities. Technically, they make choices from different sets of feasible input–output combinations. These so-called technology sets differ because of differences in available stocks of physical, human and financial capital (e.g., type of machinery, size and quality of the labour force, access to foreign exchange), economic infrastructure (e.g., number of ports, access to markets), resource endowments (e.g., quality of soils, climate, energy resources) and any other characteristics of the physical, social and economic environment in which production takes place. Due to such differences, it is imperative to estimate separate production frontiers for different groups of countries. Separate frontiers have been estimated for universities in Canada (McMillan and Chan, 2004), Australia (Worthington and Lee, 2005) and the United Kingdom (Glass et al., 1995), and for bank branches in South Africa (O'Donnell and van der Westhuizen, 2002) and Spain (Lovell and Pastor, 1997).

There is often considerable interest in measuring the performance of countries across geographical boundaries. The caveat is that such comparisons are only meaningful in the limiting special case where frontiers for different countries are identical. As a general rule, efficiency levels measured relative to one frontier (e.g., the Malaysian frontier) cannot be compared with efficiency levels measured relative to another frontier (the Taiwanese frontier). Therefore, the results from cross-country studies of productivity growth are not strictly comparable as each country is benchmarked against the frontier for that region as a whole. If the frontiers of the two regions or two countries are identical or very similar, then there is no real problem. In practice, however, it is rare that the frontiers estimated for two different regions or countries are likely to be similar enough to facilitate the use of a single frontier. In empirical work, one tends to reject the null hypothesis of constancy of the production frontier across different regions. Therefore, it is in these instances that it is imperative to construct metafrontiers for comparison of performance of different countries.

The main objective of this study is to empirically measure the level of catch-up in productivity growth achieved by different groups of countries in Asia over the period of 1980–2006. This paper provides the metafrontier framework to measure and compare the productivity growth performance of countries under different technologies in Asia. This study uses metafrontier approach to investigate the technology gap and catch-up in productivity in group of Asian countries. There is no study, to the best of our knowledge, commissioned to investigate the technological gap and catch-up in productivity in Asia as different groups of countries. However, Han et al. (2002) in their paper use a varying coefficients frontier function model to examine the sources of growth between 1987and 1993 in 20 manufacturing sectors of four East Asian economies. In addition, this study extends the period of study until year 2006 as compared to the previous studies, thus taking into effect the latest technological change and how it affects the countries' performance in Asia. Furthermore, analyses of technical efficiency of countries within the same regional level are important and challenging. From a policy point of view, it is of interest to distinguish the regional differences in mean efficiency levels and to determine whether the regions share some common characteristics.

The rest of the paper is organized as follows: Section 2 details the definitions of group and meta-frontiers as well as technology gap ratios (TGRs) and presents the empirical model to be used in this study. Section 3 describes the data and Section 4 presents results. Finally, policy implications and the conclusion of this study are detailed in Section 5.

2. Basic concepts and theoretical framework

This section discusses the basic concepts used in meta-frontier analysis and the breakdowns of the Malmquist productivity index.

دریافت فوری ← متن کامل مقاله

ISIArticles
مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات