Efficiency gains from regionalization: economic development in China revisited

Patricia E. Byrnes[a,*], James E. Storbeck[b]

[a]*Institute for Public Affairs, University of Illinois at Springfield, Springfield, IL 62794, USA*
[b]*Department of Operational Research & Systems, Warwick Business School, Coventry, CV4 7AL, UK*

Abstract

This paper uses a DEA model of multi-unit efficiency measurement to investigate the gains from regional analysis of efficient economic development. The model is applied to the Chinese city economic development data used by Charnes, Cooper, and Li in a recent issue of this journal to demonstrate the usefulness of alternative DEA-based measures in economic development policy. Assuming that Chinese cities can cooperate within a region reveals that efficiency gains are possible. This may provide additional information to policy makers in terms of how to direct planned investment. Additional information is provided and traditional DEA model results are also explained within this regional development context. Published by Elsevier Science Ltd.

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1. Introduction

Data Envelopment Analysis (DEA) has proven to be an important tool in the analysis of a wide spectrum of policy issues. For example, a recent well-known application, authored by Charnes et al. [1], involves the use of DEA in analyzing the economic development of Chinese cities. Using macroeconomic data on outputs (domestic product measures) and inputs (labor and investment or capital), these authors employed traditional DEA models to compare the economic performance of major cities in China. Suggestions for how this analysis might be

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* Corresponding author.

used to inform economic development policy makers in a planned economy were also provided. This analysis was later extended by Sueyoshi [2]. Macmillan [3,4] provides extensions of DEA to development analysis of multi-regional economic planning in the United States. Applications of DEA to location analysis evaluation include those of Desai and Storbeck [5] and Desai et al. [6]. These studies demonstrate how DEA can be used to determine the efficiency of various spatial configurations.[1]

The extension of DEA to economic development policy has motivated this paper. The above examples suggest that economic development may be better evaluated on a regional basis since, as in the case of China, economic development policy often focuses on regional development. However, the DEA models in these studies generally fail to account for regional aspects of economic development. They thus assume the economic performance of each Decision Making Unit (DMU) is independent of other DMUs in the sample. For example, in the Chinese city case, economic development in any given major city is considered independent of any other city's development. Indeed, some of the cities are located very near each other and are considered to be part of the same "region" in economic development policies. In the current study, we present measures of economic development that allow for analysis of regional, city or individual DMU economic development efficiency.

In order to model regional economic development, two strands of literature that extend DEA models based on the construction of alternative reference technologies are relevant. The first involves DEA analysis of the efficiency of an industry based on the performance of firms in that industry [9,10]. In these models, the approach involves constructing reference technologies using data from individual firms. Further, it allows for hypothetical reallocation of resources across firms to construct an industry reference technology.[2] The efficiency measures gauged relative to these "industry" reference technologies are compared to the "firm" reference technologies (which do not allow for reallocation of inputs across firms) in order to evaluate the performance of both individual firms and the industry. In this regard, Førsund and Hjalmarsson [9] argue that analysis of industry technologies "can be useful as a kind of description of industrial structure and structural change based on technical relationships, i.e., the distribution of input coefficients and capacity, giving a hypothetically maximum output for given amounts of inputs."

The second strand of relevant literature involves analysis of firms based on the performance of multi-units owned by the firm. Similar to the industry structure models, these (DEA) formulations construct an "additive technology" to investigate the gains from combining different units within a firm. Modeling the productivity benefits of combining units has allowed for the measurement of efficiency gains in a wide variety of settings, including plants of electric utilities [11] and units in branch banking [12].

The next section contains proposed DEA models and measures for regional economic

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[1] For an application of this model to determine candidate sites for regional medical facilities, see Haynes et al. [7]. Balakrishnan et al. [8] use DEA to assess the efficiency of different location covering solutions to a retail outlet network siting problem.

[2] Førsund and Hjalmarsson [9] present an industry reference technology where all inputs are reallocable. Färe et al. [10] extend this model of industry production where only some of the inputs are reallocable while others are firm-specific (not reallocable) across firms in an industry.