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Ownership, autonomy, incentives and efficiency: Evidence from the forest product processing industry in China

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ABSTRACT

Using enterprise-level data from China's Northeast-Inner Mongolia state-owned forest area for the year 2004, this paper investigates the technical efficiency of forest product processing mills and the relationship between institutional and managerial practices and efficiency. A two-stage procedure proposed by Simar and Wilson (2007) is adopted. In the first stage, a bootstrapped data envelopment analysis (DEA) model is used to compute the efficiency scores. In the second stage, the bootstrapped DEA scores are estimated over a set of mills' institutional and managerial systems and other characteristics with a bootstrapped truncated regression. The results show that there is a wide dispersion in the technical efficiency among mills. Private ownership, autonomy and mill size have statistically significant positive impacts on efficiency. These results provide support for the ongoing reform and implications for future development of this area.

Introduction

Institutional and managerial systems are generally important for the economic efficiency of industrial enterprises. In the past two decades, especially due to economic transitions in former centrally planned economies, there has been an upsurging interest in issues associated with institutions and

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management and the impacts of changes in such aspects on enterprise efficiency. In contrast to privatization of state-owned enterprises *en masse* in former Soviet Republics and post-communist Eastern European countries, the gradualist enterprise reform in China emphasized enterprise restructuring through consolidation of property rights at the local government level and introduction of an innovational governance structure that stressed autonomy and incentives (Li, 1997; McMillan, 1995). The present study provides evidence from the state forest product processing industry that not only institutional innovations but also changes in ownership matter for enterprise efficiency.

Most of the studies on China's state-owned enterprises have found positive total factor productivity (TFP) growth during the reform period through institutional innovations. This performance improvement is attributable to a number of factors: enhancement of manager autonomy in enterprise decision-making (Groves et al., 1994), a range of incentives offered to both managers and workers to link rewards with efforts, such as increased marginal profit retention and rising performance-based bonuses (Groves et al., 1994; Jefferson and Rawski, 1994; Li, 1997; Zheng et al., 2003), development of an improved manager appointing system that is responsive to market forces (Groves et al., 1995), as well as intensified product market competition and improved factor allocation (Li, 1997). While large-scale privatization was not embraced in China at the beginning of the reform period, the importance of ownership change to improve performance could not be overlooked. Studies have shown that restructuring of state-owned enterprises in China has pronounced effects on improving labor productivity (Li and Rozelle, 2004) and profitability (Dong et al., 2006; Bai et al., 2009), and on increasing innovative effort and returns to capital (Jefferson and Su, 2006).

Accounting for 42% of China's total forest area, 68% of the total timber volume and almost all of the nation's natural forest resources (Xu et al., 2004), China's state-owned forest areas are an important part of the forest sector.[2] The forest product processing mills, located in state-owned forest areas, play a major role in timber production and processing for the state sector. While historically having contributed enormously to China's economic development, these areas have relapsed into a situation of "two crises" – ecological degradation and economic loss. Hence, reform has been carried out since the 1990s following a similar course as in other state-owned industrial sectors. However, to the best of our knowledge, only few rigorous empirical studies have evaluated the effects of similar reform in China's state-owned forest areas on enterprise efficiency, not to mention effective policy design for the economic performance advancement of the sector. The present study tries to fill this gap.

Using comprehensive enterprise-level data from China's Northeast-Inner Mongolia state-owned forest area for the year 2004, this paper aims to examine the technical efficiency of forest product processing mills and the relationship between institutional and managerial practices and efficiency. Technical efficiency measures the distance between a mill and the estimated production frontier, and captures TFP in level form for the short-run (see Coelli et al., 2005, for a more detailed comparison between technical efficiency and productivity). In particular, the study seeks to address the following questions: Under what ownership type do mills operate relatively more efficiently? Do increased autonomy and more lucrative incentive schemes improve efficiency? Since this study does not focus on the impact of institutional and managerial reform on productivity growth but rather sets out to compare the static efficiency across concurrent enterprises, our data, which include mills that have undergone the reform and mills that have not, serve the purpose of this study well.

A two-stage procedure proposed by Simar and Wilson (2007) is adopted in this study. In the first stage, a bootstrapped data envelopment analysis (DEA) model is used to compute the efficiency scores of the mills based on input and output data. In the second stage, the bootstrapped DEA scores are estimated with a bootstrapped truncated regression over a set of mills' institutional and managerial systems and other characteristics. This approach takes care of the bias in DEA efficiency calculation and the correlation problem in regression analysis so that more efficient estimation of the second stage parameters can be achieved.

A number of papers have applied DEA to study the efficiency of the forest product manufacturing industry in different countries and regions. Yin (1998) examines the productive efficiency of 44 paper mills in North America in 1994, and shows that the sector features constant returns to scale

[2] The other part of China's forest sector comprises collective forest areas.