Abstract

Technical efficiency and firm growth dynamics in the Ethiopian manufacturing sector

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In the face of mounting competition in domestic and international markets the survival and success of firms depend on their business performance. Thus, to maintain competitive advantage, firms need to assess their performance periodically. This study examines the performance of manufacturing firms in Ethiopia in terms of technical efficiency and firm growth dynamics using establishment-level census panel data over the period of 2000 to 2009. The “true” random effects stochastic frontier model (Greene, 2005a, 2005b), which can disentangle time-varying technical inefficiency from time-invariant unobserved heterogeneity, and the conventional fixed and random effects models are used to estimate efficiency for the aggregated and individual industry groups. The results indicate that efficiency estimates are sensitive to model specifications of firm-specific unobserved heterogeneity. We find a significant gap in efficiency estimates between the “true” random effects model and the fixed and random effects models, which would imply considerable heterogeneity of manufacturing firms in Ethiopia. Our results suggest that firm-specific heterogeneity would be particularly significant in the food and beverages,
non-metals, and furniture industries. We also show that the production of the Ethiopian manufacturing sector is largely responsive to changes in intermediate inputs compared to labor and capital inputs. The mean technical efficiency varies considerably across firms within an industry. On average, technical efficiency for the whole manufacturing sector is estimated to be 74 percent in the study period.

We investigate if efficiency variation among firms is systematically associated with firm size and age. The results indicate that the effect of these variables on efficiency varies from industry to industry. However, overall, their relationship with efficiency seems to be insignificant. We further qualitatively discuss that the major problem for the variation in efficiency among firms is the inability of firms to operate at their full production capacity, which is mainly caused by shortages of raw material supply. We also found that firms in the manufacturing sector have shown positive technological progress in the study period.

We also examined the efficiency of manufacturing industries in Ethiopia from the DEA perspective. In the DEA analysis, we first proposed a handicap setting model for fair evaluation of the manufacturing industries in Ethiopia. The manufacturing industry comprises many sectors which include many companies in the category. Thus, there is a “two-layered” structure. The statistics of a sector is the sum of those of its member companies. In order to evaluate the relative efficiency of industrial sectors, we need to take account of performance of their membership companies. For this purpose, we proposed a handicap model that enabled us to compare industries under a handicap race. Using the model, we classified industries into no-handicap and with-handicap groups. Since we use an input-oriented model, we modify inputs using the handicaps and evaluate the sectoral
efficiency. We found four sectors belonging to the with-handicap group the most handicapped sector being the Machinery and equipment. If this industry could be improved by innovation, it would become the top industry in the manufacturing sector, while the other three handicapped sectors remain inefficient even after taking account of handicaps.

The above DEA analysis did not consider any statistical noise in the data. However, a growing concern over DEA is that results may be biased in the presence of statistical noise such as measurement errors. To address this problem, three recently proposed DEA resampling models which account for measurement errors in the data are utilized in a separate chapter. Using these three resampling models, we gauge the confidence interval of the efficiency scores of each industry. Unlike previous studies which tried to estimate past and present efficiency of decision-making units, we further evaluate the future efficiency of the industries using future forecasting model. This enables us to assess the future potential of the industries.

This dissertation also studies firm size and growth rate distribution patterns and growth persistence of manufacturing firms in Ethiopia using a quantile regression approach. This approach has unique advantages over the standard econometric techniques in that it allows the impact of the independent variables to vary over the entire conditional distribution of the dependent variable. Our findings indicate that the distributional properties of firm size and firm growth rate show significant deviations from a Gaussian distribution. Particularly, while firm size exhibits a right-skewed distribution, growth rate distributions are highly leptokurtic that resemble a fat-tailed Laplace distribution. The empirical results indicate that firm growth decreases with size suggesting that small firms
have faster growth than larger firms in terms of employment. This highlights the ability of small firms to create significant job opportunities in the Ethiopian manufacturing sector. Furthermore, we find high negative autocorrelation of growth rates in consecutive years. This means that any high positive or negative growth events of employment in any given year are unlikely to be repeated the following year. In other words, there is lack of persistence in employment growth. Our results are robust to size, temporal and sectoral disaggregation of the data. Generally, all these results suggest that Gibrat’s law of proportionate effect is rejected in the case of Ethiopian manufacturing.

The research findings can be helpful for industrial policy makers as background information for further development of the sector.

**Keywords:** Stochastic frontier analysis, “true” random effects, unobserved heterogeneity, technical efficiency, Data Envelopment Analysis, resampling, measurement error, firm size distribution, firm growth rate distribution, autocorrelation, quantile regression, growth persistence, Ethiopian manufacturing