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Determinants of technical efficiency in the ASEAN manufacturing industry

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ABSTRACT

This study investigates the determinants of technical efficiency in the manufacturing sector across six ASEAN economies Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam over the period 2000–2022. The purpose is to assess cross-country variations in efficiency performance and identify key macroeconomic and demographic drivers that shape long-term productivity. The analysis adopts a two-stage framework that combines Data Envelopment Analysis (DEA) with Tobit regression. The DEA results reveal substantial heterogeneity, with Singapore consistently achieving the highest efficiency, while Vietnam persistently lagged behind. Although an overall upward trend is observed, efficiency in Indonesia, Thailand, and Vietnam declined notably after the COVID-19 pandemic, reflecting the sector's vulnerability to external shocks. The Tobit regression results show that foreign direct investment (FDI) is a significant positive determinant, with a 1% increase in FDI inflows enhancing efficiency by 0.44%. In contrast, macroeconomic instability and demographic pressures undermine performance, as a 1% rise in inflation reduces efficiency by 1.14%, and a 1% increase in the elderly population share decreases efficiency by 2.88%. These findings highlight the importance of policies that promote sustained FDI inflows, stabilize inflation, and address aging through labor market reforms and productivity-enhancing measures. Strengthening manufacturing efficiency is essential for sustaining long-term growth, boosting global competitiveness, and advancing ASEAN's regional integration agenda.

Contribution/ Originality: This study employs a DEA approach to estimate the technical efficiency of the ASEAN manufacturing industry from 2000 to 2022, and Tobit regression is used to assess the determinants of technical efficiency. The results demonstrate that foreign direct investment enhances efficiency, while inflation hampers the efficiency of the ASEAN manufacturing industry over the study period.

1. INTRODUCTION

The manufacturing sector occupies a pivotal position in economic development by enhancing productivity, promoting industrial diversification, and creating employment opportunities. In developing economies, it functions as a critical driver of structural transformation and sustainable growth, helping to reduce reliance on volatile primary sectors. Within the ASEAN region, manufacturing accounts for approximately 5% of global manufacturing value added and represents a major pillar of gross domestic product (GDP) for most member states. From 1991 to 2020, it consistently ranked as the second-largest contributor to ASEAN's GDP, with particularly strong performance in subsectors such as chemicals, food and beverages, metals, and motor vehicles.

Table 1. Average annual GDP share of manufacturing in ASEAN member countries, 1991–2010.

Countries	Average Annual Share Contribution		
	1991-2000	2001-2010	2011-2020
ASEAN	21.62	23.77	21.28
Brunei	16.41	16.06	14.33
Malaysia	25.98	26.75	22.60
Singapore	25.35	25.20	19.97
Indonesia	19.58	22.79	21.13
Thailand	26.77	29.67	27.15
Vietnam	9.42	15.23	16.20
Philippine	25.63	23.75	19.84
Myanmar	7.16	7.43	7.04
Cambodia	11.15	17.95	16.85
Lao PDR	8.40	9.77	8.36

Source: Asian Productivity Organization (APO) (2023).

Table 1 shows that the average annual GDP share of manufacturing in ASEAN member countries was uneven. The manufacturing contribution towards GDP rose from 21.62% in 1991–2000 to 23.77% in 2001–2010 before declining to 21.28% in 2011–2020. This slowdown coincided with global supply chain disruptions, most notably during the COVID-19 pandemic. Historical growth patterns in Figure 1 further reveal frequent volatility, with sharp contractions in the growth rate of the ASEAN manufacturing industry's output during the 1998 Asian Financial Crisis, the 2009 Global Financial Crisis, and the 2020 pandemic. Moreover, structural challenges such as labour-intensive production methods, slow adoption of advanced technologies, and limited innovation capacity have constrained productivity gains.

Previous studies, including Tan (2006), Vu (2016), and Yasin (2022), have investigated manufacturing efficiency at the firm or national level, highlighting foreign direct investment (FDI), export orientation, and technological change as key drivers. However, limited attention has been given to the influence of broader macroeconomic factors such as inflation, demographic shifts, and trade openness on manufacturing efficiency within the ASEAN context over the long term.

This study seeks to address this gap by evaluating the technical efficiency of the manufacturing sector in six ASEAN economies, Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam, over the period 2000 to 2022. Technical efficiency scores are estimated through Data Envelopment Analysis (DEA), while Tobit regression is employed to identify the principal determinants. The findings are expected to offer evidence-based insights to inform industrial policy, particularly with regard to attracting FDI, promoting macroeconomic stability, and addressing demographic challenges.

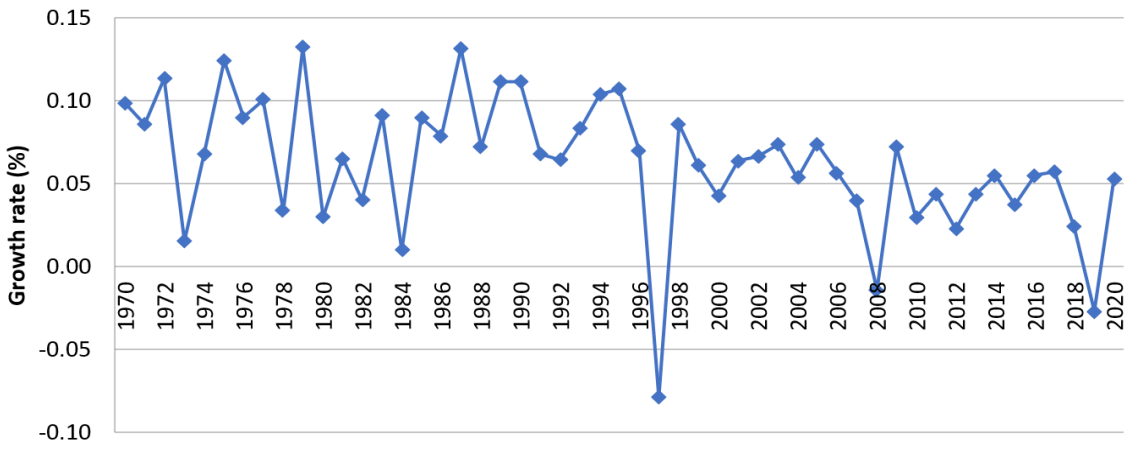

Figure 1. Growth rate of the output of the manufacturing industry in ASEAN (1970-2021).

Source: Asian Productivity Organization (APO) (2023).