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From Luminosity to Global Trade: A Cross-Country Analysis of Nighttime Economic Activity and Trade Composition

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Abstract

Over the past two decades, satellite-based nighttime light (NTL) data have emerged as an increasingly reliable proxy for economic activity. A large body of literature has identified strong association between nighttime luminosity and country's GDP. However, existing studies treat economic activity as homogeneous, focusing on aggregate production, without any distinction between traded and non-traded activities. So far, literature has not explored whether NTL is able to capture the differential dynamics of merchandise and service trade. Fundamentally, the production process for these two sectors is very distinct due to their intrinsic nature. Merchandise trade is heavily dependent on physical infrastructure intensive good production activities. On the other hand, service trade is heavily dependent on digital technology and less geographically constrained. These compositional differences suggest that nighttime luminosity can reflect heterogeneous patterns for trade-related production process across sectors as well as the level of economic development. Using a dynamic panel estimation framework for top 50 trading economies, we examine the relationship between fluctuations in nighttime luminosity and sectoral trade flows for 2013-2023. The analysis shows that nighttime activity is a significant indicator of trade across sectors but the nature and magnitude of the association vary with the level of development. For developed economies, nighttime activities have greater association with merchandise trade whereas for the developing countries, greater nighttime activities represent greater service trade. Results suggest that developing countries are integrating into global economy through services especially ICT-enabled ones, leveraging digital infrastructure and semi-and-low-skilled workforce.

Keywords: Merchandise Trade, Service Trade, Nightlight Data, Economic Development, Dynamic

Panel Model