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What drives the energy saving role of FDI and industrialization in East Africa?

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ABSTRACT

Analysis of the unconditional impacts of foreign direct inflows (FDIs) and industrialization on energy intensity does not show the hidden roles of some economic conditions such as income and trade openness. In this study, we focused on the conditional impacts of FDIs and industrialization on energy productivity using a panel data consisting of thirteen (13) East African countries covering 1980–2011. The baseline result shows that higher income and a well-integrated economy are pro-energy productive, but FDIs and intense industrialization are anti-energy productive in the sub-region. This result remains robust even when we exclude the high income group and control for income group effects. Income significantly promotes energy productivity more in low income group than middle income group. Intense industrialization and FDIs significantly decreases energy productivity only in low income countries. Trade openness significantly promotes energy productivity only in middle income group. We have shown that FDIs and income, intense industrialization and FDIs, and intense industrialization and globalization are complementary forces that promote energy productivity in East Africa but this is more evident for the middle income group than the low income group in the sub-region. Based on the result, we recommend a quadruplet programme called the "Growth, Industrial, Foreign investment and Trade programme" **(GIFTP).** Last, our result suggests that unconditional analysis of energy productivity should not be seen as an end in itself but a basis for further analysis.

Contents

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1. Introduction

East Africa is an emerging sub-region in Africa with huge economic prospects and investment opportunities. However, energy insecurity is a predominant feature in the region (see [1,2]). With limited energy supply and higher demand for energy, energy security is a big problem in the region. For example, except for Mauritius and Seychelles, where electrification rate is close to 100%, the rest of the countries have rate of electrification below 60% (see Table A in appendix). Energy intensity remains high and continues to increase in countries such as Comoros, Madagascar, Malawi, Mauritius, Burundi, and Seychelles (see Fig. A in appendix). No definite trend is observed for Kenya, Rwanda, Mauritania, Zimbabwe, Uganda and Mozambique, but, looking at the levels, energy intensity remains high in these countries. The trend is declining in Zambia which is good but the levels still remain high. On the whole, we can conclude, based on the data presented, that energy intensity is high in the region. This is an indication that more energy is required to produce a unit of output in the sub-region. Thus, energy is not used efficiently in the region. Given the close link between energy consumption and climate change (see [3–5]), the current energy use pattern in East Africa has important implications on the region's environment. For instance, carbon dioxide emissions from energy sources in the region have, on the average, increased (see Fig. B in appendix). Since there is an important link between energy efficiency and security of the energy system, between energy efficiency and sustainable development, and between energy efficiency and environmental quality, investigating the drivers of energy productivity has important policy implications for ensuring a secure energy system, sustainable economic development and environmental quality in the sub-region.

Increasing the flow of foreign direct Inflows (FDIs) and promoting industrialization has important implication for energy use patterns in the region. Over a decade now, FDIs have increased substantially in Africa. According to a study by African Development Bank, the Organization for Economic Cooperation and Development (OECD) and the United Nations Development programme, external financial flows to Africa have quadrupled since 2000 (see [6]). In East Africa, FDI projects have grown at a compound annual growth rate of 19.9%, the strongest in Africa since 2007 (see [6]). The high inflow of FDIs has both scale and technical implications for the sub-region. For example, FDIs are forecast to equal 7.2% of the continent's GDP [6]. In terms of the technical effect, FDIs promote domestic competition and investment in technology and that causes energy efficiency improvements (see: [7–9]). Despite the potential of FDIs to promote energy efficiency, energy intensity levels still remain high in the sub-region. This raises the important question; are there some country-specific conditions that affect how FDIs promote energy savings in the region? Cole [10] argues that the impact of FDIs on energy intensity depends on the economic environment and structure, stage of development and the price of energy in the country. Thus, there are potential important interactions between FDIs and other regional-specific conditions that may lead to desirable outcomes in the region's energy efficiency promotion. For example, lower income signals small market size to investors, and this may impede the inflow of FDIs that are energy-efficient. On the other hand, higher income signals large market size, and this may facilitate the flow of FDIs that are energy-efficient. Also, the structure of the economy determines which type of FDI is required. An economy dominated by the energy-intensive sector is expected to attract onto herself FDIs that are more technologically oriented. Likewise, growth of the service sector may attract FDIs that are less technologically oriented.

It is a fact that the industrial sector integrates well with other sectors in the economy. Therefore, promoting industrialization is a caveat to achieve sustainable economic development. However, due to the energy intensive nature of the sector, promoting industrialization leads to significant energy consumption and carbon dioxide emissions. By implication, while promoting industrialization will cause sustainable economic development, it will be at the expense of the environment. Governments in Eastern Africa have taken steps to achieve a self-sustaining industrial development and also improve upon the competitiveness of the industrial sector (see [11]). In November 2011, the East Africa Countries (EAC) industrialization Policy was approved by the EAC summit. The goal of the policy is to structurally transform the manufacturing sector via high value addition and product diversification. It is anticipated that the policy will promote sustainable economic development in the region. However, without any measures in place, achieving sustainable economic development via the EAC industrialization policy will be at the expense of environmental quality in the region. Searching for the connecting factors that could facilitate the integration of the goals of sustainable economic growth and environmental quality is a more enviable economic situation for any developing economy. Nonetheless, these connecting factors remain unknown in the sub-region.

The objective of this study is to investigate the specific regional conditions that enhance the energy-saving potentials of FDIs and reduce the energy requirement of the industrial sector in East Africa. First, we investigate whether the energy-savings effect of FDIs crucially depend on the level of income and industry characteristics. Second, we investigate if technological diffusion through trade and FDIs leads to significant reductions in industry energy requirements in the sub-region. There are studies that have analysed the implications of FDIs on energy intensity (see [7,8] and [12–15]), FDIs on energy consumption (see [16–18]), industrialization on energy intensity (see [14] and [19–22]) and industrialization on energy consumption (see [21,23,24]). The main problem with these studies is that they assume the impacts of FDIs and industrialization on energy intensity or energy consumption to be unconditional. Thus, they ignore any potential important interactions between these variables and any other country/regional specific conditions. This makes the empirical models of these studies less insightful and rigid.

The main contribution of this study is that we estimate the conditional impacts of FDIs and industrialization on energy productivity. By allowing the impacts of FDIs and industrialization on energy intensity to be conditional, we introduce more flexibility