# *INVESTING ENERGY PRODUCTIVITY IN AFRICA: IMPACT OF ENERGY EFFICIENCY AND ECONOMIC STRUCTURAL CHANGE OVER 1990-2017*

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## Overview

Energy plays a key role in enabling economic growth. It is an important production factor particularly for many African economies, hampered by unreliable electricity supply and high energy costs. The extent to which different countries use energy as an input to generate economic output varies significantly (Liu et al., 2019). The quantitative assessment on energy productivity progress across African economies is yet scarce (Azhgaliyeva et al., 2020). Our study aims to fill this gap by investigating trends of energy productivity based on a sample of 22 African countries and the African continent over the period of 1990-2017.

In this study, we first provide insights into stylized facts of trends in energy productivity across African economies from 1990 to 2017. Second, we identify main drivers of energy productivity changes with a decomposition approach. Precisely, we distinguish the effect of energy efficiency technological change from that of the economic structural change- two major determinants of energy productivity. Finally, we apply the regression analysis to identity main drivers of energy indexes (intensity, efficiency and activity) derived from our decomposition analysis.

## Methods

As a first step, We use the convergence analysis to investigate the absolute level and growth rate of energy intensity of three sectors both collectively and separately across 22 African economies over the period 1990-2017. Sceond, we apply the well-known logarithmic mean divisia index method to decompose the changes in total energy consumption across 22 african economies from 1997 to 2017. Three factors are quantified, namely the activity growth effect, the economic structural effect, and the efficiency effect.

To further investigate the determinants of energy intensity, energy efficiency and economic structural change indexes across African countries, we use the regression models to include several relevant variables such as GDP per capita, energy prices, imports and exports as share of GDP. More specifically, we use mean group estimator (MG) of Pesaran and Smith (1995) that first estimates cross-section specific regressions and then averages those estimated individual-country coefficients to arrive at panel coefficients.

## Result

The convergency analysis shows that in Africa, countries with initially high energy intensity caught up with countries with initially low energy intensity between 1990 and 2017. While the energy intensity of the industrial sector converges quickly, the disparity of energy intensity in the agriculture and services sectors across countries still persists. The energy intensity level in the best performers stagnated, meaning that the technological innovations remain limited.

Our country specific decomposition analysis over the period 1990-2017 shows significant heterogeneous trends of energy efficiency effect and economic structural effect across 22 African countries. Energy efficiency effect, largely due to the technological change, contributed to increasing energy productivity apart from 8 countries (Botswana, Algeria, Namibia, Nigeria, Cote d'Ivoire, Senegal, Togo, and Mozambique). On the other hand, the economic structural effect in most of lower-middle and upper-middle income African countries contributed to improving energy productivity. Meanwhile, most of low-income African countries moved their economies towards more energy intensive production activities.

The panel regression analysis identifies energy prices as the prominent driver of energy productivity across African countries over the same period. Compared to the 1990 level, doubling energy prices in these African

countries is expected to reduce energy intensity and improve energy efficiency by around 12% and 17%, respectively. Our results also support the significant role of trade patterns in determining economic structural effect in African countries. Imports tend to substitute to energy intensive activities, while exports tend to encourage more energy intensive activities in African domestic market.

## Conclusions

The economic growth and improving living standards in Africa can involve both improving energy efficiency and rising energy consumption (Wei&Liu, 2017). This presents a challenge to track the energy efficiency role in this fast development context. It is important to remember that energy efficiency improvements do not necessarily imply using less energy, particularly in countries where access to energy services is still expanding and demand is not yet approaching saturation. Energy efficiency means that even though energy consumption is growing, it is growing less rapidly that it would have otherwise.

Energy efficiency can become core pillars of government policy in Africa. End-use energy efficiency investments must be considered on par with those in large scale energy supply infrastructure, given the fact that the African market continues to grow with considerable energy efficiency leapfrog opportunities.

## References

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