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Trade and consumption of energy varieties: Empirical analysis of selected West Africa economies

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ABSTRACT

This paper examined the relationship between consumption of energy varieties (total, electricity and road transport) and trade (export and import) in selected West African countries. Data spanning 1971 to 2010 was used to estimate vector error correction models (VECM) for 6 countries based on data availability.

Empirical analysis showed that there is insignificant linkage between consumption of energy varieties and export of Benin. However, there is a one-way positive linkage running from energy varieties to import of the country. For Cote d'Ivoire, energy varieties have insignificant relationship with export and import. However, while inverse relationship runs from export to both electricity and road transport energy consumption positive (direct) association runs from import to total energy and transport energy consumption. With respect to Ghana, positive causality runs from electricity and road transport energy consumption to export. However, there is a significant positive feedback effect between import and electricity as well as road transport energy consumption. For Nigeria, there is a significant positive link running from both electricity and road transport energy consumption to export and import. Senegal's case suggests a bi-directional inverse linkage between export and total energy consumption. For Togo, both export and import are insignificantly linked with energy use.

These mixed findings generate different policy implications across the selected West African countries, which are well articulated in the paper.

Contents

1. Introduction

The role of trade and energy in economic growth and development cannot be overemphasized. Available data from the World Bank [1] revealed that, over the past 4 decades, many West African countries witnessed rapid growth in income and energy

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production/consumption as well as trade. However, the dynamic effects of trade and energy on economic development have led to some challenges in policy making and debates. The Challenges in policy making and debates arose from the need to expand trade and the quest for energy conservation due to the nonrenewable nature of some energy sources. This informs the need for research to unravel the link between the two important subjects.

The relationship between energy and trade is a significant area of research on many grounds. For instance, if energy consumption Granger causes exports or imports, it implies that any drops in energy use arising from government policy such as energy conservation polices, will bring about reduction in exports or imports flows and hence, dampens the gains from trade. Alternatively, promotion of economic growth through increased trade facilitated by trade liberalization policies will be jeopardized by energy conservation policies. However, a unidirectional causality from exports or imports to energy will not make energy conservation policies at odd with trade liberalization policies articulated to increase economic growth.

Despite the fact that there is a huge literature on the relationship between energy consumption and national output (GDP) as will be seen in the literature review section, and even much more texts focusing on the association between GDP and exports [2–4] very little has been explored on the connections between trade and energy. This important fact was first made by [5] and subsequently reechoed by [6,7]. The fact that very few studies [5–12] exist on this subject is another confirmation.

This present paper differs from the earlier ones in a numbers of respects. First, this paper focuses on West Africa where (to our knowledge) no such study exists and therefore there appears to be little or no empirical basis for policy. Second, since it is possible that consumption of different energy sources produce alternative impacts on export and import, therefore a more disaggregated analysis is better for policy analysis (use of different energy variables instead of only one variable employed in earlier studies). Energy required for export production (electricity which is majorly hydro power) may be different from that required for transportation to the markets (transport sector energy such as gasoline, diesel and charcoal). Similarly, different energy may be required for various import purposes, and besides the welfare effect of different energy sources is diverse. This leads to the use of total energy consumption, electricity consumption and the transportation sector energy consumption in this paper. Trade facilitation involves a well functioning banking system, airports and transportation network which consume energy. About 30% of global energy consumption is traced to the transportation sector [7,13].

Third, this paper is motivated by the idea that a good and policy oriented empirical analysis should be based on a solid and clear theoretical framework. This point was earlier made by [7] who stated that the earlier analyses were ad hoc. Thus, instead of approaching the issue from energy demand theory only, we improved upon the significant work of [6,7] by considering both energy demand and trade theories so as to see the clear energy consumption-trade nexus. We also account for the peculiarities of West African economies in terms of dependency on energy consumption and trade such that we use relative price (real exchange rate) instead of absolute energy price employed in earlier studies[2]. Fourth, we conducted individual country level analysis to see whether there is heterogeneity of the interactions of the variables of interest across West African countries. Heterogeneity issue is also addressed by ensuring that our sample covers the two main West Africa's economic sub-groups (WAEMU and WAMZ) as well as income groups[3]. This is necessary in order to see whether it will be advisable to harmonise policy at regional (such as ECOWS) and sub-regional levels (such as within WAEMU or WAMZ).

The rest of this paper is organized as follows; section II is on the background information (stylized facts) on trade and energy consumption in the Selected West African countries, while section III is on literature review. The theoretical framework and methodology are discussed in section IV, while section V presents and discusses the empirical results, and section VI is on policy analysis, and conclusions.

2. Energy consumption and West Africa's trade

2.1. Trend and composition of energy consumed in West Africa

Per capita energy consumption in West African countries for which data is available is displayed in Fig. 1a–c. In comparative terms, per capita total energy consumption was higher in Nigeria and lower in Senegal during the period. The level of total energy consumption reflects the size of the economies and their levels of industrialisation. However, in relative terms, per capita electricity consumption was higher in Ghana, followed by Cote d'Ivoire, and lower in Benin, followed by Nigeria. Comparatively, per capita road sector energy consumption in the 1970s and 1980s was higher in Cote d'Ivoire and lower in Nigeria and Senegal. But in the 1990s and 2000s, the reverse was the case, as it was lower in Cote d'Ivoire and higher in Benin.

2.2. Trend and structure of West Africa's trade

Figs. 2 and 3 present export and import of goods and services across the selected West African countries. In comparative terms, Nigeria's export was the highest among the countries (multiples), while Benin and Togo witnessed lower values. Similarly, in relative terms, Nigeria's import was the highest, while Togo and Benin also recorded lower values.

3. Literature review on the link between trade and energy

A review of literature reveals that there have been a number of studies on the economic related energy issues, which can be divided into four broad areas. The first of these broad areas focused on the relationship between energy consumption and output/income-GDP. The second group is on the link between energy consumption, foreign direct investment (FDI) as well as financial development, while the third category analyses the energy embodied in trade. The fourth covers the link between energy consumption and trade

With respect to the spread of studies reviewed across the globe, there are economic related energy studies at the global and regional levels as well as by income level [12,14–21]. There are also cross-country analysis among the studies reviewed [12,22–28]. A number of country specific studies which have been done include those for Taiwan [29,30], Lebanon [31], China and India [32–36]. Other studies include those on Malaysia [37,8,9], Russia [38], Brazil [39], Pakistan [40–42], Greece [43,44], Indonesia [45,46], USA [47], Turkey [10], and Canada [48]. Some studies have been done for some notable groups such as Middle East and North Africa—MENA [49], OECD [50,11],

[2] Some earlier studies used Consumer price index because energy price is not available.

[3] WAEMU mean West African Economic and Monetary Union; WAMZ mean West African Monetary Zone; ECOWAS mean Economic Community of West African States. In terms of income level, Nigeria, Cote d'ivoire and Ghana have higher income than other countries in the sample.