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Determinants of import demand for non-renewable energy (petroleum) products: Empirical evidence from Nigeria



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HIGHLIGHTS

- Long-run and short-run drivers of import demand for petroleum products were estimated.
- kerosene import is income elastic, gasoline import is income and relative price inelastic.
- Exchange rate policies may have diverse effects on import of various petroleum product.
- Expanding market size has implication for import demand for petroleum product varieties.
- Import demand for petroleum products responds differently to various sectoral incomes.

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ABSTRACT

This study estimated determinants of import demand for refined petroleum products in Nigeria for the period 1984–2013. It employed the autoregressive distributed lag (ARDL) bounds test cointegration method and analysed both long-run and short-run determinants of import demand for total and specific petroleum products.

In the long-run, aggregate and sectoral incomes are significant determinants of import of refined kerosene. Further, real effective exchange rate (REER), aggregate income (GDP), manufacturing sector's income, domestic energy production (DEP) and population growth rate (PGR) are drivers of import of refined motor spirit. Moreover, REER, DEP and manufacturing sector's income are propellers of import of refined distillate fuel. Also, REER and total output of petroleum products are major drivers of total import of refined petroleum products.

Short-run results show that previous period GDP, PGR and manufacturing and service sectors' incomes are determinants of import demand for refined kerosene. Moreover, REER, GDP, previous PGR and manufacturing sector's income exert significant effects on the import of refined motor spirit. Further, significant effects of REER, DEP, previous PGR, domestic output of the product and manufacturing and service sectors' incomes on the import demand for distillate fuel were found.

Policy implications of the foregoing are articulated in the paper.

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1. Introduction

1.1. Research issues and motivations for the study

Energy has been universally recognized as one of the most important inputs for economic growth and human development (Sahir and Qureshi, 2007). Energy use in developing countries has risen more than four-fold over the past three decades and is

expected to increase rapidly in the future (International Energy Agency (IEA), 2007). A number of factors influence energy requirement of an economy, with economic growth being the most important. Economic growth is often accompanied by industrialization, transportation, electrification, ICT¹ and rapid growth of economic activities, all of which require various types of energy. The traditional production and growth theories focus much on labour and capital as major factors of production and

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ignore the importance of energy in the economic activities (Stern and Cleveland, 2004). There is rapid increase in demand for energy product as a result of expansion of economic activities and growth of household income which in turns raised their expenditure on automobiles, electrical appliances and other energy consuming products (Zhao and Wu, 2007). For instance, in Nigeria, the gap between energy production and consumption had been on the increase from 75,424.168 kt in 1971 to almost 139,641.359 kt in 2010 (World Bank, 2015).

Despite the fact that Nigeria is an oil-rich economy, domestic production has been largely crude, while consumption relies significantly on imports. Among the associated problems of the energy gap in Nigeria are insufficient and malfunctioning refineries and other energy generating facilities, inadequate pricing and corruption (Ishola, 2006; Diji, 2006). A number of reforms have been undertaken to address these energy generating problems. These include partial and full deregulation of the energy sector, articulation of energy master plan, liberalization of foreign investment regime and setting up of commissions for elimination of corruption (Ishola, 2006; Diji, 2006; Ibitoye and Adenikinju, 2007).

Based on findings from literature review, this paper contributes to the existing literature on energy demand particularly trade in energy products in the following ways. First, although there are many studies on energy demand in general as shown in Section 1.3, very few of them exist for Africa and Nigeria in particular (Ibitoye and Adenikinju, 2007; Dayo and Adegbulugbe, 1987; Enibe and Odukwe, 1990; Akinlo, 2008, 2009; Iwayemi et al., 2010; Oseni, 2012; Shaaban and Petinrin, 2014). Other energy related studies on Nigeria are those on oil price shocks (Iwayemi and Fowowe, 2011; Salisu and Mobolaji, 2013), linkages in the Nigerian oil and gas industry (Nwosu et al., 2006; Adewuyi and Oyejide, 2012), energy-trade nexus (Adewuyi and Adeniyi, 2015) as well as energy for sustainable development (Oyedepo, 2012, 2014). It should be mentioned that none of these studies focused on import demand for energy products. Thus, in spite of the role of energy import in economic activities in Nigeria, little is known about its determinants, which is a major gap in the literature.

Second, apart from the foregoing, generally, there is dearth of studies on import component of energy demand. The few studies that exist on crude oil import demand are those for China (Zhao and Wu, 2007; Roberts and Rush, 2012), Turkey (Altinay, 2007; Ediger and Berk, 2011), India (Ghosh, 2009), US (Camacho-Gutierrez, 2010), South Africa (Ziramba, 2010), Barbados (Moore, 2011), Korea (Kim and Baek, 2013), and Indonesia (Mardiana et al., 2013). Thus, only one of these studies was done for Africa, and none for West Africa which include Nigeria which heavily rely on import of refined petroleum products for economic activities. Moreover, the focus of the existing studies was on crude oil import and not on import of refined petroleum products at aggregate and product levels, which is the subject of this study. Further, most of these studies neither explored the standard import demand model for analysis nor examined the impact of sectoral income on energy import demand (apart from aggregate income), which is very important for sectoral policy on energy conservation and carbon emission reduction. In addition, the findings of these studies are inconclusive since the reported determinants and impacts varied. Also noticed in the trade literature is that, most previous studies have focused exclusively on aggregate import demand and disaggregated analysis (Goldstein and Khan, 1985; Santos-Paulino, 2002; Tang, 2003a, 2003b; Nayaran and Smyth, 2005; Adewuyi and Akpokodje, 2010) that concealed attention on energy import demand.

Third, this study provides empirical estimates of the determinants of energy import demand which would assist in the design of government policy in the following ways. It will aid the

projection of future energy demand and market behaviour. It will facilitate policy decision of government such as the determination of the foreign exchange requirement for energy products import and its implications for import of other products as well as the general economic activities in a country. It is also useful for analysing the implications of government policies and programmes such as currency depreciation or devaluation and industrialization for energy demand particularly import. It is also useful in the articulation of policies for managing the negative environment effects of the energy production and consumption. Also, the aggregate and sectoral productivity impact of energy import demand in a country can be analysed. It also provides a basis for analysing the impact of energy market growth on energy import demand, which has implication for domestic energy use.

It is against the above background that this study examines major determinants of import demand for refined petroleum products in Nigeria at aggregate and sectoral levels. The rest of this study is organized such that Section 1.2 presents stylized facts on petroleum import demand in Nigeria, while Section 1.3 contains a review of related literature on energy demand and energy import demand. Section 2 covers theory and methodology used in the study, while Section 3 presents and discusses the empirical results. Section 4 concludes the paper with policy implications.

1.2. Stylized facts on import demand for petroleum products in Nigeria

Nigeria's import of varieties of refined petroleum products is shown in Table A1. The import of petroleum products in Nigeria has been unstable since the 1980s, with motor gasoline being the largest among the products imported over the years (Table A1 and Fig. 1).² The trend of individual petroleum product was reflected in the total import of petroleum products during the period under review. The periods 1989–1993 and 1994–1998 appeared to be associated with the lowest imports of petroleum products in the country. This development could be associated with the civil unrest and the prevailing loss of business confidence that characterized the economy during these periods.

In Nigeria, domestic consumption of the various petroleum products has not matched the domestic production. Hence, there is observed production gap when domestic production was compared with domestic consumption. Moreover, for all the petroleum products, the trend of imports and production gap followed similar pattern over the years as can be seen from Figs. 2, 3, and 4 which are for kerosene, motor spirit and distillate fuel respectively. Similarly total petroleum imports and total petroleum production gap followed similar pattern for all the years since 1984 with near perfect match between 1999 and 2004 (Fig. 5). This suggests that the discrepancies between imports and production gap canceled out across varieties of petroleum products; thus reflecting the dynamics in the consumption of the various products overtime.

1.3. Literature review

1.3.1. Literature on energy demand

Energy demand literature is quite extensive at single-country level. However, results are mixed in terms of the direction of influence, as well as price and income elasticities of energy demand. For instance, some studies simply stressed that the direction of response of consumers' energy demand to changes in income and energy price followed theoretical expectation. In line with this,

² Note that the daily data were converted to yearly data by multiplying by 365.

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