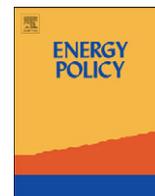




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Demand elasticity of oil in Barbados

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ABSTRACT

The importation of oil is a significant component of Barbados' imports, rising from 7% of imports in 1998 to over 20% in 2009. This increase has impacted greatly on the level of foreign reserves. As a price-taker, relying entirely on imported oil for our energy needs could prove a continuous drain on the economy. With a view to formulating an appropriate energy policy for Barbados, this paper analyses the demand for oil using monthly data from 1998 to 2009. The paper estimates the elasticities of demand for oil by employing Pesaran (2001) single equation cointegration approach and comparing the results with countries that rely heavily on imported oil and whose policy objective are to alter their energy structure to rely less on imported oil. The results show that the demand for oil imports is price inelastic in the long run. The consumption of oil is responsive to past consumption, prices, income, electricity consumption and the number of appliances imported in the short-run. A policy framework to reduce the use of oil for electricity consumption via alternative energy sources should be considered and the taxation of oil imports given its elasticity is a good source of revenue.

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1. Introduction

The importation of oil is a significant component of Barbados' import bill, rising from around 7% of total imports in 1998 to over 20% in 2009. It is now the highest category of imports, accounting for 20.8% of the import bill, surpassing food and beverages and machinery, which account for 16.9% and 14.7%, respectively, of total imports (see Fig. 1). Imported oil for energy has impacted greatly on the level of foreign reserves.

In addition, as a price-taker, depending entirely on imported oil for our energy needs could prove a continuous drain on the Barbadian economy. With a view to formulating an appropriate energy policy for Barbados, this paper analyses the demand for oil in Barbados using monthly data from 1998 to 2009 and comparing the results to those of countries which also rely considerably on imported oil but are naturally endowed or have invested in alternative sources of energy which may allow them to somewhat alter their energy mix. The study is different from the previous studies by Cox (1978) and Mitchell (2009) in that instead of using the international price per barrel of crude oil, it utilizes an aggregated import oil index¹ for Barbados which consists of namely; gasoline, diesel and fuel oil. This index is a better measure

of price in that it reflects the actual price that is paid for the refined product as oppose to unrefined crude. The use of the import price of oil² also accounts for the cost of insurance and freight paid by importers thorough the entire sample period. These costs were previously excluded from past studies in Barbados. The change in the price determination process over the sample period, where a subsidy³ protected consumer from the full pass through of crude oil price increases is also taken into account with the use of the import price index. It is different from the studies by Durant (1991) and Carter et al. (2009), which are confined to one section of energy demand by estimating the demand for electricity. It also tests for the relevance of factors other than income and price such as household appliance and motorcars use in determining the level of energy demand.

The paper estimates the elasticities of demand for oil by employing Pesaran (2001) single equation cointegration approach. This technique performs well in small samples and allows for direct estimation of results, even when there is a mixture of nonstationary and stationary variables.

The paper is divided into five sections. Section 2 continues with a brief review of the literature. The selected model and data are discussed in Section 3, whereas Section 4 present the empirical methods and the results. Section 5 concludes the paper and offers some policy implications.

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¹ Individual price indices were constructed for gasoline, diesel and fuel oil using prices per barrel obtained from the monthly survey of Barbados National Oil Company Limited and the Paasche methodology. Weights were change each year to account for proportion in imports. The individual indices were combined to arrive at an aggregated fuel index.

² Oil refers to total consumption of fuel oil, gasoline and diesel oil.

³ The subsidies were a pricing mechanism by Government under which the Cost of Insurance and Freight (CIF) prices of oil products were not passed on to consumers.



Fig. 1.
Source: Central Bank of Barbados.

2. Literature review

The demand for oil proxied by some measure of energy consumption is conventionally modeled as a simple demand function comprising variables such as price, income, a measure to capture technological change and maybe a lagged dependent variable arising from the incorporation of a stock adjustment mechanism.

Durant (1991) adopts a partial adjustment mechanism to test the demand for electricity to Barbados for the period 1966–1988. He starts with the premise that household electricity consumption is the product of the stock of appliances and the rate of utilization of this stock. His findings indicate that real per capita income and the marginal price are the variables which best explain variation in average household electricity consumption.

Carter et al. (2009) use micro-level data to estimate a model of residential electricity demand for Barbados. The authors use the Heckman two-step approach (see Cameron and Trivedi (2005) for details) to regress a variety of household characteristics on the consumption of electricity. They utilize data taken from a Residential Customer Survey done by the Power Company in 1997 and include variables such as household appliances by type (a portfolio of appliances), income per household, numbers in household, average price of electricity, marginal price of electricity information and number of bedrooms. They estimate the price elasticities to be significant and varied by household according to the energy saving devices used. The results also show the income elasticities to be insignificant.

Mitchell (2009) estimates the demand elasticities for oil in Barbados using annual data during the period 1960–2005. He utilizes the error correction and Johansen (1992) Vector Error Correction techniques and reports that the results are consistent to those obtained in the literature, except for income elasticity of demand which appears to be relatively low. He also finds lagged demand and prices to be significant in the short-run, whereas no relationship is found between energy demand and the ratio oil imports to nominal GDP used as a proxy for efficiency.

Craigwell and Mitchell (2009) employ an asymmetric Error Correction Model (ECM) as well as a Threshold Autoregressive Process (TAR) and Momentum Threshold Autoregressive Process (MTAR) ECM to investigate whether there is empirical evidence of price asymmetric behavior between monthly gasoline and crude oil prices for the Eastern Caribbean Currency Union (ECCU) and Barbados during the period 2004–2007 using monthly data. A visual inspection reveals stickiness in ECCU and Barbados

gasoline prices to the consumer. Dominica's gasoline prices to the consumer, however appear to be fairly fluid, a result of the implementation of a pass-through of crude oil to gasoline price changes observed at the start of the review period. Results of the asymmetric ECM reveal that price increases persist in Antigua and Dominica but not in Barbados. Decreases from the equilibrium between crude oil and gasoline prices are quickly adjusted in Antigua and Dominica, while in Barbados expansions above the equilibrium relationship is adjusted but at a very slow pace.

Bentham and Romani (2009) emphasize the importance of employing the end-use price rather than the international price when examining the responsiveness of energy demand. The authors investigate the relationship between energy demand, economic growth and prices in 24 non-OECD countries using a panel data set, with sector level observations from 1978 to 2003, and a flexible specification. They use recently developed methods by Griffin and Schulman (2005) to control for unobserved trends such as technical change and apply them to new data set for developing countries with extended coverage and previously unavailable end-use price data. The results of Bentham and Romani (2009) conclude that not only the income, but also price elasticity of energy demand may be non-constant as the price level varies. They also confirm that energy demand is more responsive to end-use price than international oil price change.

Rather than adopting the international oil price change to model energy demand, this paper uses the end-use price as well as other factors which significantly impact on oil consumption in Barbados such as, electricity consumption, appliance use and the level of vehicle imports.

Before we begin to rethink or reshape our energy policy, consideration must be given to studies done in countries like Brazil where the importation of oil-derived products is one of the determinants of their balance of payments deficits, fiscal deficits and economic growth and government has responded by putting renewable energy programs in place to reduce the reliance on oil imports. Now Brazil is the only major economy in which there has been a substitute developed for gasoline. The same can be deduced from China which has an unbalanced product mix dominated by coal but is still very dependent on oil imports to satisfy its industrial demand.

Alves and De Losso da Silveira Bueno (2003) estimate the price elasticity of gasoline, cross-price elasticity between gasoline and alcohol and the income elasticity of gasoline following the co-integrating techniques of (Engle and Granger, 1987). They use annual variables such as gasoline consumption per capita, real per

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