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Evaluating a seasonal fuel tax in a mass tourism destination: A case study for the Balearic Islands

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ABSTRACT

This paper estimates the monthly aggregate demand for diesel oil and gasoline in a mass tourism region, characterized for a high level of seasonality. Using time series models, price elasticities are estimated with special emphasis in evaluating differences between seasons in order to assess the consequences of a fuel tax applied exclusively during the high season. Using the case study of the Balearic Islands (Spain) from January-1999 to December-2010 results from a partial adjustment model show a relatively low price-elasticity, evidencing how the internalizing mechanism that could be argued for introducing the tax in order to reduce transport externalities does not work. Additionally no statistical differences have been found between seasons for both fuels invalidating the argument that tourism activity reacts differently to host activity.

1. Introduction

Petroleum products demand has received a great deal of attention as a research topic during the last decades. Initially, since the 1973 oil crisis, a growing number of studies modeled demand for gasoline addressing concerns about the availability of this non-renewable resource. Most of those studies focus on the demand for motor gasoline for automobiles since the segment was relatively important and represented one of the highest growth rates. The quantification of price and income long-run elasticities of fuel demand was of paramount interest in order to project future trends of oil markets and to plan infrastructures and strategic reserves (Dahl and Sterner, 1991).

Whereas the last late century scientific research was fueled mainly by the threat of energy scarcity, nowadays environmental problems like the potential global warming change are becoming increasingly important. Recently, studies have directed the interest to the various environmental consequences of petrol consumption, particularly with respect to the emission of greenhouse gases (Gallo, 2011; Kyle and Kim, 2011; Marrero, 2010). In this new context, accurate estimations of petrol demand are also important because of the wide range of fiscal instruments that are worldwide applied.

The need for mechanisms that promote more efficient use of transport has encouraged the use of fuel taxes or charges, given their considerable benefits in terms of the achievement of a “double dividend” through the improved efficiency of the tax system (Bovenberg and Mooijr, 1994) and efficient compliance with the “Polluter Pays Principle”. Because tourism is one of the most transport-intensive sectors, these principles have led to different purposes aimed to directly tax those activities less environmentally respectful, particularly the increase of fuel prices which is one of the last options that have recently emerged in the context of tourism policy (Mayor and Tol, 2010; Rothengatter, 2010; Tol, 2007; Zhang et al., 2010).

Recently Aguiló et al. (2012) contemplated the possibility of taxing gasoline and diesel oil fuels only during high season months in those destinations characterized by a high level of seasonality. The theoretical arguments for a temporal discriminatory fuel tax during the year include the high exportability of the tax, especially if it is applied during the high season an important part of the revenues from taxes will come from non-residents (e.g., by non-voters), and discouraging private road transport during the high season, which is one of the most important tourist externalities (Palmer et al., 2007).

The objective of this paper is to model and estimate diesel oil and gasoline demand with the aim of assessing the application of a fuel tax applied exclusively during the high season months. The paper is structured as follows. In Section 2 the relationship between gasoline demand and their determinants is discussed, with reference to the

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seasonal contribution of the tourism sector. In Section 3 methodological considerations and model specification are introduced. Section 4 presents data and results. Section 5 discusses policy implications and concludes.

2. Tourism and fuel demand from road transport

The tourism sector remains a controversial issue in sustainable development. Although tourism is considered an important source of foreign currency and contributes to the economic growth and the generations of jobs, the interest for their environmental consequences has been increased recently. Awareness about environmental impacts, their contribution to environmental degradation and climate change, because of the large quantities of fossil fuels that are required to operate, has centered the most recent literature (Bakhat and Rosselló, 2011; Konan and Chan, 2010).

Lundie et al. (2007) researched an environmental measure of tourism yield by input–output analysis showing that the major driving factor for energy input is accommodation, causing 16–29% of the total energy demand. Becken et al. (2003) also observed key tourism industry subsectors with the highest energy demand, notably transportation, accommodation, and activity in tourist attractions. Other studies suggested the relevance to research these three subsectors in terms of their onsite impact by energy consumption and transportation (Dubois and Ceron, 2006; Kelly and Williams, 2007).

The Environment Protection Agency estimated that 76.5% of greenhouse gas emissions of the tourism and recreation sector were caused by transportation (against 15% for lodging, 2.7% for restaurants, 1% for retail, and 4.8% that are activity-specific) in the United States (EPA, 2000). Although air transport is behind this preponderance, recent studies on social trend showed that tourism is highly influenced by income-driven lifestyles that increase auto-utility and energy use for pleasure and leisure, and thus, people tend to be more concerned with personal convenience than with environmental protection (Becken, 2004). With the significant increase of non-package holidays, tourist habits worldwide seem to favor a higher number of shorter breaks to short-distance, short-haul destinations, which in turn leads to increased mobility. Besides, the continued growth of low-cost airlines and the increasing use of the Internet will sustain this trend and give more extension to “self-service” tourism (Rey et al., 2007).

These new trends in tourism point towards an increase in tourist mobility in the host country or region. On the other hand, the growing road vehicle use implies an increase in mobility related problems, like atmospheric pollution, noise pollution, congestion and more accidents (Litman, 2009), as well as problems involving the over-congestion of natural spaces due to increased visitor numbers and difficulties in managing transport supplies for tourists visiting a specific location during peak or slack seasons (Batabyal, 2009). At this point it should be highlighted that the quality of the environment is an input in the tourism production function, playing a decisive role in the tourism experience and, by extension, in tourism demand. Thus, a reduction in the quality of the environment and over-congestion in certain places both have implications on a tourist destination's competitiveness (Dwyer and Kim, 2003). This highlights the crucial importance of policies aimed at reducing the negative costs associated with an increase in vehicle traffic. Consequently, transportation demand management strategies have become a central issue in regarding sustainable tourism policies in multiple destinations being the analysis of the fuel demands one of the key issues to be determined previous to the design of any policy.

To our knowledge, none of the fuel demand or tourism studies so far has used monthly time-series data to analyze fuel demand in tourism destinations. In this study diesel and gasoline demand price elasticities are also estimated to evaluate the consequences of a seasonal tax. Thus, the paper is a contribution to the literature, first, to formally test the relationship between tourism activity and the demand of road transportation fuels and, second, to providing a first evaluation of the effects of a seasonal fuel tax.

3. Methodology

Empirical studies of diesel and gasoline demand have received considerable attention in the literature. In its simplest form, the demand for fuel has been modeled as a function of real income and gasoline price (Birol and Guerer, 1993; Ramanathan, 1999). Empirical evidence show that characteristics related to geographic area, period and year of study and type of data have significant impacts on the estimated value of gasoline's price elasticity (Brons et al., 2008). Other variables are also considered, for instance, Bentzen (1994) and Polemis (2006) argued that a time trend should be included in modeling to capture the effect of increasing fuel efficiency and per capita vehicle stock (used also as a measure of income); Alves and Bueno (2003) incorporated real alcohol prices for the case of Brazil; and Sene (2012) considered population growth for the Senegal.

Functional specification of the demand equations has also a significant impact on the estimated value of the price elasticity of gasoline demand (Brons et al., 2008). Literature review reveals that the demand for fuel can be modeled as a log-linear function, in which demand depends on income, the price of oil and perhaps some other variable as those mentioned above. The log-linear demand function has been criticized in different ways. The most important criticism is that it implies constant elasticity for any range of values in the explanatory variables. However, the benefit of the log-linear is that coefficients can easily be translated into elasticity.

Based on previous literature, and considering the aim of this study, the simplest analytical framework that can be formulated considering the monthly aggregate long-run diesel and oil demand function is:

$$\ln G_{jt} = \alpha_0 + \alpha_1 T_{jt} + \alpha_2 \ln GDP_{jt} + \alpha_3 \ln P_{jt} + \alpha_4 \ln SP_{jt} + \sum_{k=5}^{m} \alpha_k X_{jt}^{k} + \mu_{jt} \tag{1}$$

where G is the fuel (diesel or gasoline) consumption at month j and year t; T stands for a linear trend that could be present in the time series as an indicator of increase in fuel efficiency; GDP is the income indicator; P is the real fuel (diesel or gasoline) price; SP is the real substitution fuel price (gasoline price in the vase of diesel and diesel price in the case of gasoline); X^k is a set of k determining variables related to tourism and population pressure; α_i $(i = 0, 1,\ldots, m)$ are parameters to be determined, and μ_t is the error term. It should be highlighted that α_i can be interpreted as the long-run elasticities as long as variables are expressed in logs and in levels. Otherwise, special emphasis in the study of the error term properties should be considered in empirical application in order to reject the spurious regression problem.

The basic double-log model assumes that elasticities are constant over each analysis period. However, factors such as the level and change in fuel price as well as to different behavioral responses may lead to differences in price elasticity estimated during different periods of the year. To investigate these issues, two dummies HS (high season) and LS (low season) can be included in the Eq. (1) to separate the effect of price changes. Thus, $HS = 1$ when $j =$ May, June, July and August and 0 otherwise, whereas $LS = 1$ when $j =$ January, February, March, April, September, October, November and December and 0 otherwise. Then, the extended model is:

$$\ln G_{jt} = \alpha_0 + \alpha_1 T_{jt} + \alpha_2 \ln GDP_{jt} + \alpha_3^{HS} \ln P_{jt} * HS_{jt} + \alpha_3^{LS} \ln P_{jt} * LS_{jt} + \alpha_4 \ln SP_{jt} + \sum_{k=5}^{m} \alpha_k X_{jt}^{k} + \mu_{jt} \tag{2}$$

In contrast to static models that provide average elasticities, partial adjustment model is a dynamic model that yields short and long-run elasticities (Crôtte et al., 2010; Houthakker et al., 1974; Li et al., 2010).