



## Expressway Traffic Demand Forecasts in the Volatile Economic Environment of Greece

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### Abstract

The forecasting of expressway traffic demand for existing facilities is not particularly challenging for regions and countries with stable or moderately growing economies. In most cases the objective is to carefully establish a reliable estimate for the average annual growth for the next N years using demographic and macroeconomic inputs. Recent applications for freeways and rural highways in Hawaii indicate that the traditional methods using time series or tracking important trends, such as tourism in Hawaii, work well for horizons between 5 and 20 years.

Models relying on growth do not adapt well to substantial decreases in traffic demand. A dramatic case is Greece, where a multitude of changes such as increased fuel taxes, reduced GDP, increased unemployment, increased car registration (or car ownership) taxes, and a collapsed new car market caused substantial reductions of traffic on all toll roads in the country, including the Attica Tollway in the capital city of Athens.

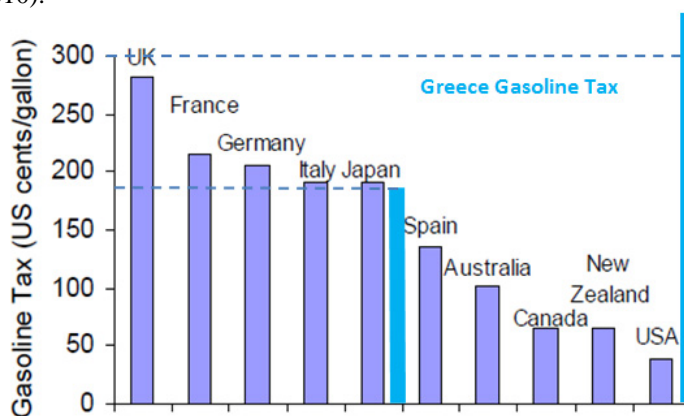
Given several series of high quality monthly data from January 2005 to December 2012, a number of estimates and forecasts for Attica Tollway toll transactions were estimated. Toll transactions are a measure similar to average daily traffic. ADT represents a traffic load at a specific location whereas toll transactions are the total daily vehicle entries to the facility. Then the 2013 to mid-2015 actual data were used to evaluate the models.

Autoregressive models were employed to arrive at toll transaction forecasts between 2013 and 2024. The models used International Monetary Fund (IMF) and Economist Intelligence Unit (EIU) forecasts of the GDP for Greece, as well as scenarios for future fuel prices. The impacts of the much increased fuel prices and of the economic and business downturns to traffic are obvious and the models capture them successfully. However, errors in the GDP forecasts cause errors in the predicted traffic. The stock market index appears to be a useful leading indicator with a two year lag.

*Keywords:* Traffic Toll Forecasting Athens Greece Economic Crisis Demand Elasticity

## 1 Background

Greece joined the European Union in 1981, adopted the Euro in 2001 and over the next seven years the country's GDP per capita increased from \$12,400 in 2001 to \$31,700 in 2008. The financial crisis of the developed world in 2008 combined with Greece's mounting public debt had a dramatic effect for the country beginning in the fall of 2009. On February 25, 2010, Greece enacted a substantial fuel tax increase. The gasoline tax increased by about 85%. The U.S. gallon is used so that the resultant taxes can be compared by inserting Greece's fuel taxation in Figure 1 of a report on fuel taxation (Litman, 2010).



**Figure 1:** Gasoline excise taxes in different countries.

Figure 1 indicates that until February 25, 2010 Greece had an average rate of fuel taxation, but after this date, Greece had one of the highest fuel taxes, as follows. Using mid-2010 values,

- “before” price of gasoline in Greece =  $0.296 \times 1.35 \times 3.79 \times 1.19 = \mathbf{\$1.802}$  per U.S. gallon
- “after” price of gasoline in Greece =  $0.530 \times 1.35 \times 3.79 \times 1.23 = \mathbf{\$3.335}$  per U.S. gallon.
- Equation=[price per liter]  $\times$  [Euro/US \$ exchange]  $\times$  [liters per US gallon]  $\times$  [applicable VAT rate]

A lesson from (Litman, 2010) is that every national economy is dependent on affordable mobility on a well-developed roadway network. Greece has been developing fast, high capacity urban and intercity motorway networks, but high transportation fuel costs should be expected to impede mobility and economic growth.

While Attica Tollway was exhibiting a robust annual growth of traffic, the sudden increase in fuel price significantly reduced toll transactions, as shown in Figure 2. Throughout this paper we use monthly toll transactions at all toll plazas to represent traffic demand. This ensures that all vehicles that entered the Attica Tollway are accounted consistently every month.

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