# IS DIESEL DEMAND AS PRICE AND INCOME ELASTIC AS GASOLINE DEMAND?

Ensieh Shojaeddini, Colorado School of Mines, +17203971660, eshojaed@mines.edu

Carol A Dahl, Colorado School of Mines, 1-303-273-3921, cadahl@mines.edu

Overview

Oil plays a key role in all economies especially in the transportation sector, which has led to continuous and growing global demand for gasoline and diesel for road transport as shown in the figure. The majority of expected future oil demand growth is also expected to be driven by the transportation sector. The International Energy Agency indicates transport's share of global liquids use is expected to increase from 54% in 2015 to 56% in 2040. The consumption patterns of these transportation fuels will clearly be influenced by the price of diesel and gasoline along with income and other socio-economic variables. To better
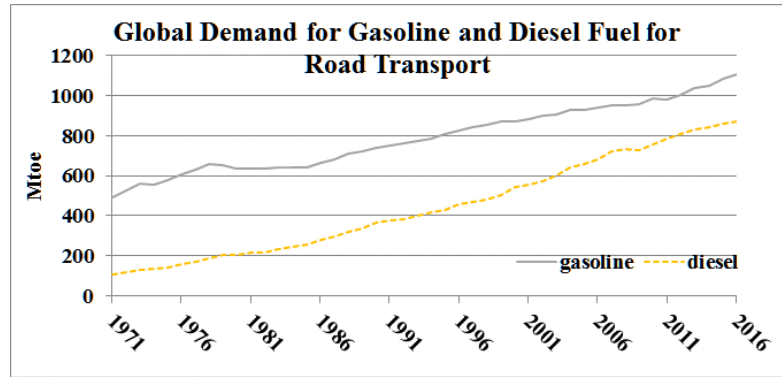
understand such shifts, both past and future. a variety of econometric studies have been done to try to quantify these effects. Gasoline demand studies have received the bulk of this attention. For example, Dahl (2010) found 247 studies for gasoline demand with 2365 estimates for around 80 countries and some cross-section time-series of countries. However, diesel demand studies are not nearly as numerous and she found only 63 such studies. Her summaries from these studies across diverse countries, time periods and methodologies suggest that gasoline may be more price elastic but less income elastic than diesel fuel. Dahl (2012) concentrated on econometric studies on static models. Again the studies varied by geography, model type, and time period but they again favored the hypothesis that gasoline was more price but less income elastic than diesel fuel. More recently, Labandeiraa et al. (2017) found 469 observations to do meta analysis on gasoline demand price elasticities and 136 observations to do meta analysis on diesel demand elasticities. Their results also suggested gasoline might be more price elastic. One contribution of this study contribution is to try to verify whether these results hold on models estimated with consistent data sets and methodologies.

The most comprehensive study that we are aware of that includes both gasoline and diesel demand is Al Dossary (2008) who estimates such demand for 23 countries. However, his data only goes through 2005. Thus, it does not include the massive price run up to 2008, the equally impressive price collapse of 2009, followed by recovery and the more recent recollapse and rebound. Nor does it include data on policy changes that have caused significant shifts of light duty vehicles toward diesel in some countries. Another contribution of this study will be to update and extend his study including data from 1970 to 2016 on 42 countries.

Methods

In this paper, we employ Al Dossary's model and estimate the following gasoline and diesel demand for road transportation on data from 1970-2016 for 42 countries representing the majority of current and potential future key consumers.

$$Q_t = \beta_0 + \sum_{i=0}^{n} \beta_{Gi} P_{G_{t-i}} + \sum_{j=0}^{m} \beta_{Dj} P_{D_{t-j}} + \sum_{k=0}^{p} \beta_{Yk} Y_{t-k} + \sum_{s=0}^{r} \beta_{Us} U_{t-s} + \sum_{v=0}^{w} \beta_{Iv} I_{t-v} + \sum_{x=0}^{z} \beta_{Fx} F_{t-x}$$

$$+ \sum_{l=1}^{q} \beta_{\lambda l} Q_{t-l} + \varepsilon_t$$

Where Q is per capita gasoline or diesel consumption in road transportation.

Y is real GDP per capita measured in 2000 local currency.

P_G and P_D are the prices of gasoline and diesel fuel in real local currency.

I is industrial share of GDP.

U is urbanization.

F is female labor force participation rate.

We use an Autoregressive Distributed Lagged Model (ARDL) method in our time series analysis, which nests seven alternative specifications, and the modelling technique is general to specific. This model allows us to more extensively test most of the models encountered in the gasoline and diesel demand literature including the error correction model (ECM). Although stationarity/cointegration testing is now standard practice, most of the older studies and even some of the more recent do not do such tests. As we will carefully test all data for all countries, our results may indicate which earlier estimates are candidates for spurious regression. Careful attention will be paid to whether results are stable across time and countries and whether the included social-demographic variables, not included in many previous studies, add to our understanding. In addition, we employ instrumental variables for prices to estimate the demand for large countries where the prices are expected to be endogenous.

Results

The length and breath of our sample will allow us to eventually test and answer some rather important questions about the current transport fuel market and its evolution including

- ✓ What are price and income elasticities for gasoline and diesel road consumption by country?
- ✓ Are these elasticities stable across countries and time?
- ✓ How are structural economic changes influencing these demands?
- ✓ What taxes would be needed to moderate the growing demand?
- ✓ How much do we expect demand to grow in the coming decade?
- ✓ Are gasoline and diesel fuel demand elasticities similar?

Conclusions

Given the importance of transportation and energy to our economy, environment, security, and personal well being, these esectors are often subject to a variety of policies. Understanding transportation fuel markets and their response to prices, income and other demographic variables will help inform policy makers on the implications of many of these policies. For example, fuel price policies and their effect on fuel consumption have implications for traffic congestion, fuel consumption, and carbon emissions. Income elasticities will have important implications for the evolution of these markets and aid oil exporting countries in picking the timing of their diversification out of these markets and help emerging markets design transportation infrastructure to meet growing mobility needs while managing the negative externalities relating to traffic congestion and local pollution

References

Al Dossary, Nasser (2008) "Global Demand for Road Transport Fuels" Ph.D. Thesis, Mineral Economics Program, Colorado School of Mines, Golden, Colorado.

Dahl, Carol A. (2010) Gasoline and Diesel Text and Bibliography Gasoline and Diesel Databases: http://dahl.mines.edu/courses/dahl/dedd/DEDD-D&G2010.doc.

Dahl, Carol A. (2012) "Measuring Global Gasoline and Diesel Price and Income Elasticities," Energy Policy, Special Issue on Transport Modelling.41 (February), 2–13.

Xavier, Labandeiraa, José M. Labeagac, Xiral López-Oteroa (2017) A meta-analysis on the price elasticity of energy deman, Energy Policy, 102(Supplement C), 540-568.