

# ***DIESEL OIL DEMAND IN BRAZIL: DETERMINANTS AND 2030 FORECAST***

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## **Overview**

Fuel consumption increased strongly in the last fifteen years in Brazil. Diesel oil consumption was 35 billion liters in 2000 and 59 billion liters in 2014. It corresponds to a 4% growth rate by year (EPE, 2014). As Brazilian diesel production grew at a slower pace, diesel imports almost doubled, from 6 billion liters in 2000 to 11 billion liters in 2014.

The transport segment (freight and passengers) was the main determinant of diesel demand growth in Brazil. It increased at a 7.2% rate a year between 2000 and 2014. Due to government incentives, 312 thousand new trucks were sold in 2011 and 2012 (EPE, 2013).

The increase of diesel imports is currently a major concern of Brazilian authorities. New refineries were planned but as Petrobras is in a deep financial crisis, projects were postponed or suspended. As refine activity is not attractive in Brazil, the domestic supply must not increase substantially in the next years.

The objective of this paper is to analyze the determinants of diesel oil demand from 2000 to 2014 and to forecast demand from 2016 to 2030. We use state level annual data to estimate a dynamic panel data model. Our intent is to contribute for the Brazilian energy planning throughout a robust analysis of diesel demand, which can be useful for demand management and supply decisions.

The paper is organised as follows: The next section describes the methodology used to forecast diesel demand and shows the dataset used in the paper. The third section presents the results of the forecast. Finally, the fourth section concludes the paper and provides some directions.

## **Methods**

Diesel oil demand was estimated through a dynamic panel data model. The demand specification can be represented by:

$$q_{it} = \rho q_{i,t-1} + X'_{it}\beta + u_{it}; i = 1, \dots, N \text{ and } t = 1, \dots, T \quad (1)$$

where  $q_{it}$  is the diesel demand at the state  $i$  and time  $t$ ,  $q_{i,t-1}$  refers to demand in time  $t - 1$ ,  $X'_{it}$  is a vector of other variables that influences demand and  $u_{it}$  is the regression error. The error can be decomposed in  $u_{it} = c_i + \varepsilon_{it}$ , where the fixed effect  $c_i$  is the non-observed specific features that are constant in time in each Brazilian state and  $\varepsilon_{it}$  is the idiosyncratic compound. We suppose  $c_i \sim IID(0, \sigma_c^2)$  and  $\varepsilon_{it} \sim IID(0, \sigma_\varepsilon^2)$ .

To handle the endogeneity problem that results from the inclusion of the autoregressive term we applied the Arellano and Bover (1995) and Blundell and Bond (1998) method. The System Generalized Moments Method (System GMM) considers a system with variables in level and in first differences.

Based on this econometric model, diesel demand equation can be specified as:

$$q_{it} = \beta_0 + \rho q_{i,t-1} + \beta_1 P_{it} + \beta_2 Y_{it} + \beta_3 F + \beta_4 P_{oit} + \beta_5 D + u_{it} \quad (2)$$

where  $P_{it}$  is the diesel oil price in the state  $i$  and time  $t$ ,  $Y_{it}$  is income,  $F$  oil diesel fleetand,  $D$  is aregional *dummy* that identifies North, South, Center Westand and Souteast regions.

From the estimated equation (2), we simulate future demand of diesel oil until 2030 to evaluate impacts of different economic scenarios on supply and demand balance. Those scenarios include oil diesel price, income and fleet.

The data set was provided by the Oil, Natural Gas and Biofuels National Agency (ANP), by the Energy Research Company (EPE) and by the National Traffic Department (Denatran). The data is annual and covers the period from 2000 to 2014 for the 26 states and the Federal District.

## Results

By the econometric analysis, we conclude that diesel demand is inelastic to price variations. An 1% increase in diesel oil price will cause a 0.2% reduction on diesel consumption. This low price elasticity is due to the lack of substitute fuels.

Diesel demand is also inelastic to income variations. An 1% increase on consumer income will result in a 0.1% increase in diesel oil demand.

In our diesel oil consumption forecast, it shows a moderate growth from 2015 to 2017. After 2019, consumption growth accelerates as Brazilian macroeconomic situation improves. Table 1 shows the forecast of the consumption and production of diesel fuel in the Brazilian market.

Tabela 1. Demand and Supply Balance: 2015 – 2023

	2015	2016	2017	2018	2019	2020	2021	2022	2023
	$10^3 \text{ m}^3/\text{d}$								
Supply	154,00	162,46	177,08	178,97	181,71	181,87	182,03	182,18	181,18
Demand	161,24	167,30	173,99	181,00	188,65	196,30	204,58	213,50	216,36
Balance	-7,24	-4,84	3,10	-2,03	-6,93	-14,42	-22,55	-31,32	-34,17

Source: Results obtained

In the demand and supply balance, we see that Brazil will be a net importer of diesel for most of the years. We estimate exports only in 2017. After 2019, diesel oil production will not be enough to match the increasing demand. So, diesel imports upsurge again.

## Conclusions

Regarding the relevance of oil diesel consumption for the fuel sector in Brazil, this research estimated the demand determinants and developed a long term forecast model for oil diesel demand in the Brazilian transport segment.

The demand forecast for 2016-2030 indicates a strong demand increase in our reference scenario. So, Brazilian energy policy must consider it as to provide security of supply of this .

In our reference case scenario, the entry of the two new refineries (Abreu e Lima and Comperj) won't be enough to compensate diesel demand growth. As Brazilian economy recovers, diesel oil imports increases.

## References

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