

Chapter 12

Option Value Embedded on the Brazilian Flex and Sustainable Vehicles

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ABSTRACT

The Brazilian auto industry has changed significantly since 2003 by the introduction of the flexible fuel vehicles that can run with any mix of gasoline or sugarcane ethanol. Sugarcane ethanol is a well-known renewable fuel and an efficient alternative to fossil fuel due to its high energy yield and its great sustainable potential for fixing carbon dioxide. Consumers see great opportunity in acquiring a flex fuel vehicle, because car owners can select the fuel by considering its relative price and sustainable profile. This study applies the real options methodology to capture the worth of owning and operating a Brazilian flex fuel vehicle, regarding the relative prices of the two fuels. The more uncertain the relative prices of fuels the more valuable the option value embedded in Brazilian flex fuel vehicles becomes. The authors develop sensitivity analyses regarding different scenarios on Brazilian fuel markets and discuss their impacts.

INTRODUCTION

Brazilian flex vehicles are a reality and they are running since 2003 when Brazilian auto industry introduced the first flex cars that could use any mix of gasoline and ethanol for refueling. Brazil has a successful history in ethanol production and also

a established distribution ethanol infrastructure all over the country that resulted from the conception and diffusion of the ethanol car in the end of 1970, with the Proalcool (National Program for Ethanol) in 1975 (Nascimento, Yu, & Marques, 2009; Yu, Nascimento, Nigro, Frederick, Junior, & Mello, 2009).

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By 2010, more than 90% of new cars sold in Brazil have flex fuel engines (Nascimento, Yu, & Marques, 2009; Nascimento, Yu, Quinello, R., Russo, Nigro, & Lima, 2009) that also constitute around 50% of the whole Brazilian car fleet. The flex fuel vehicles play an important role, not only for each consumer, but also for the whole Brazilian economy due to the savings on fuel expenses, due their sustainable profile and also because they represent an important employment generator, opening working positions most in sugarcane cultivation, but also in ethanol production.

The Brazilian ethanol production is well known as the most efficient in the world and represents a great solution for the greenhouse effects problems because ethanol from sugarcane has the largest efficiency in energy transformation. On the other hand, Brazilian flex fuels cars can fix almost 90% of CO₂ used and created in the whole ethanol production and operation cycle (Nascimento, Yu, Quinello, R., Russo, Nigro, & Lima, 2009).

Thus, the objective of this work is studying the fuel expenses savings of a Brazilian consumer when operating a flex fuel vehicle. For this, we implemented a Monte Carlo simulation representing the evolution of both fuels prices in order to achieve the supposed option value embedded on the Brazilian flex vehicles. We have obtained the data for time series of both fuels from July 2001 up December 2009 from ANP (n. d.).

We conducted our research with two of the most sold Brazilian flex fuel vehicles: the FIAT Palio Flex and the Volkswagen Gol City Flex. We have considered two use lifetimes: 5 and 10 years. The study compares the total fuel expense during the use lifetime of the vehicle when operating just only with gasoline against the fuel expenses with the option that the consumer has, with flex fuel car, of refueling with the cheapest fuel at each refueling moment.

Our most important results show that Brazilian flex fuel vehicles present today an option value, that is, savings with fuel expenses of about 10% and 20% of their buying prices, respectively, for

5 and 10 years of time of use. Other important results show that these option values of the flex fuel vehicles are very sensitive to any improvements in the conditions of relations between gasoline and ethanol prices. Increases in gasoline prices as well as decreases in ethanol prices greatly improve the option value of flex fuel vehicles.

THEORETICAL BACKGROUNDS

This section presents a discussion about Brazilian flex vehicles and the real options theory applied in this study.

Brazilian Flex Fuel Vehicles

Since the Brazilian government created the Pro-alcool (National Program for Ethanol) in 1975, Brazil auto industry experimented a great and important history of development of engines and their more interrelated subsystems as fuel tank, fuel filters, pumps and others, always searching for their adequacy in order to work with ethanol fuel. The first ethanol Brazilian car was built in the end of 1970's (Nascimento, Yu, & Marques, 2009).

Brazilian flex fuel cars can run on any proportion of gasoline and ethanol in the tank. The vehicle owner has the option to choose the cheapest fuel between gasoline and ethanol in the refueling moment. More than 90% of Brazilian new vehicles are flex-fuel cars and also around 50% of the whole fleet of Brazilian vehicles is constituted by flex fuel cars.

Working together their most important fuel injection suppliers - Magneti Marelli, Bosch and Delphi - Brazilian auto industry developed the flex fuel vehicle in 2003 with several technological innovations. These innovations were concentrated mostly in the software processing of signals captured by a pipe oxygen sensor, which allows the software to estimate the gasoline to ethanol ratio presented in the fuel just burned, and consequently, the software can control the fuel and air mixture

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