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Introduction

Flex cars were released in the Brazilian market at the beginning of 2003. This type of vehicle is capable of running not only on gasoline but also on ethanol and on any mixture of the two fuels. From 2003 onwards, its sales have risen and in 2007 the market share of this new type of vehicle was approximately 90%.

One direct effect of the introduction of flex automobiles in the market regards the substitution degree between these two fuels. As percentage of flex cars grows in relation to percentage of cars that run only on one fuel, we might expect that the substitutability between gasoline and ethanol rises. This will result in a larger cross-price elasticity of demand between the two fuels.

The supply side of the market will also be affected. Considering fuel retail market as imperfectly competitive, we believe that fuel stations will respond to the raise in the degree of substitution between gasoline and ethanol on the demand side by strengthening the competition in the market. This supply effect implies that lower prices will be charged in this new equilibrium. As gasoline and ethanol become closer competitors, we also expect that the correlation between the two fuel prices will be higher.

This work will study the competitive effect of the introduction of flex cars on the fuel retail market in the state of Rio de Janeiro. We use a weekly survey carried out by the national petroleum agency ("ANP") that monitors the price charged by fuel stations and the price stations pay to fuel distributors over 38 municipalities in the state of Rio de Janeiro. We also have had access to stock of cars by fuel type in each city over time on a monthly basis. This data base is available from years 2002 to 2008.

We use panel data methods to examine gasoline and ethanol retail prices. We test the hypothesis that an increase in the percentage of flex cars reduces fuel retail prices. We also test the hypothesis that an increase in the proportion of flex cars augments the correlation between gasoline and ethanol retail prices, which is an indication of stronger competition between the two fuels.

Considering that in 2007 gasoline and ethanol average prices were R$ 2.57 and R$ 1.7 per liter, the results show that a 10% increase in the percentage of flex cars reduces ethanol and gasoline prices in approximately 14 cents and 18 cents, respectively. We also find that an increase in the percentage of flex cars augments the sensitivity between fuel prices, which is consistent with the interpretation of strengthened competition between gasoline and ethanol.

The fact that lower prices are being charged by fuel stations increases consumers' welfare. This welfare gain is not restricted to owners of a flex car. Consumers that drive mono-fuel cars are also facing reduced fuel prices due to the introduction of flex cars.

We run a series of regressions to test the robustness of our results.

First, we examine fuel retail margins instead of retail prices. We find that a 10% increase in the percentage of flex cars reduces both fuel prices in approximately 6 cents. The results are still significant. The sensitivity between the two margins also increases as percentage of flex cars augments.

Second, we verify the robustness of our results to changes in the regressors. More specifically, instead of controlling for the competing fuel price we control for the competing fuel cost. We expect that an increase in the percentage of flex cars will decrease ethanol and gasoline prices and augments the sensitivity between one fuel price and the cost of the competing product. The results are significant and corroborate our hypothesis.

Finally, we create a measure of spatial competition between stations based on the geographical distance between them. We add this control variable to our reduced form model.

As far as we know, the only work that studies the relation between flex cars and the fuel market is Ferreira, Prado and Silveira (2007). They build a partial equilibrium model that predicts consumers will buy a flex vehicle as long as its price is not too high when compared to a mono-fuel car and as long as there is a reasonable variation in gasoline prices. Their model also predicts that the relative prices of the fuels (ethanol price/gasoline price) will be constant and equal to the technical marginal rate of substitution between the two fuels (around 70%), given that gasoline price is not too high or too low. Apart from the model, they verify empirically if the substitutive character of ethanol and gasoline imply that their relative price is stationary. They find evidence in favor of stationarity, but the estimated equilibrium level is below the aforementioned 70%.

Alves and Bueno (2003) estimate the cross-price elasticity between gasoline and ethanol, but their analysis considers a time period before the release of flex cars (until 1999). They find a cross-price elasticity of 0.48 in the long run. They argue that this is a low value and its size is explained by the relatively high costs associated with changing from a car that runs on one fuel (gasoline or ethanol) to an automobile that runs on the other fuel.

This work also contributes to the literature on fuel retail markets, which is a prominent field of studies. Borenstein (1991), Slade (1992), Shepard (1993) and Borenstein and Shepard (1996), to mention just a few, study aspects that affect gasoline pricing decisions in retail markets. For example, Shepard (1993) investigate the manufacturer-retailer relationship and finds evidence that retail prices of some gasoline products are lower when the station is allowed to control the retail price directly.

This paper is organized as follows: section 2 discusses characteristics of the flex cars and of the Brazilian fuel market and explains the expected competitive effect of the introduction of flex cars on fuel prices. Section 3 describes the data we used and also shows some descriptive statistics. We discuss our empirical model in section 4 and present our results in section 5. We discuss the robustness of our results in section 6 and the concluding comments are offered in section 7.