PRICE RATE ANALYSIS OF GASOLINE, ETHANOL AND SUGAR BETWEEN 2001 AND 2015 IN BRAZIL

Igor Gimenes Cesca, PhD Candidade, University of São Paulo, Phone +55 19 3253 1234, E-mail: igcesca@usp.br;
Fernando Antonio Slaibe Postali, Tenured Professor, University of São Paulo, Phone +55 11 3091 5915, E-mail: postali@usp.br;
Virginia Parente, Professor, University of São Paulo, Phone +55 11 3091 2617, E-mail: vparente@iee.usp.br

Overview

In Brazil, ethanol and sugar production occurs through the same energetic input – sugar cane. In addition, it is important to consider that since 2003 there are flex-fuel vehicles that run either on gasoline, or on ethanol, or with any mixture of both. Thus, the dynamics of the price series of sugar, ethanol and gasoline directly affect producers, consumers and economic policies as well. In this way, a hypothesis was established of a conjecture about the existence of an interdependence between markets of vehicular gasoline, vehicular ethanol and domestically produced sugar. Finally, the objective of this work is to analyse the joint movement between such variables between the years of 2001 and 2015 and their implications in the Brazilian fuel market.

Methods

The databases collected for this research were time series of sugar product prices (paid to the Brazilian producer) and the fuels ethanol and gasoline. The periodicity of the data is monthly and it was considered from July 2001 until December 2015, totalizing 174 observations. It was also considered a dummy variable to model governmental interference in the price of vehicular gasoline between 2006 and 2014, reducing it artificially. In this way, this variable received value 1 in every month between 2006 and 2014 while in the other months of the observed period, it received a value 0.

In order to verify the conjecture of interdependence between markets, a model was elaborated to analyse the dynamics of the variable prices. This model quantified the relationship between the time series of price. Thus, in the modelling of the variables, once it was conjectured on the interdependence between markets, it was considered that all the variables were endogenous to the model, that is, a Z_t series was influenced by the other series of the model, just as Z_t was also influenced. Therefore, given an exogenous shock, the final value of the time series was a consequence of a reaction to the joint motion of all the model variables. Hence, it was important to isolate the exogenous shocks of the variable of interest to track its dynamic effect on the model. The ideal methodology for this is the vector autoregressive (VAR) modelling (ENDERS, 2008).

According to one of the assumptions of the VAR, the time series have to be stationary, that is, the stochastic process that generated the series has constant mean and variance, which can be verified through unit root tests. Nevertheless, if the assumption of stationarity is not confirmed, it is possible to model using the error correction model. This model consists of VAR with a cointegration vector. For the determination of this vector, the Johansen test (JOHANSEN, 1988; JOHANSEN, JUSELIUS, 1990) is used. The coefficients of this vector estimate the long-term relationship between the variables. Meanwhile, the coefficients of the error correction model inform the estimation of the short-term relationship between the time series.

Results

Firstly, all the parameters found in the cointegration vector of the error correction model are significant at 1%. In this way, it is confirmed that there is a long-term relationship between the time series of prices for gasoline, ethanol and sugar. In relation to the coefficient values of the cointegration vector for each time series, it is known that each of them quantifies the speed of the price adjustment for the long term. Thereby, the highest value was for the ethanol series, followed by the sugar series and, finally, the gasoline series. It can be added that the ethanol adjustment coefficient was almost three times the sugar adjustment coefficient and five times the gasoline adjustment coefficient.

The possible causes for a considerably higher value for the ethanol price series have their origins in the recent crisis in the sugar cane industry. As explained earlier, price control has reduced the profit margin of vehicular ethanol. Hence, there was a greater need for price adjustment for this product when compared to other products in order to pass on cost increases to the price of the same product. Despite the crisis in the sector, sugar had its price appreciated in the foreign market. Because of that, there was no need for sugar price readjustment.

As for the short-term relationship, the results for the dummy variable that models government interference indicate that this variable is significant at 1% for the gasoline and ethanol price series. As for the sugar price series, this dummy variable was significant at 10%. For all three cases, it was possible to verify that this variable has negative coefficients, that is, its participation implies negative prices. This occurred as expected, since the purpose of this interference was to contain the increase in fuel prices. Thus, the hypothesis that there was a governmental interference through the control of prices of vehicular gasoline is confirmed. It reduces the prices of gasoline and ethanol fuels. In light of the results obtained and the comparisons made with other studies, the governmental interference started to influence fuel prices in the short term, changing the market dynamics and reducing the role of the variables in determining the prices.

Besides, it was made an forecast error variance decomposition for the short-term analysis. Thus, the analysis of variance decomposition indicates that, for the time series of gasoline prices, this fuel was mostly influenced by its own price variation in the short term. However, as the months went by, the influence of the prices of sugar and ethanol on the price of gasoline increased. For the price of ethanol, in the first months, this variable is influenced by itself and by the price of gasoline. For the long term, as the months went by, the influence of its price and the price of gasoline decreased, while the influence of the sugar becomes more relevant. Finally, for the price of sugar, for both short and long term, this variable was influenced mainly by its own deviations.

Conclusions

As the present study indicated, the price control imposed by the Brazilian government on vehicular gasoline has changed the market dynamics of gasoline, ethanol and sugar products. With this interference, fuel prices became artificially smaller. As a result, changes in gasoline prices are explained by ethanol – in this case, anhydrous – only in the long-term, while vehicular ethanol received short-term influence of gasoline, since price control was done by means of this fuel. In addition, Brazilian sugar had its price appreciated in the foreign market in such a way that the mills chose to increase the production of this product. So, the price of sugar was not influenced by either the price of ethanol or the price of gasoline. On the other hand, the price of sugar explains the short and long-term variance in the price of ethanol and the long-term price of gasoline.

For a long-term analysis, the ethanol adjustment speed was also higher when compared to the others. The possible causes for this result from the fact that the price of gasoline is not adjusted regularly and, given the low return on investment (ROI) of ethanol, there was a greater need for price adjustment for this product, in order to pass on increases in costs for the price of ethanol itself. Therefore, it can be concluded that public policies for vehicular ethanol deserve greater attention for the future. After all, the consequences of such a price control policy were those responsible for reducing the ROI of the sugar and alcohol sector, since more than sixty mills were closed during the study period of this research (2001 to 2015).

More specifically on public policies, it is suggested that new policies should ensure that, in the short term, there is price transmission between automobile fuel (gasoline and ethanol), as well as ethanol and sugar. This suggestion would follow the same direction of the economic theory, as economic factors would become more relevant in determining the market price of products rather than exogenous factors, as was observed with governmental interference through price controls.

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