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Review

Can increasing gasoline supply in the United States affect ethanol production in Brazil?

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ABSTRACT

The increasing supply of non-conventional oil in the U.S. has changed the dynamics of crude oil market and the flow of oil products in the Atlantic Basin. The Gulf of Mexico (GoM) emerges as an exportation hub of oil products, contributing to a scenario in which gasoline prices tend to decline. Meanwhile, from 2010, the competitiveness of the Brazilian sugarcane ethanol has been ruptured by the country's gasoline price policy that had not followed international price parity. The political conjuncture of the U.S. incites high utilization rates of their refining system in the GoM. In this context the *profitability* of the ethanol business can be impacted in Brazil, by either the current policy of controlled domestic gasoline prices or a future scenario of declining gasoline international prices. Therefore, this study tests if this gasoline price scenario can compromise even more the competitiveness of the Brazilian ethanol. Particularly, for a scenario of falling prices, ethanol production in Brazil would be under strong pressure of gasoline supply coming from the U.S. This can impact Brazil's ethanol industry, whose development has been justified by climate change policies. In that sense, the paper also discusses the future opportunities and challenges for Brazil's ethanol industry.

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Contents

1. Introduction

Different studies have investigated the linkages between gasoline and ethanol in Brazil. For instance [5], estimated the impacts that price variations of Brent oil price have had over the price of gasoline ex-refinery prices in the Brazilian market. Then, they analyzed the hypothesis of ethanol price in Brazil being influenced by the price of Brent. The price of oil generally refers to the spot price of a barrel of benchmark crude oil. A benchmark crude or marker crude is a crude oil that serves as a reference price for buyers and sellers of crude oil. Brent Crude is a mix of crude oil from 15 different oil fields in the North Sea. From 2002 onwards, Dated

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Brent predominates as the dominant layer. The market layers with a physical component always kept a dominant role in process of Brent price formation [36].

In turn, several studies indicate that sugarcane-based ethanol is a fuel of high competitiveness [26,27]. According to Crago et al. [7] Brazilian ethanol supply has a large expansion potential, due to the low utilization rates of the country's productive lands. Actually, only 5% of productive lands in Brazil are devoted to sugar cane ethanol production [4], whereas the U.S. deal with a significant agricultural limitation. This also means that the U.S. face the challenge associated to biofuel competition against food supply, since biofuel net production requires more than 30% of the corn produced in the country (Westcott, 2007). In addition to the considerable expansion potential, Brazilian ethanol has a higher productivity comparing to the U.S. one, as it is possible to obtain 45% more ethanol by land unity, in relation to the corn-based ethanol [7].

However, while Brazil's sugarcane-based ethanol has showed competitive gains in the last decade in relation to the US corn-based one [3], and the gasoline as well [38], the first three years of the new decade points to an inversion of this trend and also indicates a contraction tendency for ethanol margins in Brazil.

The constant increasing of crude oil supply in the U.S. in the last years [15] has led to a new concern about the future competitiveness of both ethanol and gasoline in the Brazilian market. The empowerment of Gulf of Mexico (GoM) as an exportation hub of oil products (Diesel and gasoline to Europe and, especially to Latin America) can affect projects associated with Brazilian ethanol supply expansion. The increasing supply of tight oil, concomitantly with the oil products demand drop in the U.S. provided the main conditions to make the GoM region a major oil products exporter.

This study aims to analyze how the evolution of tight oil production in the U.S. (on a ten-year horizon) can affect the Brazilian ethanol competitiveness, as well as its unfolding on investments of the sugarcane-based sector in Brazil.

In addition, in 2015/2016 the fall of crude oil price (Brent) below $30 a barrel poses threats for the already challenged ethanol industry in Brazil. Ethanol has well developed manufacturing technology in comparison with long list of other renewable fuels that can be stored, such as biojet, biodiesel and green diesel found in literature. Hence ethanol can play an important role as energy storage device in smart grid technology. Notwithstanding, the importance of ethanol as green energy product should be highlighted in two directions:

1 Ethanol is the main fuel source liquid biomass that can be stored.
2 The ethanol is an agriculture product in which the living standards are interlinked.

This paper is structured as follow. Section 2 presents the driving factor behind the change in oil products flow in the Atlantic Basin. Section 3 analyses the competitive gains of Brazil's sugarcane-based ethanol along the last decade. Section 4 demonstrates how gasoline low prices can affect the utilization factor of ethanol plants in Brazil and the risk perception of the business, from the perspective of investing on new productive units. Econometric tests are also proposed to evaluate the impacts of an eventual drop of crude oil price on the gasoline exportations from the U.S. to Brazil, and on the ethanol profitability. In this section, the GoM marginal refining scheme is identified, being tested under different price levels, aiming to investigate the potential of gasoline exportation to Brazil and its competitiveness in relation to ethanol. Section 5 sums up the main conclusions of this article, highlighting the future opportunities and challenges for Brazil's ethanol industry, as the transparent pricing rule for oil products in Brazilian refineries and possible alternative uses for ethanol, as the utilization of flex vehicle technology in the electrical power production.

2. Why did the United States increase its exportation of oil products?

The 2008 economic crisis brought down the demand for oil in the US, notably by diesel [18]. The fall in the price of fuel in the US market (DOE, 2014) encouraged exports to Europe and to Latin America. In this context, the high degree of complexity of US refineries, particularly the PADD3,[1] provided competitive advantages over other refining plants in the world, which contributed to the growth of exports from the GoM.

In 2010, the growth in supply of tight oil in the US, concomitant with the recovery of oil demand, helped strengthen the GoM as the most important exporter in the Atlantic Basin, mainly due to regulatory constraints which prevented the oil flows out of the US (see Fig. 1).

When comparing under more details the evolution of gasoline prices[2] in the four main refining centers in the U.S., there is a detachment in the GoM price trajectory[3] regarding the observed values in other PADDs, from 2011, when USGC gasoline exportations become more relevant (see Fig. 3). This event has became more prominent with the increasing of the tight oil supply in the GoM, mainly in Bakken and Eagle Ford play, which impelled an investment wave in logistics to reverse the flows of crude oil forward the refining plant core of the region. In fact, since crude oil importation in U.S. represented a historical necessity and there was a pursuit to cater to the oil products demand, the oil pipelines net were built in order to supply the states in the middle of the country. The way to do it was to send oil from the GoM Coast to Cushing hub, Oklahoma (PADD 2).

However, the recent light crude oil supply excess due to the increasing of Bakken[4] and Eagle Ford[5] production has been contributing to WTI[6] price discounts, which results in a significant direct reduction of the refineries' production costs (Table 1).

Alike WTI, other North-American currents perceived discounts with the increase of crude oil supply in the U.S. The three crude oils produced in the U.S. are similar in quality in relation to Brent (STRUBE et al., 2012). Hence, the price discount of these currents relatively to Brent means lower cost to obtain the same oil products yield. This fact results in higher refining margins and, thus, competitive gain for the refineries in the U.S. in relation to other refining centers in the Atlantic Basin.

The general quality characteristics of oil production in U.S., based on the tight oil, are related to light oils[7] and low sulphur content. In this sense, US refineries ran into an availability of those

[1] *Petroleum Administration* Defense District (PADD) refers to the division that was made during the 2nd World War, in order to manage the crude oil resources. The refining capacity of PADD 3 (GoM) is around 9 MM bpd, the greatest among the 5 hubs in the U.S. (PADD 1, 2, 3, 4 e 5) [10,14].

[2] Regular Reformulated Retail Gasoline Prices.

[3] The oil products prices in the U.S. usually have followed the crude oil market with a short time-lag [22]. Therefore, an alignment between GoM ex-Refinery prices and Brent was always expected (see Fig. 2), being the latter the most important crude oil marker in oil products pricing in the Atlantic Basin.

[4] Field located mostly in North Dacota. It is the largest tight oil production in U.S [11].

[5] Field located in GoM, with the 2nd largest tight oil production in U.S [11].

[6] West Texas Intermediate – reference current of light oil price in U.S., priced in Cushing.

[7] According to the American Petroleum Institute rankings for light oil corresponds to API above 31.1 [39].

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