An Economic Model of the Contemporary Oil Market: OPEC and the New Competitive Fringe

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Abstract:

As a successful cartel, the Organization of Petroleum Exporting Countries (OPEC) has established itself as a critical player in the global market for oil. Using the theoretical model outlined by Dr. Lawrence J. White, we examine the oil market through the framework of the OPEC cartel acting as a dominant firm facing a global competitive fringe, specifically hydraulic fracturing firms. We show that, in a theoretical context with ceteris paribus assumptions, the presence of a viable competitive fringe could result in a net decrease in market price over time.

I. Introduction

The Organization of Petroleum Exporting Countries (OPEC) continues to, arguably, be the most powerful player influencing the price of crude oil and petroleum across the globe for the 50 years since its creation. In the past, OPEC, as a successful cartel, has been able to raise oil prices above a competitive market price level through restricting output, yet today the organization's behavior is very different, and it remains unclear whether OPEC was, or is, a profit maximizing cartel (Carlton & Pearloff, 2000). The organization's continued existence and influence is a notable phenomenon in itself – in the absence of legal protections, traditional economics would predict that such a collusive agreement would break down over time because one player can undercut the cartel's set price, extract a majority of the market share and earn excess profit. In defiance of this theoretical framework, the OPEC model has proven robust over time, though, as we will discuss later, the cartel does face challenges from time to time from some of the member states.

It is estimated that OPEC countries, namely Saudia Arabia and Iran, possess nearly 80% of the world's crude oil reserves. Since the oil embargo of 1973, the United States has increased its investment in its own reserves, although its market share still remains dwarfed by those held by the combined OPEC countries (Zhou 2014). The United States has failed to establish complete independence from OPEC, but fringe industries may be disrupting the current status quo. Hydraulic fracturing in particular, or "fracking" as it is commonly known, has become increasingly prominent in the United States. The U.S., along with other oil producing countries, cannot individually compare with OPEC's market power or output, but together, minor producers

constitute a competitive fringe of oil producers that is exerting a significant effect on oil markets, and is likely partially responsible in the global collapse of crude prices in the past 18 months.

In this paper, we will examine the global oil market through the framework of the OPEC cartel acting as a dominant firm facing a global competitive fringe. In doing this, we define the players and their characteristics, specify the conceptual model, which will be built off of principles from economics of industrial organization, discuss the equilibrium condition, and finally discuss future expectations, limitations, and considerations of the study.

II. Economic Framework and Model

There are at least a few economic models that can be used to describe OPEC behavior and its position in the oil market, with no general consensus as to which is best fit. As macroeconomic and geopolitical environments change over time, models become more or less robust and fall in and out of favor. Carlton and Pearloff (2000) specify at least 4 distinct models, each describing OPEC and the oil market differently. These models include: 1) That OPEC is a profit maximizing cartel; 2) Saudi Arabia (or the core OPEC group) is a dominant firm 3) OPEC aims to achieve political objectives rather than maximize profits; and 4) The oil industry is competitive. While each of these models has merits and useful descriptive power in their own rights, we use a slightly modified model that more accurately describes OPEC's current position in the global oil market and can be used to draw more insightful forward-looking conclusions about the market's direction. Essentially, the framework we specify is a combination of the first two models that Pearloff lists. We acknowledge that OPEC is a cartel (and will discuss some implications of this structure later in this paper), but believe that OPEC as a whole behaves as a profit maximizing dominant firm facing a competitive fringe playing a multiple period game in

which the firms choose output. This framework is not necessarily inconsistent with any of the other theories, and results in a relatively simple yet robust model to describe the market.

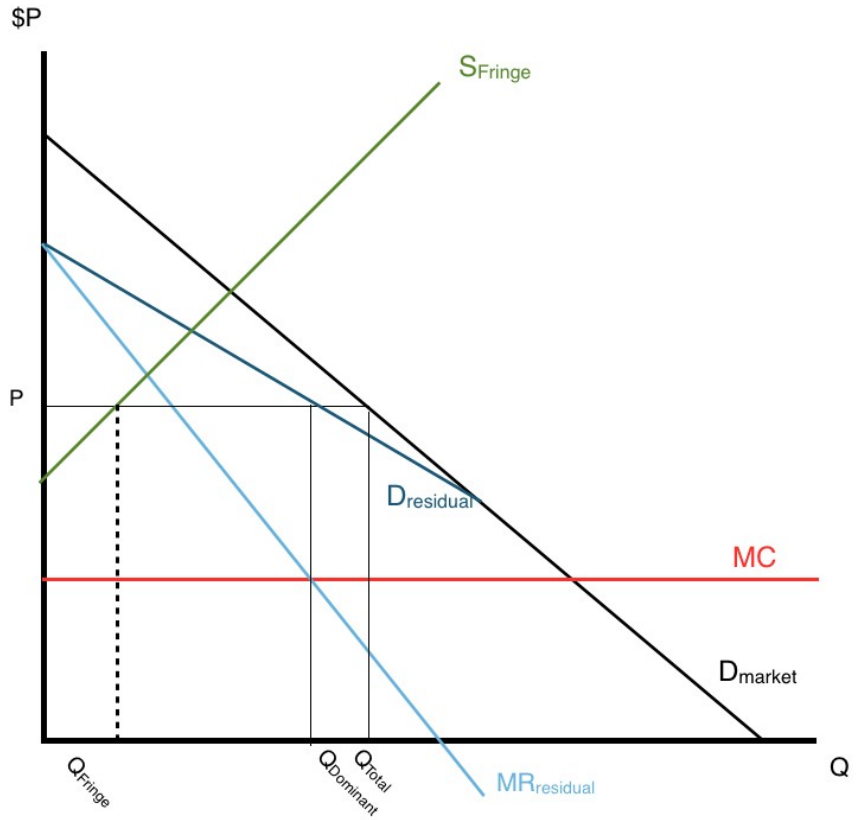
The Organization of Petroleum Exporting Countries defines its principle aim as the "coordination and unification of petroleum policies of Member Counties" (OPEC Statute, 1961). Despite certain member countries pushing for output reductions from time to time to raise prices to fund the countries own fiscal operations, generally over time, with confidence we can say that OPEC has behaved in the unified and highly coordinated way that its statute specifies. For this reason, we treat the cartel of OPEC member nations as a single dominant firm. Also, classifying OPEC as solely a cartel would imply that it has had the power to control market prices and output exclusively and successfully exclude the entry of new competitors into the market for oil production – an implication that is clearly not consistent with characteristics of the global oil market over the past decade.

Though OPEC is not the only player in the global oil market, it is clearly the player that exerts the most market power. Thus, we classify its position as the dominant firm and note its historically superior production cost technology that results from its significant economies of scale. In this framework, other active firms in the market are described as "fringe". For this concept, we build off the theory that the fringe, or "competitive fringe", consists of many smaller, reactive firms that produce an identical product but with an inferior cost technology (White, 2007). While recent technological developments, namely fracking, challenge the level of "inferiority" of the competitive fringe's cost technology, we will return to this idea later after developing the model under White's assumption that the competitive fringe has an intrinsic cost disadvantage. Essentially, as petroleum in its many forms is a commodity, so the model holds that the product OPEC produces is identical to the product the fringe is producing. White

correctly predicts that if the dominant firm – OPEC, in this case – cannot permanently eliminate the competitive fringe through pricing at or beneath costs, the dominant firm must tolerate their presence. It is here that we can begin building a model of supply and demand in the market given the current assumptions outlined by White (2007). The competitive fringe provides supply to the market that is then subtracted from the market demand curve to reveal the residual demand that is available to the dominant firm. From here, under the current assumption that OPEC is a profit maximizer, OPEC's action becomes clear and consistent with accepted principles of microeconomics.

The dominant firm maximizes profit when facing its residual demand by producing at the quantity where marginal revenue of production equals the firm's marginal cost. It is important to note that in this model, the dominant firm clearly exercises market power, as the price it charges is in excess of the price that would prevail if the market were wholly made up of competitive firms able to replicate the dominant firm's production technology (White, 2007). At higher prices, fringe firms are willing to supply more and replace the dominant firm's sales – a result that is consistent with past behavior in the oil market. Figure 1 below shows illustrates this framework graphically.

Figure 1: Dominant Firm Facing Competitive Fringe – Cost Advantage

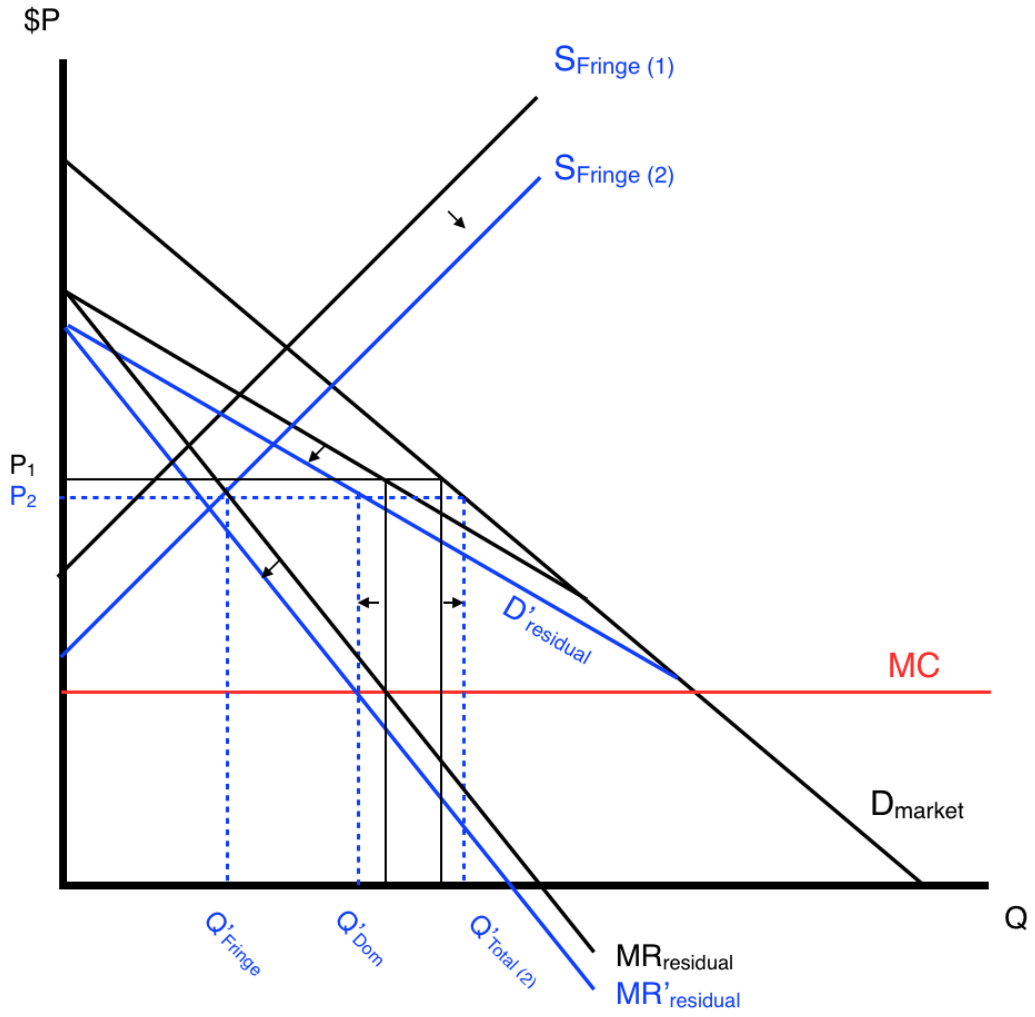


In the model outlined above, the equilibrium occurs at a total quantity that is the sum of the dominant firm's profit maximizing quantity when facing its residual demand curve and the competitive fringes' total output, which occurs where the fringe supply curve meets the price set by the output determined from the dominant firm's level of output. We can see graphically, that if the dominant firm dropped price below the the competitive fringe's marginal cost, as illustrated by the fringe's supply curve, the dominant firm could foreclose entry of competitive fringe firms. Given the current set of assumptions, such actions would not be consistent with a profit-maximizing firm playing a single period game.

While the model specified above may have meaningful power in describing aspects of the oil market of past decades, an important modification needs to be made in order to make the framework more representative of the extant conditions in the global oil market. As discussed previously, fracking as a technological development in oil extraction, does not suffer from nearly as severe of an inferior cost structure as the fringe firms faced in the past. Fracking has allowed for easier, more inexpensive entry into oil production and has allowed extraction in geographical areas that were previously under-utilized. Essentially, the dominant firm has lost some of its cost advantage when compared to the competitive fringe – the technological improvements and the expansion of offshore drilling in the United States and other developed countries have also increased the supply of petroleum provided by the fringe, thus shifting the supply curve outwards. As the fringe supply increases, the dominant firm loses some of its market share and market power as total market output increases.

Figure 2 below shows this modification to the original economic framework. As the competitive fringe's marginal cost of production decreases to levels closer to the marginal cost of the dominant firm (as evidenced by the fringe supply curve moving closer towards the dominant firm's marginal cost curve), and market price remains above both cost curves, the fringe can and will capture an increasing market share from the dominant firm. Consumers also enjoy lower market prices as additional fringe firms enter as well as depicted by a shift in price from P_1 downward to P_2. In other words, as more firms enter the fringe, the market becomes overall more competitive and efficient.

Figure 2: Dominant Firm Facing Competitive Fringe –Decreasing Cost Advantage

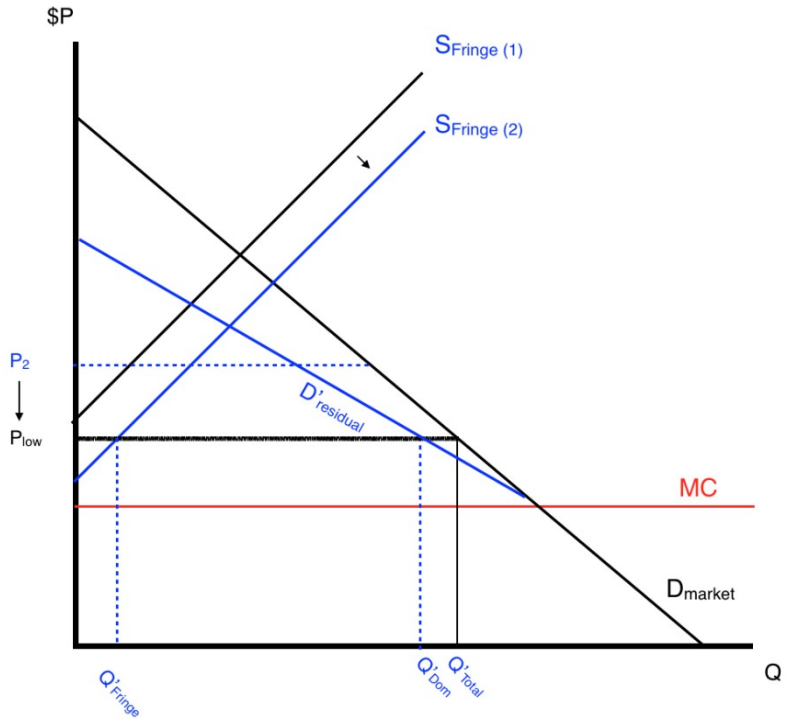


With the advent and adoption of fracking, as well as other causes of increases in supply from fringe firms such as expansions in offshore drilling, market forces have put downward pressure on price. Despite conventional economics dictating that because oil is a non-renewable natural resource, over time the price is expected to rise (Carlton & Pearloff, 2000), in the short and medium term, we expect the dynamics between firms to result in a very different outcome. OPEC has not been unresponsive in the face of these changing market dynamics as a result of the fringe, and in fact has reacted very clearly by using its cartel power to support output in hopes of

maintaining its market share. Essentially, even in the face of less profitable production, OPEC has increased output to reduce market prices in an effort to thwart entry from its competitors, and fight against losing its share of the market. In fact, the price of oil has fallen nearly 50% since OPEC declined to cut production at their meeting in Vienna late 2014 (Krauss 2015).

Figure 3 illustrates the pricing tactics employed by the oil cartel and the resulting impact on market equilibriums. Here we witness the dominant firm lowering market price (to the bolded black line, P_{Low}) by expanding production, despite the fact that pursuing such an action results in an output level, which is not profit-maximizing for a single period. One might predict that the cartel would commit to this level of output until supply from the competitive fringe is adequately suppressed. This assumption only holds, however, if fringe competitors hold inferior cost disadvantages in the production process. Under the cost structure of the competitive fringe of the past, as depicted by $S_{Fringe\ (1)}$, we would predict that output levels would return to the cartel's original profit maximizing output once competitors have been forced out. Due to changes in production and technologies and the increased prominence of fracking, however, the competitive fringe now operates on $S_{Fringe\ (2)}$, which as Figure 2 displayed, results in decreased market price in a medium-run equilibrium. Economists may be correct in assessing that the recent decrease in oil prices is the sole product of competitive pricing by the incumbent cartel (Rowell 2015). While we do not dispute this framework, we argue that, to the extent OPEC begins reining in production back to its profit-maximizing output, equilibrium prices should net in lower prices for consumers and increased market share from the competitive fringe.

Figure 3: Dominant Firm Drops Price to Maintain Majority Market Share



Returning to the original definition and expectations of a traditional cartel, we now finally consider whether or not OPEC should fear an evolving technology from a competitive

fringe. To reiterate, a cartel maintains its market power by establishing collusive agreements between its members, but if one or more members attempt to undercut another, the cartel is predicted to break down. A suitable competitive fringe may successfully disrupt the stability of collusive agreements by further influencing downward pressure on market price, as Figure 3 displays, thereby provoking more strained members to abandon the cartel. If OPEC continues to price significantly below the profit-maximizing output with the goal of forcing fringe competitors out of the market, players in the cartel may eventually remove themselves and produce according to their own individual cost curves. We may witness such behavior in the oil market today, as cartel member Venezuela has threatened removing itself from the cartel if OPEC does not begin raising prices in the near future (Faucon et al. 2014). As members begin to leave the cartel, market power exerted by OPEC should weaken, allowing for even more entry from a competitive fringe and subsequently lower equilibrium market prices.

III. Conclusion

Popular in the media is the notion that recent decreases in the prices of oil is the sole result of a dominating cartel pricing its competitors out of the market (Rowell 2015). The expected outcome of this narrative is often derived from the logic that, as OPEC returns to its profit-maximizing level of output after expelling its competitors, markets prices should increase back to their original levels, thus rendering the introduction of fringe competitors meaningless in terms of changes to market share and output. Although we do not contest that the recent price drop is the result of such practice, we argue that equilibrium prices should return to a lower level than before due to the shifted supply curve faced by competitive fringe firms.

We further hypothesize that as competitive fringe firms enhance their production process over time and garner greater market share, we predict that the collusive agreement set by OPEC should begin to dismantle over time. This effect will be especially magnified if OPEC continues to engage in pricing practices that exist solely to drive competitors from the market. Certain members of the cartel like Venezuela may abandon the agreement if they find that profits can be maximized by producing as an individual firm.

From a public policy perspective, we conclude that supporting investment in the fracking industry and other fringe energy sectors in the United States may be in the best interest for consumers, but only if it is the case that the fringe sectors hold decreasing cost disadvantages when compared to OPEC. It may also prove advantageous for the United States to subsidize such industries if OPEC attempts to reduce market price to eliminate competition.

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