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Disagreement in bargaining: An empirical analysis of OPEC

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Abstract

We consider a stylised model in which two cartel members bargain over the aggregate-production quota in a world of asymmetric information. We show that when the two cartel members are sufficiently different, the probability of agreement depends on both the current state of demand and initial production. Specifically, the probability of agreement is much lower when demand is low (and initial production is relatively high) than when demand is high (and initial production is relatively low). We also find that, regardless of the current demand state, the more extreme is initial production, the higher is the probability of agreement. Using an event study, where we take as events OPEC production quota announcements, we demonstrate empirically that the predictions of the model are borne out.

JEL classification: D70; D82; L13; L71

Keywords: Status Quo; OPEC; Collusion; Disagreement; Bargaining

1. Introduction

In this paper, we study whether agreements are easier to achieve when times are good or when times are bad. In the industrial organisation literature, this is an issue that has received careful attention starting with the work of Rotemberg and Saloner (1986) who, more precisely, ask when is it easier for firms to collude. In a world of i.i.d. demand shocks, Rotemberg and Saloner show that collusion is most difficult when demand is high. Subsequent work has provided conditions for which it is hardest to collude during recessions (see e.g., Athey, Bagwell and Sanchirico – henceforth ABS – (2004), Bagwell and Staiger (1997), Haltiwanger and Harrington (1991) and Staiger and Wolak (1992)). There is also some debate at the empirical level as to whether collusion is easier or harder to sustain during good times. Scherer and Ross (1990, Ch. 8) have argued that collusion is more difficult to sustain during recessions. Wilson and Reynolds (2005) provide empirical evidence consistent with the view that successful collusion is more difficult during booms, though they caution that other macroeconomic factors may be at play which are not captured by their oligopoly model (see p. 165).[1]

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[1] Although Wilson and Reynolds's model is non-collusive, many of its testable implications are identical to those of Staiger and Wolak (1992), which is a model of collusion. We will discuss Staiger and Wolak (1992) below.

We contribute to this debate by providing a model in which the probability of agreement depends on the current state of nature, and by providing conditions under which agreements are more likely in good times than in bad times. Our model eschews the traditional oligopoly models in favour of a bargaining approach. This is because our interest lies in examining the behaviour of the Organization of Petroleum Exporting Countries (OPEC) and we feel that the bargaining problem its members confront at each meeting cannot be ignored. OPEC is obviously a cartel that restricts output in order to obtain super-competitive profits and must be concerned with the incentives each of its members has to overproduce. Given the many folk theorems present in the literature, there is not a unique way to split the gains from cartelisation of the oil market, and the problem of splitting these gains involves a great deal of closed-door negotiations. At times individual members' posturing for market share leads to extended periods of inaction, causing lower (though still super-competitive) profits for all.

Before discussing the precise details of our bargaining model, we first motivate the necessary departure from the standard oligopoly models of collusion. Consider ABS (2004) who study optimal collusive behaviour when firms' marginal costs are subject to random shocks.[2] While they show that collusion is more difficult to sustain during bad times, their model makes other predictions which are not borne out in our data. In particular, market share instability is a key feature of ABS (and other models of collusion), since low-cost firms are allowed to undercut the monopoly price without fear of punishment in the low-demand state. In contrast, at least since the early 1980s, OPEC has been playing a quantity game, setting shares of an aggregate quota and allowing prices to fluctuate.

If one looks at Fig. 1, which displays each member's share of the aggregate quota over time, it appears that the shares of most countries have been relatively stable over time. There are a couple of exceptions but we feel that they have little to do with OPEC. For example, during the first Persian Gulf War, Saudi Arabia's share of the aggregate quota increased dramatically, while Iraq's and Kuwait's shares dropped to zero. Following the war, Kuwait's share recovered to its pre-war level, while Iraq's share has fluctuated widely for obvious political reasons. To a lesser extent Indonesia's share has declined, while Qatar and Venezuela have seen their shares increase over time. For Indonesia, this is due mainly to declining reserves, while the increased prominence of Qatar and Venezuela can partly be explained by the drop in Iraq's production after 1998. Hence, our point is not that OPEC shares have not changed, but that they are much more stable than received theory would predict.[3]

Another important stylised fact which motivates our bargaining approach concerns the size of shocks and the probability of agreement. In Section 3.4, we show that for large shocks (positive or negative) OPEC is more likely to reach agreement than for small shocks. In the model of Staiger and Wolak (1992), for small negative shocks, the maximal level of collusion decreases in a continuous manner, while for large negative shocks, collusion breaks down and players employ mixed strategies in the quantity-setting subgame. As with ABS, market shares are unstable but, beyond that, large shocks lead to unsuccessful collusion. In our bargaining model, the presence of private information creates a wedge between the interests of the proposer and the responder. Importantly, the size of this wedge is independent of the size of the demand shock. Therefore, for a larger demand shock, the private information is relatively less burdensome, leading to an increased likelihood of agreement.

We are not the first to discuss collusion and cartels in a bargaining framework. For example, Ray and Vohra (1997) use their model to characterise stable cartels, while Seidmann and Winter (1998) provide a brief discussion of cartels in the context of gradual coalition formation. In papers more closely related to ours, Cramton and Palfrey (1990, 1995) discuss cartel formation through the lens of mechanism design. The connection to bargaining is particularly strong in the latter paper where the authors include an explicit ratification stage. Finally, and perhaps most valuable to us, there is a survey by Levenstein and Suslow (2002) on what determines cartel success. In it, they argue that, "[b]argaining problems were much more likely to undermine collusion than was secret cheating" (p. 16). In addition they state that, "bargaining issues may arise as a result of a decline in demand" (p. 18). Scott Morton (1997) provides further evidence along these lines in her study of British shipping cartels arguing that, "It was much easier for a [cartel] to allocate six sailings a year to an entrant if the original members could keep their current schedules… Hence, increasing trade on a route made negotiating entry easier" (p. 702).

[2] In the context of OPEC, it may strain reality to assume that marginal costs are unknown and subject to random shocks; however, it is reasonable to assume that there are other economic and political factors, which are unknown and random, that affect a country's "opportunity" marginal cost.

[3] One may also be concerned that while quota shares have been stable over time, actual production has not. Cheating is a problem in OPEC; however, Kaufmann et al. (2004) have shown in a regression analysis that OPEC influences oil prices through two distinct channels: its announced quota and by how much it cheats on the quota. We focus on the former channel.