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Multi-market collusion with territorial allocation☆

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ABSTRACT

We develop a supergame model of collusion between price-setting oligopolists located in different markets separated by trade costs. The firms produce a homogeneous good and sustain collusion based on territorial allocation of markets. We first show, in a much more general framework than some earlier literature, that a reduction in trade costs can paradoxically increase the sustainability of collusion. Then we prove a new paradox in which the scope for collusion may be enhanced by an increase in the number of firms. The paper thus highlights several hitherto unknown theoretical implications of collusion under price competition.

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1. Introduction

Since the 1990s, there has been a dramatic increase in the prosecution of cartels by American and European antitrust/competition agencies. Many of these cartels have involved firms from more than one country, and many of these have been charged with dividing up international markets on the basis of territorial allocation. Typically, firms have reciprocally agreed to stay out of each other's home markets as well as other markets traditionally served by their rivals, respecting each other's "spheres of influence". Very recently (April 2014), the European Commission fined 26 European, Japanese and Korean firms who had cartelized international markets for high-voltage power cables. The modus operandi of the cartel was succinctly summarized by the Commission as follows:

> The cartel had two main configurations: (a) On the one hand, it had as its objective the allocation of territories and customers.… Pursuant to this configuration Japanese and Korean producers refrained from competing for projects in the European home territory while European producers would stay out of Japan and Korea. They also allocated projects in most of the rest of the world and made use of a quota arrangement for a certain period of time. (b) On the other hand, the "European cartel configuration" involved the allocation of territories and customers by the European producers for projects inside the European home territory or allocated to the European producers.[1]

Similar patterns of territorial allocation had earlier been found in many other cases. In 1994, the Commission fined 42 cement producers for (among other infringements) agreeing not to enter each other's home markets. In subsequent cases involving steel tubes and methionine, it found that European producers had agreed not to sell to each other's national markets and to Japan, with Japanese producers reciprocating. The same principle was discovered in a case prosecuted on both sides of the Atlantic involving American, German, and Japanese producers of graphite electrodes. Similarly,

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[1] Summary of Commission Decision of 2 April 2014 Relating to a Proceeding under Article 101 of the Treaty on the Functioning of the European Union and Article 53 of the EEA Agreement (Case AT.39610 — Power Cables), http://ec.europa.eu/competition/antitrust/cases/dec_docs/39610/39610_8248_3.pdf.

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in the choline chloride (vitamin B4) cartel, three manufacturers in North America reached an agreement (known as the Ludwigshafen protocol) with their three European rivals to withdraw from each other's home markets, and to share the Latin American and Asian markets.[2] Apart from these individual cases, a recent study of 81 international cartels detected by European and American competition agencies between 1980 and 2007 found that eighty per cent of them allocated territories or specific customers to their members (Levenstein and Suslow, 2011, p.475).

Historically, territorial allocation by international cartels was prevalent in the early twentieth century, when very few countries had competition laws and those that did were reluctant to enforce them even domestically, especially during the depressed 1930s. A study of 71 international cartels of the interwar period found that 30 of these involved exclusive territories; along with export quotas, this was the most frequent form of cartel organization in the chemicals and minerals industries (Suslow, 2005, Table 4, p.717). Even earlier, according to Notz (1920), 114 international cartels were known to have existed before the First World War, most of them involving territorial allocation. He described in this context cartels producing steel rails, quinine, aluminum, and explosives.[3]

Several common features are salient in these cases: (i) The cartels were based on *spheres of influence* (SOI) in territorial markets, respecting the home market principle. (ii) Most of them involved more than one firm in each territory, with firms sharing their domestic markets. (iii) These cartels were predominantly found in industries producing homogenous products. In this paper we provide a theory of cartels with all these features.

We consider a standard supergame model of collusion between price-setting oligopolists located in different markets separated by trade costs. The firms produce homogenous goods at constant marginal costs and try to sustain collusion based on territorial allocation of markets using a grim trigger strategy. We first prove that assuming one firm in each market, a decrease in trade costs may promote collusion, a result we call the *trade cost paradox*. Earlier authors have obtained this paradox, along with some other implications of collusion with SOI, using linear demand in a two-country setting. We extend these results to general demand, and to many countries, each with one firm. We show that while a decrease in trade costs increases the profitability of invading the foreign market(s), this is unambiguously outweighed by the increase in the severity of the ensuing price war, while profitability on the collusive path remains unchanged. The net effect is to lower the critical discount factor that is compatible with collusion.

Then we prove a new result that we call the *competition paradox*, which was hitherto unknown in the existing literature on international cartels. We show that under some parameter configurations the scope for collusion is enhanced by an increase in the number of firms. The presence of more than one firm in each country requires sharing of collusive profits in the home market, making collusion less attractive. But it also reinforces the severity of the punishment for deviation by making the non-cooperative equilibrium more competitive. On balance, starting from one firm in each country, a symmetric or asymmetric increase in the number of firms reduces the critical discount factor, creating greater scope for collusion.

The common feature of these two paradoxes is that pro-competitive changes in the economic environment might actually promote collusion. This runs counter to the conventional wisdom in economic thinking.

We proceed as follows. In Section 2, we set up a basic model of two markets separated by trade costs, with one firm in each market. We establish that collusion with firms monopolizing their home markets is an equilibrium if the firms do not discount future profits too heavily. We also derive some comparative static results on the effect of varying market sizes on the likelihood of collusion. We establish the trade cost paradox in Section 3, and generalize it to a multi-country setting. The competition paradox is analyzed in Section 4. In Section 5, we examine the robustness of some of our results by allowing for the possibility that in case of breakdown of the international cartel the firms can revert to a domestic cartel in their respective countries, if it is feasible. Interestingly we find that both our paradoxes continue to hold in this setting, providing a further generalization of the results. Conclusions and possible directions for future research are outlined in Section 6.

1.1. Theoretical literature

The possibility of SOI emerging as a collusive equilibrium in an infinitely repeated game was first demonstrated by Pinto (1986). Bernheim and Whinston (1990) formalized the analysis of multimarket contact, showing that cross-market retaliation against defection can reinforce collusion when firms compete in markets that differ in some respect. They showed that geographically distinct markets separated by trade costs are especially suited to collusion on the basis of SOI. Both papers assumed that deviation from the collusive arrangement would be punished by firms reverting to a more competitive outcome, but did not employ the standard grim trigger punishment involving eternal reversion to the Nash equilibrium of the constituent stage game. The effects of varying market size on the likelihood of SOI were analyzed by Lommerud and Sørgard (2001) with linear demand. They also obtained the inverse relationship between trade costs and the likelihood of collusion (what we call the trade cost paradox) with grim-trigger punishment.[4] We first prove both these results for general demand, and then extend the trade cost paradox to the case of more than two countries. Moreover, we go further to show how the relationship between the critical value of the discount factor that supports collusion and the level of trade costs depends on the convexity or concavity of the demand curve.

Several earlier authors have qualified the trade cost paradox. Lommerud and Sørgard (2001) showed that it disappears if the duopolists compete in quantities rather than prices; Schröder (2007) showed that it disappears if trade costs are *ad valorem* or fixed rather than per unit. Both these papers *assumed* that collusion would take the form of exclusive SOI, which is not always optimal for the firms. Two-way (intra-industry) trade can take place in a collusive equilibrium if trade costs are low enough. This possibility was analyzed in the case of two countries, each with one firm, by Bond and Syropoulos (2008) and Ashournia et al (2013) with quantity-setting firms, and Akinbosoye et al. (2012) for price-setting firms with differentiated products produced under constant returns to

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[2] These cases are drawn from Harrington (2006), Connor (2007), and De (2011), who also provide information on many other international cartels that functioned on the basis of global price fixing and sales quotas rather than territorial allocation. In many cases, territories were allocated by continent or country, while quotas were used to divide up the markets among firms within those territories.

[3] Most of the cases reviewed above concerned allocation of national markets by international cartels, but large domestic markets could also be carved up into exclusive territories. In an early American case interpreting the Sherman Act, six producers of cast iron pipe were found to have allocated specific cities among themselves (*Addyston Pipe & Steel Co. v. United States*, 175 U.S. 211 (1899)). For that matter, many of the recent EU cases involved territorial allocation within the integrated internal market of the European Union.

[4] This was independently proved by Gross and Holahan (2003), also using linear demand. In an appendix to their paper, Lommerud and Sørgard (2001) showed that the result held for inverse demand characterized by $P = 1 - q^b$ with $b > 0$, using numerical simulations for values of b.

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