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The effect of competition on trade: Evidence from the collapse of international cartels ☆

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ABSTRACT

How do changes in competitive intensity affect trade patterns? Some cartels may find it advantageous to eliminate cross-hauling and divide markets geographically. We exploit a quasi-natural experiment associated with increased antitrust enforcement to determine if market division strategies were used in seven recently-prosecuted international cartels. Since antitrust activity is unlikely to affect spatial patterns of demand and supply (other than through its effect on the competitive environment), enforcement-induced changes are ideally suited to study the effect of competition on trade patterns. Analyzing the cartels individually and as a group, we find no significant change in spatial patterns of trade following cartel breakup; in particular, there is no systematic change in the effect of distance on trade. These results suggest that cross-hauling is not uncommon under collusion and hence that the existence of cross-hauling by itself does not provide evidence of effective competition.

1. Introduction

The willingness of antitrust authorities, particularly in Europe and the United States, to prosecute international cartels has led to the detection and collapse of a large number of cartels.[1] What impact does this increase in competition have on trade patterns? We analyze seven international cartels – broken up by antitrust intervention – in order to improve our understanding of the relationship between collusion and trade.[2]

Brander and Krugman's (1983) seminal work demonstrates that Cournot duopolists may engage in intra-industry trade in homogeneous goods, as it is in each duopolist's self-interest to maintain prices so high that it attracts entry into its home market. Pinto (1986) and Fung (1991) extend this model to a repeated game environment and show that collusion is possible: there exists a collusive Nash equilibrium characterized by geographic specialization and enforced by a threat of Cournot reversion to the Brander–Krugman equilibrium. Baake and Normann (2002) and Bond and Syropoulos (2008) present models in which colluding firms rely on a market sharing arrangement where firms participate in both geographic markets.[3] The intuition from this set of papers is that, if firms are sufficiently patient, trade costs are high, and products are differentiated, a market division collusive arrangement is stable. A collusive equilibrium may still exist for homogenous products, or where transportation costs are low, or firms are less patient, but cartel stability then requires

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[1] See Evenett et al. (2001) and Levenstein and Suslow (2006) for an overview of international cartel prosecutions.
[2] Following a similar approach, Symeonidis (e.g., 2007, 2008) exploits changes in antitrust policy in the UK as a source of exogenous variation in competition to examine the effect of competition on productivity, innovation, concentration and profitability.
[3] The Brander–Krugman model in turn drew upon Smithies's (1942) model of basing-point pricing.

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market-sharing. Market-sharing reduces the profits of collusion, but it reduces the incentive to deviate more and so stabilizes collusion.[4]

Following the collapse of a cartel, the "geographic specialization" collusive equilibrium implies a significant change in trade patterns. The demise of a cartel will be associated with a weakening in the relationship between distance and trade, as under collusion firms would have been assigned markets based on distance. There will also be a decline in concentration as formerly forbearing cartel members enter one another's markets. On the other hand, if the collusive equilibrium was "market sharing," then we should see little to no effect on trade patterns, as cross-hauling is observed both before and after cartel breakup.

We selected seven cartels based on four criteria that establish both the appropriateness of the cartel to these models and the availability of data for empirical analysis. First, the cartel must be international in membership. Second, the cartel must have collapsed because of antitrust intervention. Third, there must be a close match between the product affected by collusive behavior and the trade data. Fourth, we must have a reliable measure of the date of cartel breakup. Seven commodity chemical cartels operating in the late twentieth century satisfy all four of these criteria.

Finally, in order to assure that these cartels were strong enough to have affected trade patterns, we verify that they were successful in raising prices. If observed prices were not higher during the cartel period, we would infer that the cartel was ineffective and would expect no measurable change in trade patterns following its collapse regardless of the intended collusive behavior. As Fig. 1 shows, there were significant declines in prices following the breakup of each of the cartels selected for analysis.[5]

We examine the effect of cartel breakup on spatial market share patterns, specifically the effect of distance on trade, by estimating a gravity equation.[6] In general, our results are consistent with market sharing during collusion in that we find no significant change in the coefficient on distance in our gravity estimates. We also look for changes in concentration following cartel breakup. We consider several measures of concentration, including the number of countries from which a country imports and the Herfindahl–Hirschman Index (HHI) of importers in a national market. We find slight decreases in concentration, particularly in the long run. These changes in concentration appear to be similar to patterns in other similar non-cartelized products, indicating that they reflect broader changes in trade rather than changes in the nature of competition in these seven markets. For each dependent variable – price, gravity, and concentration – each cartel is examined individually and also jointly in a meta-analysis of all seven cartels.

Our estimates suggest that market sharing and trade are not inconsistent with collusion.[7] While this finding is specific to this set of cartels – which are relatively typical of contemporary international cartels more generally – there may be others that use market division agreements. The optimal collusive arrangement depends on transportation costs and the discount rate. Our results also suggest that econometric screens that examine trade patterns to detect collusion may be ineffective in industries such as these in which collusion involves market sharing. For example, Harrington (2007) proposed that a "collusive marker" would include the observation that prices rose and imports simultaneously declined.[8] While nothing in our work suggests that this marker would give rise to false positives, it would miss collusion such as that found in the industries studied here.

2. Theoretical motivation

In this section we present a formal symmetric, two-country model based on Bond and Syropoulos (2008) and discuss the applicability of the results in more general multi-country contexts. Consider a symmetric two-country, Cournot model of trade. We refer to the two countries, i and j, as "home" and "foreign," with (symmetric) demand in each country given by a linear demand function $P_i = A_i - Q_i$, where Q_i represents the total quantity sold in country i. Assume constant marginal cost for each firm, normalized to zero without loss of generality. Trade cost per unit exported is τ (which can be thought of as transport costs, or more generally transportation costs plus tariffs). Let q_i represent the quantity sold by the firm in country i in its home market and x_i represent the quantity it exports. The total quantity sold in country i is $Q_i = q_i + x_j$, and the total quantity sold by firm i is $S_i = q_i + x_i$. The aggregate profit of firm i is the sum of profits earned in its home and export markets:

$$\Pi_i = \left\{\left[A-\left(q_i+x_j\right)\right]q_i + \left[A-\left(q_j+x_i\right)-\tau\right]x_i\right\}.$$

As in Brander and Krugman, the one-shot non-cooperative game yields a reciprocal dumping equilibrium. (As the firms/countries are symmetric, we drop the i and j subscript for brevity.) In particular, as long as trade costs are not prohibitive (i.e., $\tau \leq \frac{A}{2}$), the symmetric non-collusive Nash equilibrium strategies (q, x) are $q = (A + \tau) / 3$ and $x = (A - 2\tau) / 3$. This yields non-collusive profit, Π^N:

$$\Pi^N = \frac{2A^2 - 2A\tau + 5\tau^2}{9}. \quad (1)$$

Turning to the repeated game, profit in the collusive equilibrium, Π^E is:

$$\Pi^E = \{[A-(q+x)](q+x) - \tau x\}. \quad (2)$$

If a firm deviates from the collusive agreement, the payoff from deviation is:

$$\Pi^D = \frac{1}{4}\left\{(A-x)^2 + (A-q-\tau)^2\right\}. \quad (3)$$

Note that deviation profits are strictly convex in (q, x) for all admissible output pairs.

[4] Bond and Syropoulos (2008), p. 1081; note that the relationship between the discount factor and transportation costs in sustaining collusion is non-monotonic. Their model demarcates the regions in which we are likely to see different competitive interactions (p. 1091). Baake and Normann (2002) highlight the implications of their model of collusion in homogenous goods for the relationship between trade and antitrust policy: "Fung's (1991) conclusion is that differentiated goods are a necessary condition for collusive intra-industry trade. … antitrust authorities responsible for promoting competition in free-trade areas need not be concerned about industries which trade in homogenous goods. Our paper shows that … [i]ntra-industry trade in homogenous goods is not a reliable indicator of competition" (p. 483).

[5] Fig. 1 shows prices four years before and after the breakup of each cartel. A cartel might also be considered effective if it had stemmed declining prices, raising price relative to the counterfactual price. That was not the case for any of these seven cartels. Note that in some cases, such as Vitamin A, prices had begun to fall prior to the reported cartel breakup. This often reflects related antitrust activity. In Vitamin A, FBI agents intervened in March 1997 almost two years before the official breakup. For a more general discussion of the effect of cartels on prices, see, for example, Levenstein and Suslow (2006) and Connor and Bolotova (2006).

[6] The gravity equation is a well-established relationship between trade, national income and geographic distance (Tinbergen, 1962). Some papers have examined the effect of particular factors on the distance coefficient (e.g., Freund and Weinhold (2004) on the effect of the internet) while others have examined changes in the coefficient on distance over time (e.g., Berthelon and Freund, 2008). Another influential literature uses the gravity equation to examine border effects (e.g., Anderson and van Wincoop, 2003; McCallum, 1995). Helpman et al. (2008) provide an overview of empirical estimates of the gravity equation.

[7] For other case studies examining the relationship between collusion and trade, see Hummels et al. (2009) and Asker (2010).

[8] "A common feature to implementing a collusive allocation is the "home-market principle" whereby cartel members reduce supply in each other's home markets … where, ideally, each cartel member takes control of their home market and then share the global demand that was not part of any cartel member's home market. … In a competitive market, one would expect a rise in a firm's price to result in more imports, ceteris paribus. However, an allocation scheme based on the home-market principle would result in the suspicious combination of a higher price and fewer imports" (Harrington, 2007, p. 6). Harrington goes on to argue that a simultaneous increase in prices and a decline in imports is a "collusive marker."