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Abstract

The Joint Executive Committee (JEC), one of the most studied cartels in all of economics, was at best partially successful at maintaining collusion. The railroad cartel faced frequent breakdowns and re-contracting efforts. This paper considers the effects that large capital debt may have had on the members of the JEC. The JEC is compared to the express cartel of the period in which all firms were creditors. The latter had no breakdowns during the same period. It is shown through a small modification in an oligopolistic supergame that debt-burdened firms are Jess likely to maintain a stable cartel agreement than a cartel of creditors, a result that is consistent with the experience of these two cartels.

Introduction

The Joint Executive Committee (JEC) of the eastern trunk line railroads (1879-1887) is one of the most thoroughly studied cartels in the entire economic literature, because it is one of the few cartels with a large trove of data for scholars to use in testing theories of collusive behavior. I The cartel attempted to control both prices and market shares of eastbound freight (and later passengers) from America's breadbasket to the major eastern export cities.

Whether or not the *JEC* represents an example of successful collusion is a matter of some dispute. Clearly, contracts broke down on several occasions, though in general the railroads would end a competitive reversion with a new contract that the *JEC* members agreed to enforce. Although it seems that in some periods the railroads did earn monopoly profits, the weight of scholarly opinion suggests that the cartel can at best be considered a qualified success (Ellison 1994; Grossman 2004).

Exactly why the *JEC* failed to maintain collusion successfully is not entirely understood, although some factors have been identified. For example, entries by new rail companies clearly impacted contract arrangements (Ulen 1978), and demand shocks seem to have led to breakdowns (Ellison 1994).

Yet it is unclear whether these events themselves caused collusive contracts to fail or whether there were inherent problems within the *JEC* that events like demand shocks to the general economy merely exposed. In fact one aspect of *JEC* firms that was at least potentially problematic to maintaining collusion has generally not been explored by scholars. That is, the large capital indebtedness of all the companies in the cartel. Railroads were among the most capital intensive enterprises in the entire American economy and all of them had significant yearly debt service charges typically at fixed rates.

This paper suggests that such debt might well have played a part in the struggles of the *JEC* to manage collusion. We will argue that the capital charges and the consequences of not meeting them might well have hastened, if not guaranteed, defection strategies on the part of the cartel members.

We show this first in the next section by comparing the *JEC* to a contemporaneous cartel: the railroad express. As Grossman (2004) argues, the two cartels differed in a number of ways, but perhaps the most striking was that the members of the express cartel were all net creditors, receiving each period a positive cash flow from the debt they were holding. We suggest that their creditor position gave them room for less confrontational strategies than those adopted by the JEC's membership.

Indeed, the express used strategies that *JEC* could not afford. In the third section, we show why from the standpoint of theory alone we would expect successful collusion within the *JEC* to have been unlikely, but more likely in a cartel such as the express. A standard model of collusion is adapted to illustrate this result. Concluding remarks follow.

The JEC and the EXPRESS

Debt was an ongoing fact of life for all railroads and the benchmark interest rate for the bond market was the rate given to the highest quality railroad bonds not government securities (Grossman 2000). In 1884, the Lake Erie and Western Railroad, a party to the JEC, reported outstanding debt of over $85 million, and had net fixed debt charges for that year of over $6 million.[2] In 1885, the New York, West Shore & Buffalo RR, a subsidiary of the JEC's New York Central assumed $50 million in new debt as part of a recapitalization plan. The Baltimore & Ohio, another *JEC* company, in the same year consolidated the debt of just one of its branches by assuming a $10 million mortgage.[3] All railroads, in fact, were net debtors and their obligations did lead many into default (including the Erie) at various times in their history.

Consider how this might have affected decision making among the cartel's members. A heavily indebted firm observes falling prices in the market and does not know if this is due to defection by another cartel firm or to a demand shock. The former might require a trigger strategy reversion while the second a coordinated cut in output to raise prices while maintaining market shares. If information is incomplete, with the need for revenue paramount, the firm will likely increase output immediately before it can determine the cause of the downturn. Since every firm is in the same position, the result would be that everyone appears to defect: all increase output and prices fall to competitive levels regardless of the origins of the initial decline in prices. Most analyses of the JEC do show in fact that contracts broke down during demand shocks (Ellison 1994).

At the time the *JEC* was attempting with difficulty to form binding collusive agreements, the five leading railroad express firms had created a cartel that was at the time finishing its second decade under essentially the same cartel contract (Grossman 1996). Interestingly, it was in approximately the same kind of business as the railroads. The express companies were movers of freight, although the express specialized in carrying financial instruments and small packages rather than the bulk freight the rails carried. However the express had little capital since it leased rail cars from the railroads.

Grossman (2004) notes a number of differences between the cartels that might account for the variation in success rates. But one that is especially striking is the fact that all express firms were net creditors. By the 1880s, all five of the leading express firms had accumulated large portfolios composed primarily of railroad debt securities.[4] American Express and Adams, the two largest express companies had portfolios worth over $20 million (Grossman 2000). Of course the express companies like the JEC railroads faced the same general economic currents. But unlike the railroads, no express firm went into receivership during the entire life of the cartel, which extended from the late I860s into the early years of the twentieth century.

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[2] Reported in the *New York Times* Nov 24, 1884, p.5 . . [3]Reported in the *New York Times,* March I, 1885, p. 5. [4]There were live firms: American Express, Adams Express, Southern Express, United States Express and Wells Fargo & Co. Together they controlled over 80% of all express traffic (Grossman 1996). Information on the size of the portfolios emerged from a tax dispute between the Adams Express and the several slates forced them to reveal the size of their portfolio; the information on the American Express portfolio comes from their archives (Grossman 2000).

What might this have meant with respect to strategic behavior? Consider again the same scenario are the one facing JEC firms: a decline in prices that could be either a defection or a demand shock. But an express company, with a base of *revenue* coming from the debt that it owns can wait in period one to learn the causes of the fall in prices and if it is due to a general demand shock it will cut output so that collusive shares can be maintained. And in fact in the history of the express, no downturn in the economy led to widespread defection from cartel agreements (Grossman 1996).

Oligopolistic Games and Net Credit Position

The very different responses to demand shocks would be predicted by a small modification in a standard model of oligopolistic super games often used to illustrate cartel strategy (Friedman 1971; Shapiro 1989). The basic model assumes that the players are in an industry of n firms, *(n*= I, 2. 00') and they choose whether or not to collude as a quantity-setting cartel. Initially, we impose no debt constraints on the firms; they will choose to collude so long as the value of collusion exceeds the value of defection, where qj(t) = output of firm i in period t, and 7Tj [ql (t), q2(t), 00" qj(t),oo. qn (t)] = profit of firm i in period t. That is, profit for firm i depends on the output of the other firms in the industry.
The payoff to firm i for entire game is the present value (V;) of profit:

$$V_i = \sum_{t=1}^{\infty} \delta^{t-1} \pi_i[q_1(t), q_2(t), \ldots, q_i(t), \ldots, q_n(t)]$$

where $0 \leq \delta = \frac{1}{1+r} \leq 1$ is the discount factor.

When firms collude, the one-period profit for firm i is π_i^*, while π_i^c denotes the one-period profit for firm i in the event the cartel breaks down and all firms revert to a Cournot game. A "grim" trigger strategy is assumed; all set the collusive output each period as long as all other firms have done the same, but all revert to the Cournot output if any one firm deviates. Let π_i^r denote firm i's one-period profit if it optimally deviates. Thus, the payoff to firm i for the entire game if it deviates is:

the sum of the profit today and the discounted value of Cournot profits in every period thereafter. In contrast, the payoff from continuing to cooperate is:

$$V_i^* = \frac{\pi_i^*}{1-\delta}$$

which is the present value of collusive profits forever. Of course, firm i will not deviate if:

$$V_i^* \geq V_i^r, and$$

$$\frac{\pi_i^*}{1-\delta} \geq \pi_i^r + \frac{\delta \pi_i^c}{1-\delta}, or:$$

$$\delta \geq \frac{\pi_i^r - \pi_i^*}{\pi_i^r - \pi_i^c} = \bar{\delta}$$

This shows that if the discount factor is sufficiently great, collusion will be sustained. The value of the discount factor is the ratio of the gain today of reneging and the loss tomorrow of reversion back to Coumot (Shapiro 1989).

Now we modify the model to include uncertainty and variation in payoffs to debtors and creditors. For simplicity, we consider two collusive duopolies in which there is uncertainty in a one-period game. The first consists of firms that are net creditors and, the second, net debtors. For the second group, if output of either firm falls substantially, revenue is insufficient to meet fixed charges, and bankruptcy is assumed to occur. Thus, the primary difference between the two cartels is the single period penalty associated with not defecting. This penalty is not captured in (1 }-(6), but can be illustrated in the following example.

Figure I represents the one-period payoffs for the members of a creditor cartel at time t. That is, the one-period payoff to the defecting firm when the other cooperates is Jr~ = 7; the one-period payoff to cooperation is Jr~ = 5; the Coumot one-period profit is, ~ = 3; and the one-period profit from producing the cooperative output when the other firm defects is Jr1 = 2, representing primarily the return on the firm's debt holdings.

Turning to the debtor cartel, we assume the same one-period payoffs, with the exception of the profit associated with continuing to cooperate when your competitor

		Firm 2: Cooperate	Firm 2: Defect
Firm 1	Cooperate	5, 5	2, 7
	Defect	7, 2	3, 3

Fig. 1 Creditor cartel payoffs

defects, $\pi_1^d = -1$. If one defects and other does not, the latter firm defaults because of its inability to pay its debt.

Now uncertainty is introduced, and firms do not have perfect information on the behavior of competitors. That is, a decline in profit may be due to cheating by the competitor or by a negative demand shock. If firm 1 plays cooperate, payoffs associated with cooperate occur with probability of (I-P); with probability (P), payoffs are those associated with playing defect. Thus, with uncertainty comes the

possibility of error, which is particularly problematic for debtor firms given the high cost associated with default.

Modifying (6) based on these assumptions, firms I will not deviate if:

$$\delta \geq \frac{\left|(1-P)\pi_I^r + P\pi_I^c\right| - \left|(1-P)\pi_I^* + P\pi_I^d\right|}{\left|(1-P)\pi_I^r + P\pi_I^c\right| - \left|(1-P)\pi_I^c + P\pi_I^r\right|} = \bar{\delta}$$

Substituting the payoffs from Fig. I and Fig. 2 into (7), the creditor firm will not deviate if:

$$\delta \geq \frac{2-P}{4-8P} = \bar{\delta}_C$$

and the debtor firm will not deviate if:

$$\delta \geq \frac{2+2P}{4-8P} = \bar{\delta}_D$$

Comparing (8) and (9), if there is no uncertainty (i.e. *P=O),* collusion is equally likely in the creditor and debtor cartels (i.e. 8c = *8D* = 0.50). However, in the presence of uncertainty (i.e. *P>O),* the discount rate required to enforce collusion is less in the creditor cartel than in the debtor cartel (i.e. 8c < *80),* For example, (8) shows that at *P=O.1* 0, the discount rate must be 5::::0.59 in order for the firm to choose to collude. And if *P=0.20,* the discount rate must be still larger, 5::::0.75, to ensure collusion. For a debtor firm, (9) indicates that at *P=O.I* 0, the discount rate must be 5::::0.69 in order for the firm to choose to collude. And if *P=0.20,* collusion would not occur since 5> I, a violation of the general model.

This exercise suggests several points. It shows that increasing uncertainty makes collusion Jess likely to be sustained in a given cartel, regardless of the financial

		Firm 2	
		Cooperate	Defect
Firm 1	Cooperate	5, 5	-1, 7
	Defect	7, -1	3, 3

Fig. 2 Debtor cartel payoffs

position of the firms. But comparing across cartels, at a given level of uncertainty, collusion in a debtor cartel is less likely to be sustained than an agreement among creditors. Because of the substantial risk of a costly default, the debtor firm is less willing to take a wait and see approach to a downturn in demand compared to its creditor counterpart. In short, the debtor firm cannot afford to be as cautious. Moreover, we observe that as the level of uncertainty increases, this difference in the collusive behavior of debtor

and creditor firms becomes more pronounced. Indeed, the discount rate is only 17% higher for the debtor firms when *P=O.l,* but is 24% higher when *P=0.15.*

Concluding Remarks

How might this have played out in the 1880s with respect to the JEC? Consider that information about the general economy at the time was poor. Thus, a downturn in demand involved uncertainly with a payoff of potential insolvency. Firms could not take a wait-and-see approach and needed to increase output to maintain a revenue stream. Express films on the other did not face the same revenue burden and could observe general business conditions before they acted.

The degree to which the net credit position of the firms in these two contemporaneous historical cartels actually influenced their behavior is not entirely clear. No archival record explicitly states the relationship of the need (or lack of need) for debt service was behind a strategic maneuver. But their balance sheets were so strikingly opposite that, especially in light of the analysis above, it seems very likely that this factor played some role in their respective efforts to maintain stability, and that it impacted the JEC's ability to sustain their contacts. How much the debtor-creditor issue has mattered to history's other cartels is a topic that can only be determined by further research.

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