

BUREAU OF BUSINESS AND ECONOMIC RESEARCH
SCHOOL OF BUSINESS AND ECONOMICS
UNIVERSITY OF MINNESOTA-DULUTH

Working Paper No. 87-16

VERTICAL JOINT VENTURES
AND RATIONALIZATION
OF THE MINNESOTA
TACONITE INDUSTRY +

By

Raymond L. Raab
and
Donald N. Steinnes*

+ An earlier version of this paper was presented at the Western Economic Association Meeting, July, 1987. We are grateful for information and comments provided by Peter Kakela, Laurie Laaso and Peter Mayer. Nonetheless, the authors remain solely responsible for all opinions and conclusions expressed in this paper.

* Professors of Economics, University of Minnesota-Duluth, Duluth, Minnesota.

The University of Minnesota is an equal opportunity educator and employer.

I. Introduction

The legal literature on joint ventures and their anticompetitive effects has increased rapidly as this form of organization has expanded in the last few decades, with most legal cases being limited to overt collusion within horizontal joint ventures. Although joint ventures were ideal institutions for raising new and risky venture capital, it has become increasingly evident that when contraction of production capacity takes place an inextricable problem exists in disentangling the remaining capital assets. In fact, much of the recent literature on domestic joint ventures in medical partnerships, health care organizations, and real estate joint ventures is devoted to disentangling the equity interests of the members.

As is well known, the United States steel industry has been in the process of contracting over the last several years for various reasons. For the most part, this process has involved individual firms closing steelmaking plants and this phenomenon has come to be referred to as rationalization. While these closures involve many problems and costs,¹ they have an underlying economic rationale--the elimination of the high cost plants which is an efficient result for both the firm and society. Likewise, market forces may lead to the elimination, or reorganization under the bankruptcy statutes, of an entire inefficient company. Again, when the market is allowed to work, the outcome is efficient both for the firm and society.

On the other hand, when rationalization is called for on efficiency grounds (i.e., elimination of high cost operation) in an industry made up of vertical joint ventures, the rationalization process may be impeded from reaching an efficient outcome. This impediment to rationalization will be investigated in this paper.

Using the Minnesota taconite industry, in its present contractionary phase, we would like to test alternative scenarios of rationalization or capacity reduction. More specifically, on the basis of the estimation of different plant costs of production, we propose to estimate the social costs of various rationalization scenarios. These cost estimates have been made by Kakela (1985), Kirsis and Kakela (1987), and Laakso (1985 and 1987). That is, we compare the competitive solution (i.e., one plant with one independent owner with highest cost plants shut first) to the present ownership pattern (i.e., several plants where customers have cross ownership interests). In the latter case the probability of shut down is going to be determined by the pattern of ownership in individual plants and the owner's financial viability. A comparison of these costs will give an indication of one of the "hidden" social costs of the joint ownership pattern, an efficiency issue which has not been raised by past inquiries into the anticompetitive effects of joint ventures. Also, the results will suggest that forecasts of rationalization in this joint venture industry are likely not to proceed as some experts have predicted.

II. Competitive Impacts of Joint Ventures and the Minnesota Taconite Industry

Although numerous definitions of joint ventures exist for different purposes (Barnstein, 1965, p. 25; Hibner, 1982, p. 713; and Brodley, 1976, p. 454), a general definition suffices for our purpose. A joint venture involves a partial integration between parent firms of resources, knowledge, investment capital, or assets to create a new entity. Member firms combine less than their total assets and are usually managed by a separate organizational structure, although direction or control from the parent is expected. A merger differs from a joint venture in that a merger involves a complete integration of all of the assets of two or more companies to create a new entity. Fusfeld (1958, p. 587) observed

that joint subsidiaries in the steel industry involved parents whose mergers had been opposed by the Department of Justice and that these quasi-mergers may have accomplished some of the purposes of the forbidden mergers themselves. This view was also reflected by Boyle (1968, p. 81) and Pate (1969, p. 23). Unlike the past, the present merger enforcement attitude, especially as it relates to the financially troubled steel industry, is very permissive to such consolidations as a means of rationalizing present over-capacity in the steel industry (Roth, 1986, and Tollison, 1986).

Similarly Pfeffer and Nowak (1976, p. 324), Brodley (1982, pp. 1530-1533), Hibner (1982, p. 715), and Weston and Ornstein (1984, p. 85), cite the dangers of the formation of a joint venture as: (1) the possible elimination of a potential competitor; (2) a reduction in actual competition between parents through collusionary activities; and (3) the foreclosing of suppliers or customers in the case of vertical joint ventures. Generally the anticompetitive effects are felt to be serious when a competitive relationship as a buyer, seller, or competitor exists between the joint venture and its parents, when significant market power or share is held by the joint venture or the parents, or when the above-mentioned situations are persistent over time or pervasive within the industry.

On the other hand, some support for this form of consolidation is offered by Pfeffer and Nowak (1976, p. 318), Berg and Friedman (1980, p. 164), Brodley (1982, p. 1524), and Weston and Ornstein (1984, p. 85), who emphasized the possible efficiency and competitive gains of joint ventures. They cite benefits of this form of organization as a basis for: (1) obtaining economies of scale in operation; (2) providing access to large capital requirements; (3) utilizing complementarities of assets or specialized skills; (4) acquiring access to new technological or managerial capabilities; and (5) improving the risk return

ratio for entering new markets or new activities including penetration of foreign markets. It can be argued that these procompetitive features play an important role in the Minnesota taconite industry.

The steel industry had from the earliest consolidations around the turn of the century sought to guarantee ore reserves. By 1952 the four major ore firms (Pickands Mather, M. A. Hanna Company, Cleveland Cliffs, and Ogleby-Norton) sold about one-third of total production, with about half going to the nine largest steel companies on the basis of ownership. Most of the remainder went to the same companies on the basis of long-term contracts (FTC 1952, p. 33). In this way, long-term relationships were established between ore firms which wanted to be sure of customers during slack years and iron producers who could rely on dependable sources of ore during periods of peak iron demand (Gold, et al, 1984, p. 359-360). As natural ore deposits were depleted during the 1950's, beneficiating of surface taconite ores grew and dominated the output mix by the 1960's. Correspondingly, considerable gains in steel smelting technology were achieved using the new enriched ores (Kakela, 1977).

A restructuring of the ore industry took place during this same period of time. In most cases the ore firm, interested in developing a taconite ore deposit, would set up a joint venture in which it may retain some stock interest, while several consumers of ore subscribe for the remaining shares. The joint venture hires the ore firm on a management contract to develop the property and the stockholders in the mining companies share costs and ore in proportion to their ownership of stock. The joint venture corporation conducts the mining and beneficiating activities in order to take advantage of economies of scale in railroad haulage, dock facilities, primary ore crushers and grates or kilns for firing pellets. Moreover, the ore consumers, who are in a position to assume the risk of fluctuating demands, can raise the large amounts of capital required to develop the mine (Gold et al, p. 360). For these reasons, the vertical

joint ventures and vertical integration which characterize taconite ore production today were thought to have been formed to exploit existing economies of scale, large capital requirements, and the development of technological transfer which existed between the stages of ore beneficiation and iron production. According to Table 1, only the very largest integrated steel producers were able to maintain sole ownership of a taconite firm.

By the 1980's the United States taconite industry reflected the problems of the steel industry, as seen in Table 2, with significant declines in output and capacity having taken place since the peak year of 1979. The trends in the table also are representative of what was happening in Minnesota, which dominates United States ore output and production. While some reduction in capacity, or rationalization, did take place between 1979 and 1986, it did not keep pace with the decline in output. By 1986 the United States operating rate had fallen to 63.9% from 82.7% in 1979. This, by itself, would have contributed to higher costs as will be explained in the next section. The decrease in operating rate can be attributed, in part, to the impediments to rationalization created by the presence of joint ventures in the United States industry. It is this problem or this social cost of joint ventures which this paper will define and measure.

Table 1

The Minnesota Taconite Industry in 1986

<u>Company</u>	<u>Ownership and Management</u>
Hibbing Taconite Hibbing	Owned by Bethlehem Steel, LTV, Pickands Mather and Stelco Managed by Pickands Mather
Erie Mining Hoyt Lakes	Owned by Bethlehem and LTV Steel Managed by Pickands Mather
Minntac Mountain Iron	Owned and operated by USX
Minorca (Inland Steel Mining) Virginia	Owned and operated by Inland Steel
Eveleth Mines Eveleth	Owned by Rouge Steel, Ogelby Norton, Stelco, and Armco Managed by Ogelby Norton
National Steel Pellet Hibbing	Owned by National Steel Managed by M. A. Hanna Company
Reserve Mining Silver Bay and Babbitt	Owned by LTV Steel and Armco Managed by Pickands Mather

Source: Duluth Herald and Tribune, July 31, 1986, and Kakela (1985).

Table 2

North American Iron Ore Capacity, Output, and Operating Rate

	1979			1986		
	Capacity	Output	OR	Capacity	Output	OR
U.S.	93.0	76.9	82.7%	60.1	38.4	63.9%
Canada	65.2	56.1	86.0	47.6	36.9	77.5
Total	158.2	133.0	84.1%	107.7	75.3	69.9%

Source: Kirsis and Kakela (1987), page 4.

On the other hand, Table 2 indicates that in Canada rationalization proceeded more as would be expected in the absence of joint ventures. That is, while production also declined in Canada between 1979 and 1986, the decline in capacity better matched the output decline. The Canadian operating rate declined from 86% to 77.5% vs. a decline in the United States from 82.7% to 63.9%. Though this paper will not pursue further the differences between Canada and the United States, it can be stated that joint ventures are less pervasive in Canada (Kirsis and Kakela, 1987, p. 12) than the United States. Therefore, the changes in operating rates are consistent with, or provide indirect support for, the thesis of this paper, joint ventures are an impediment to rationalization.

III. Joint Ventures and the Rationalization Process

The economic rationale for cutting capacity in the steel industry in the 1980's has been well documented. Demand, both worldwide and in the United

States, has declined. While the industry might have believed in the early 1980's that the decline in demand was cyclical, it is clear now that improvements in substitutes (e.g., plastic or aluminum) have, in part, permanently lowered the demand for steel. At the same time, worldwide supply has increased and many of the foreign plants are more efficient than United States facilities. In light of these events, there are few who question that steel capacity in the United States should, has been, and will be rationalized.

Given that taconite, or beneficiated iron ore, is a producer good, the demand for it is dictated by the demand for steel. So it, too, should be rationalized correspondent to the reduction in steel capacity. On the supply side, there has been some indication of foreign competition (e.g., Brazil production of pellets) but this has, as yet, not affected the United States ore producers. One reason for foreign competition not being a threat is that as of 1986 United States ore delivered to Lower Lakes ports was \$5/ton cheaper than projected Brazilian taconite prices (Kirsis and Kakela, p. 3). More importantly, the joint venture nature of the industry, with mine production allocated to owners, obviates against sales of foreign ore to potential steel producer customers.

So while the rationale for rationalization applies to both steel and ore, joint ventures in the latter industry may impede the cutting of capacity that should take place on efficiency grounds. As will be explained, it is the nature of the market (competition, monopoly, or joint venture) which may well determine whether the rationalization that should take place will in fact occur.

With the current joint venture arrangement, ore is not "sold" in an open, or spot, market. It is transferred at internal, or posted, prices by the steel company owners of each mine operation. Consequently, each of the integrated steel producers is dependent on ore from the mine, or mines, in which it has an

ownership position. The ownership patterns, thus, dictate the demand for each mine and mines are not able to compete for customers as they would in an open market.

Given this arrangement, and the lack of a competitive market, it would be risky for an integrated steel company to agree to closure of a joint venture mine, especially if the mine were its only source of ore. If a steel company were to become dependent on ore from a mine in which it did not have an ownership interest, it would become exposed to exploitation of its demand for ore by the owners of the mines left operating, or in other words, a "partial price squeeze." In fact, to achieve the full cost savings of rationalization would require that only three mines remain in operation (see next section). However, the concentration of production in so few firms, even if a open market for ore were to exist, would lead to the potential for the three firms to control taconite prices. If this were to occur, some of the savings to society from rationalization which will be estimated in the next section would be lost.

Before trying to estimate the savings from rationalization, it is necessary to consider how rationalization would theoretically occur under alternative market scenarios of competition and monopoly. While these are theoretical, or hypothetical, they represent what could happen if the joint venture arrangement did not exist. The difference between these theoretically efficient rationalization scenarios and the actual situation which exists under joint ventures represents a cost to society which will be measured in the next section.

The key difference between the existing joint venture arrangement and the alternatives of competition or monopoly is that the latter market structures would require the presence of an open market with prices being real rather than "posted" as is the case currently. While both competition and monopoly will be discussed, it should be stated that they are similar in that a market price exists, be it competitive or monopolistic, and rationalization of production would lead to the same remaining (low cost) firms.

First, with competition, or each mine owned and operated by a separate firm, the inefficient producers would be driven from the industry by competition. The firms which would remain or close would have nothing to do with ownership since all production would be sold in an open market. Of course, it should be noted that with so few firms the potential would exist for collusion on the part of the mines to raise the price of ore significantly above their costs. If this were to occur, it would lead to less output than there would be with price competition,² and not necessarily the closure of all but the most efficient firms.

Technically, closure of plants in the purely competition^{ve} market described might be referred to as industry rationalization. On the other hand, firm rationalization might be described as the cutting of capacity by a single firm. For example, if one firm owned all the mines, it would close the least efficient and operate the most efficient (lowest cost) to produce the output required. The result would be much the same, then, as was described for competition. One difference would be that if the firm was a monopolist (i.e., it could set price for the ore because there were no competing mines) it would produce less output than would result with competition for the same reasons given in the competitive case. If, on the other hand, the owner of the mines was unable to set price (i.e., even though the firm owned several mines it was still in a competitive market) then it would close those mines whose costs exceeded the competitive market price for ore.

Though both the competitive and monopoly market scenarios lead to rationalization, with joint ventures this is less likely to happen for reasons cited earlier. The result is that capacity is not cut and therefore the most efficient, or least cost, mines are not producing all the ore. The difference between the rationalization outcome, achieved either with competition or

monopoly, and the outcome existing with joint ventures represents a cost to society of joint ventures. This will be measured for the Minnesota taconite industry.

IV. Costs and Rationalization of the Minnesota Taconite Industry

The thesis thus far is that the existence of vertical joint ventures impedes rationalization of an industry and that such a reorganization of productive capacity is justified on efficiency grounds (i.e., the industry and society would be better off with lowest cost mines producing the output required). Before an attempt is made to measure these costs (i.e., the difference between the inefficient current pattern of output characterized by present ownership patterns and the lower cost, more efficient, pattern that could exist with competition), it should be noted that the suggested rationalization would have distributional effects even though it would be justified in terms of efficiency. For example, closing mines would mean some loss to affected communities and workers. Conversely, efficient mines, which would expand output, would benefit other communities and workers. Such redistributions have some costs, but these are not being measured. This approach is typical in similar types of policy analyses (e.g., benefit-cost analysis) which make decisions based on economic efficiency, not economic distribution, grounds.³

In order to estimate the potential savings that could result from rationalization, it is necessary to obtain economic information on each individual mine. Securing data is hindered by two factors: (1) the lack of a market, which results in no real price data; and, (2) the vertical joint ownership arrangement which, together, make income and profits statements both unreliable and unnecessary. Fortunately, independent efforts have been made by Laakso (1985 and 1987) and Kirsis and Kakela (1987) to determine the costs, production and operating rates of the various mines of interest. Table 3 provides capacity, costs and output for 1986, the most recent year available. The capacities in

TABLE 3
Possible Cost Savings from Rationalization (1986)

Mine	(1) Full (90%) Capacity (million tons) (1987 effective capacity)	(2) Delivered Cost @ Full Capacity	(3) Actual Output (Million Tons)	(4) 1986 Operating Rate	(5) Estimated ¹ Cost @ 1986 Operating Rate (4)	(6) Actual 1986 Total Cost (3) X (5) (million \$)	(7) Most Efficient ² Rationalization Output (million tons)	(8) Cost (2) x (7) (million \$)
Hib-Tac	8.1	\$34.26	4.8	.59	\$40.43	\$194.1	8.1	\$277.5
Erie	8.0	31.24	6.0	.75	34.05	204.3	8.0	249.9
Minntac	12.5	35.98	5.5 ³	.44	47.85	263.2	11.0	395.5
Minorca	2.0	44.62	1.8	.90	44.62	80.3	-	-
Eveleth	3.5	50.85	3.6	1.03	50.85	183.1	-	-
National	4.5	43.12	3.9	.87	43.98	171.5	-	-
Reserve	2.6 ⁴	47.52	1.5	.58	56.55	84.8	-	-
State total	41.2	-	27.1	.66	-	<u>\$1181.3</u> (\$43.59/ton)	27.1	<u>\$922.9</u> (\$34.06/ton)

Cost Savings From Rationalization: $\$1181.3 - 922.9 = \258.4 (\$9.53/ton)

¹These costs are estimated from (2) and (4) assuming a -.53 elasticity of cost with respect to operating rate.

²This represents obtaining the 1986 output of 27.1 from the most efficient plants operating at most efficient operating rate (90%).

³This mine was on strike for the last part of 1986.

⁴Capacity for seven of 12 months before closure in August, 1986, Annual Capacity = 4.5 tons.

column (1) are based on a 90% operating rate (OR), considered to be the most efficient, or lowest cost, for each mine. The delivered cost figures in column (2) of Table 3 represent average total costs (per ton) if the mine were operating at full (90% OR) capacity. These figures include variable costs, fixed costs and transportation costs. In Kirsis and Kakela (1987) these costs are broken down in considerable detail for the lowest cost mine, Hibbing Taconite.

Based on the analysis of Hibbing Taconite, it was estimated that the elasticity of cost (per ton) with respect to operating rate is $-.53$. That is, for every 1% reduction in output below 90% (full capacity) costs (per ton) will rise by $.53\%$. Based on this elasticity, cost estimates were made for each mine (column (5)) for their 1986 operating rate (column (4)). These estimates of 1986 costs (at actual 1986 operating rates) were then used to find total actual costs for each mine (column (6)) and these were totaled for the Minnesota taconite industry.

The result suggests that the present joint venture arrangements resulted in production of 27.1 million tons and estimates a total cost of \$1,183.3 million, or \$43.59/ton. In Table 3 the last two columns are an estimate of costs if full rationalization (i.e., least cost firms operating at most efficient OR (90%) to produce the same output, 27.1 million tons) took place. Under this scenario, which would be the result in a purely competitive market, total costs would be \$929.9 million, or \$34.06 (ton). Thus, the cost saving from rationalization would be \$258.4 million, or \$9.53/ton.

In preparing the analysis in Table 3 two unusual circumstances occurring in 1986 should be mentioned. First, Reserve Mining closed in August and so its full capacity, column (1), was adjusted for the seven months it operated. Also, Minntac was on strike for the last part of 1986 but since it remained open its capacity was not adjusted. As a result of this assumption, cost savings may be

higher than if Minntac had operated for a full year. However, shutdowns have been the rule rather than the exception for all the mines in recent years so it could be argued that Minntac produced extra ore early in 1986 in anticipation of the strike.

In addition to the estimated cost saving from rationalization in Table 3, it should be noted that similar estimates have been made by Laakso (1985) and Kirsis and Kakela (1987). Laakso suggested a possible saving of \$242 million, or \$8.08/ton, based on a hypothetical output of 30 million tons and using 1983 cost information. He also estimated savings of \$2.74/ton, or \$110 million, based on a hypothetical output of 40 million tons. These results are similar to those in Table 3 except Laakso did not reveal the costs or output by individual firm. In fact, he did not even name the firms which would remain after rationalization.

Kirsis and Kakela are more current and specific. They do an analysis for the United States, not just Minnesota, and conclude that four United States mines (Hibbing Taconite, Erie, Minntac and Empire in Michigan) are the low cost producers and can supply 36.6 million tons. Thus they concur with Table 3 that in Minnesota rationalization would leave three mines--Hibbing Taconite, Erie and Minntac. While no specific cost savings estimates are made, Kirsis and Kakela (1987) state that savings of \$5 to \$8/ton are possible. Given this includes a Michigan mine (Empire) which was already operating at 90% capacity in 1986, most of the savings would occur as the three efficient Minnesota mines moved to full capacity. Therefore, per ton savings for the Minnesota industry alone would be greater than Kirsis and Kakela's \$5 to \$8/ton range.

Table 3 agrees, more or less, with the previous studies as to what savings could be achieved if rationalization were to occur. However, both of the previous studies suggest that because savings could be achieved that rationalization will take place. On the other hand, the position in this paper is that

even though savings could be made this may not occur given the current ownership pattern of the taconite industry.

Earlier it was pointed out (Table 1) that United States operating rates have fallen since 1979 which means the industry is farther from full rationalization now than it was then. It can be argued that this failure to rationalize, given the potential savings, has been and will continue to be the result, in part, of the joint venture nature of the market.

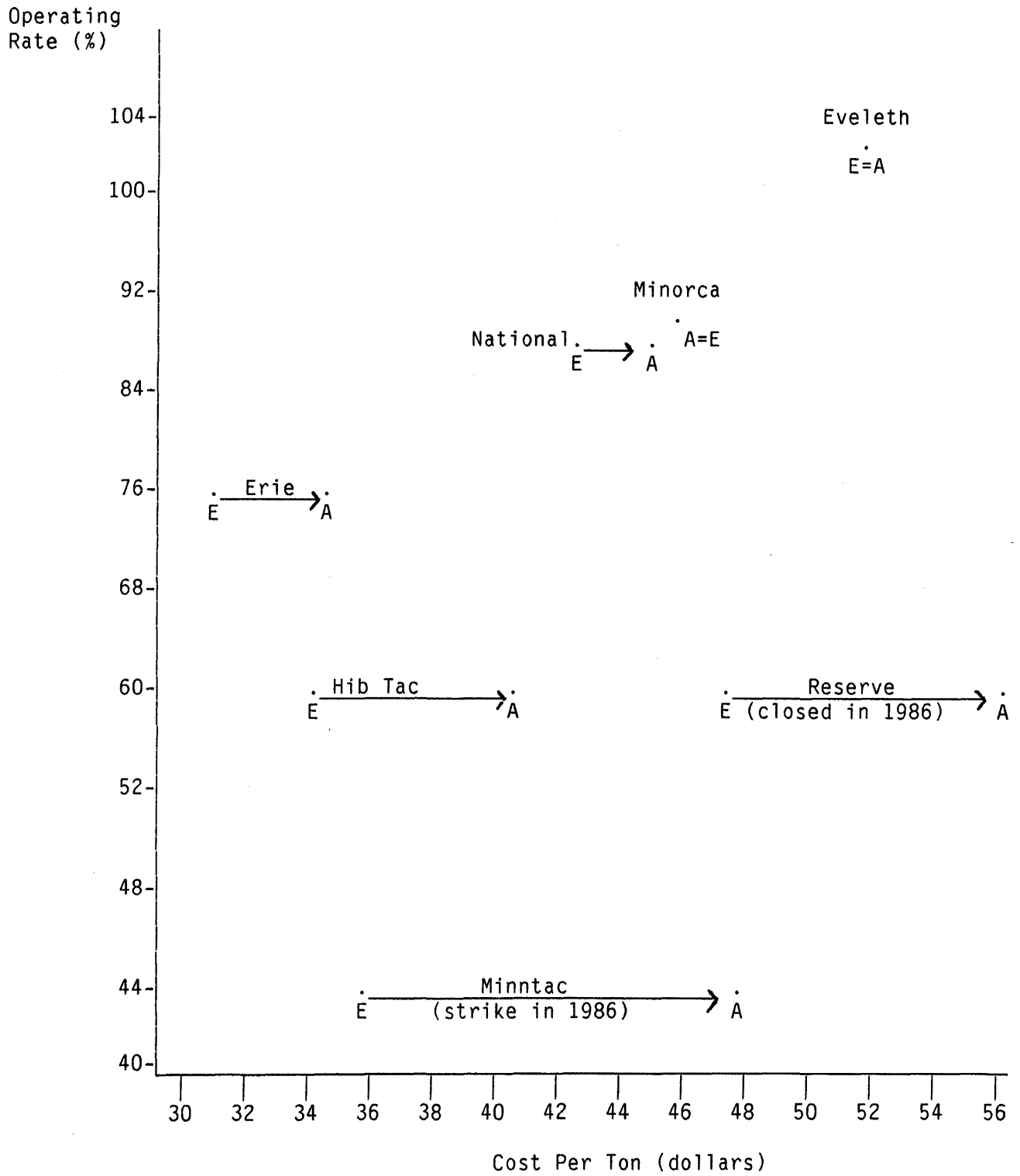
If there is to be movement toward the full rationalization suggested by Table 3, it will require that the efficient (low cost) mines operating rates rise (to eventually 90%) as the inefficient (high cost) plants close. In Figure 1 the 1986 operating rates are plotted against the efficient (90% OR) and actual costs of the mines. Contrary to what should be happening to get to full rationalization, Figure 1 suggests the opposite tendency. That is, the least efficient mines are operating at near capacity while the most efficient have the lowest operating rates. This is hardly the pattern to be expected if full rationalization is to be a reality.

An explanation for the perverse, direct relationship found in Figure 1 is that the operating rates are not dictated by costs as they would be under competition. Rather, the operating rates are dictated by the demands of the owners of each mine. Thus, the wrong pattern in Figure 1 supports this paper's contention that joint ventures are an impediment to the rationalization process.

In addition to this argument, there is another reason that rationalization is less likely to occur now than it was earlier in the 1980's. Until 1986, Kirsis and Kakela suggest that Brazil was capable of delivering pellets in Lower Lakes ports for less per ton than Minnesota mines. By 1986 this had reversed, largely as a result of concessions (e.g., energy, taxes and labor) and productivity gains so that Kirsis and Kakela estimate United States ore to be \$5/ton

FIGURE 1

1986 Costs at Efficient Versus Actual Operating Rates (OR)



Explanations:

- E: Efficient costs based on 90% OR
- A: Estimated costs based on actual 1986 OR
- E—>A: Length of arrow represents cost inefficiency at below 90% OR

cheaper than foreign ore in 1986. Consequently, the threat of foreign competition for United States producers has diminished and so, too, has the pressure to cut costs further.

V. Conclusion and Policy Implications

In summary, while this paper agrees with earlier studies that cost savings could be achieved through rationalization it is contended that this may not occur given current market conditions. The earlier studies do not consider the impediment to rationalization resulting from vertical joint ventures and assume, naively, that because cost savings could be achieved that market forces will be able to attain rationalization. While such attainment would occur in a purely competitive or monopoly market, it may not given the present nature of the taconite industry. Obtaining these savings may require some changing of the market structure, possibly through external intervention.

One possible form of government intervention would be vertical divestiture by steel company owners of the taconite firms. That is, the taconite firms would be set up as separate corporations and would be allowed to compete with each other for customers. A potential problem would occur if the mines, even after divestiture, continued to sell only to their previous owners, on long-term contracts. Such a result could negate the potential benefits resulting from divestiture and the creation of a market.

It should be noted that other experts like Kirsis and Kakela (1987, p. 19) forecast a "spot" market for taconite as something that will occur, in part because of the potential cost savings indicated in Table 3. However, this spot market, which first appeared in 1982, only accounts for 2.0 million tons and most of these transactions involve steel companies (Wheeling-Pittsburgh and LTV) who are under Chapter 11 bankruptcy protection. The sales to these bankrupt firms is something that the other steel firms, and their joint ventures, may

tolerate because the impaired firms have little, or no, bargaining power over price. In fact, the bankrupt firms, by buying from the joint ventures and no longer having an ownership position in a joint venture mine, have reduced their future options. That is, they now no longer have a guaranteed source of ore nor a guaranteed price. They have become price takers and the remaining joint venture mines are price setters.

It is this tendency toward monopoly pricing and vertical foreclosure (i.e., the low-cost mines have the potential, based on economies of scale⁴ and the difficulty of entry, to set price in the taconite industry) which cannot be ignored in the consideration of rationalization cost savings. While there are cost savings attainable from rationalization that will not be made given the joint venture arrangement, there is no assurance that creating a market (e.g., by divestiture) will guarantee the realization of such savings.

If, in fact, there were only three remaining taconite firms (see Table 3), this would hardly be a purely competitive situation. The three firms would have enough market power to set price, above cost, and so some of the savings from rationalization indicated in Table 3 may not be realized. This potential for market exploitation may be another reason why the owners continue to buy from their high-cost captive mines rather than close and be at the mercy of the fewer, and more powerful, mines that remain. The only steel companies who have closed joint ventures are those who had other sources of ore,⁵ so they did not become dependent on the spot market as a source of ore.

Given that the efficient rationalization outcome is only three firms and such a market structure is likely to lead to market failure in the form of price collusion or exclusionary behavior, it may be necessary to consider intervention to achieve an efficient outcome and to insure that savings accrue to society, not the three firms. One possibility would be regulating taconite prices, which

may be justified given the extensive economies present in the industry. The power to set price would reside with a regulatory commission rather than the mining firms and may assure them a reasonable rate of return. Such a solution would introduce all of the well-known inefficiencies inherent in rate regulation. Absent rate regulation, the alternative would be to allow foreign competition in ore by the elimination of all quotas which would limit the firms' ability to exploit their cost advantage.

Another solution would be a government (federal or state) takeover of the mining industry. While this may seem the most radical, it should be noted that a Quebec province in Canada has assumed 50.1% ownership of a mine and Minnesota is considering reopening the recently closed Reserve Mining. If, however, such ownership perpetuates the status quo (e.g., the Canadian mine is being rented to a USX subsidiary for \$1/year) and does not create a viable taconite market, then this approach only makes matters worse in that it amounts to government subsidization of the high cost firms and it continues to perpetuate the existing joint venture pattern. In fact, a government subsidy for high cost (closed) mines would actually reverse the rationalization process further. If government ownership is to be effective in the realization of rationalization savings, it may require ownership of all mines, or the industry, not of a single, high cost, mine. Complete ownership makes it possible to create a market and price ore at the cost of the least cost firms which would remain after government closure of the least efficient mines.

While such government action is possible, there are political reasons why this is an unlikely outcome. First, it would be a radical solution given the current national emphasis on the free enterprise system and private ownership. In fact, the present climate makes even divestiture an unlikely choice. A second reason for not choosing government ownership of the taconite industry is that then government would be responsible for rationalization. While it is

agreed that such rationalization is efficient on economic grounds, politicians may be unwilling to accept responsibility for mine closures because of the consequent distributional impacts.

Another approach would be for Congress to authorize the same consolidation of production by abrogating the antimerger statutes governing such an outright monopolization of the taconite industry. In this scenario, the steel companies with equity interests in the high cost mines would shut them down and absorb the losses, but merge with the existing low cost firms on a pro rata, output basis determined by the past ownership pattern. Such an approach to rationalization is consistent with the free enterprise philosophy, but creates more centralization in the taconite and steel industries when it is clear that the industry is overcentralized already. Moreover, the taconite market would be further obviated than it is today, and no competitive pressures would exist to ensure that the events of the 1980's would not be repeated in the future.

As previously mentioned, the pressure placed on taconite costs by Brazilian ores threatening U.S. ores prior to 1986 has brought about considerable reductions in costs. According to Kirsis and Kakela (1987, p. 13), cost reductions of 31% have occurred since 1982 because of successful concession bargaining with input suppliers and state/local governments. Since the threat of low cost Brazilian ores has been ameliorated, the necessity of further cost reductions based on rationalization has been lessened. Even so, the pressures of free trade and foreign competition have caused an immediate response by the industry and input. Freer trade improves the prospects for rationalization, by keeping pressure on U.S. firms to lower costs, and lessens the threat of market failure inherent in rationalization by offering a competitive market source of ore. Thus, free trade may offer the most hope for achieving rationalization savings.

The conclusion is that while rationalization of taconite mines is a good decision for society, it may not be easily achievable. Vertical joint venture operation of the mines are an impediment to such rationalization, and the policy options for affecting such rationalization are not without their problems. Nonetheless, hopefully, this study has focused attention on a problem with vertical joint ventures which may have been overlooked when they were created. While joint ventures may have advantages (e.g., pooling of capital and lowering risk) in an expanding, or new, industry, more consideration may have to be given to the problems they create when contraction and rationalization is required.⁶ This may be analagous to an old proverb of investors, "A lever on the way up may be a screw on the way down."

FOOTNOTES

- ¹ These costs include not only those incurred by the firm (e.g., the write-off of fixed costs) but also costs to society (e.g., the economic disruption resulting in communities). The federal government has already been left with pension liabilities and there currently are requests from the steel companies for direct subsidization of plant closure costs (Wall Street Journal, 1987).
- ² If pure competition were not achieved, price would not be equated with cost. Rather, price would be higher than cost and output less than under pure competition.
- ³ Technically, to ignore compensation to losers, or not require that they take place, is consistent with what economists refer to as the Hicks-Kaldor criterion.
- ⁴ The economies obtained through efficient utilization of capacity are based on moving downward along an existing short run average cost curve toward minimum cost or full utilization of capacity (90% OR). It is also true that the three most efficient firms also have the largest capacities. This can be readily verified by referring to Table 3.
- ⁵ For example, when Reserve Mining closed, its owners, LTV and Armco, had equity interests in Erie and Eveleth Mines, respectively.
- ⁶ It could be argued that the cross ownership pattern will cause high cost firms to supply taconite ore whether demand is stable or changing in either direction. This may be true since the issue is the foreclosure of access to ore which cause some firms to tap high cost ores in order to guarantee access. Our contention, however, is that these cost inefficiencies are greatest during contractions of the industry.

REFERENCES

1. Barnstein, Lewis. 1965. "Joint Ventures in the Light of Recent Antitrust Developments: Anti-Competitive Joint Ventures." Antitrust Bulletin, Vol. 10.
2. Boyle, Stanley E. 1968. "An Estimate of the Number and Size Distribution of Domestic Joint Ventures." Antitrust Law and Economic Review, Spring, pp. 81-92.
3. Brodley, Joseph F. 1982. "Joint Ventures and Antitrust Policy." Harvard Law Review, May 1982, Vol. 95, pp. 1523-1590.
4. Brodley, Joseph F. 1976. "The Legal Status of Joint Ventures Under the Antitrust Laws." Antitrust Bulletin, Vol. 21, pp. 453-483.
5. Berg, Stanford V. and Friedman, Philip. 1980. "Causes and Effects of Joint Venture Activity: Knowledge Acquisition vs. Parent Horizontality." The Antitrust Bulletin, Spring, pp. 143-168.
6. Fusfeld, Daniel R. 1958. "Joint Subsidiaries in the Iron and Steel Industry." American Economic Association Proceedings, May, pp. 578-587.
7. Gold, Bela; Peirce, William S.; Rosegger, Gerhard; and Perlman, Mark. 1984. Technological Progress and Industrial Leadership. Lexington, Mass.: D. C. Heath and Company, Ch. 14, pp. 357-414.
8. Hibner, Donald T., Jr. 1982. "Antitrust Considerations of Joint Ventures, Teaming Agreements, Co-Production and Leader-Follower Agreements," Antitrust Law Journal, Vol. 51, Fall.
9. Kakela, Peter. 1977. "Pelletized vs. Natural Iron Ore Technology, Energy, Labor, and Capital Changes." Center for Advanced Computation, University of Illinois at Urbana-Champaign, Illinois, December, CAC Document No. 251.
10. Kakela, Peter. 1985. "The Competitive Posture of Minnesota and Michigan Iron Ore Mines." Presented at Mid-Continent Regional Science Association, Duluth, Minnesota, June.
11. Kakela, Peter J.; Montgomery, Allan K.; and Patric, William C. 1982. "Factors Influencing Mine Location: An Iron Ore Example." Land Economics, Vol. 58, No. 4, November, pp. 524-536.
12. Kirsis, Karlis M. and Kakela, Peter J. 1987. "The Threatened North American Iron Ore Industry: A Presentation to the Fifth International Iron Ore Symposium," April 26-28, Paine Webber.
13. Laakso, Laurie J. 1985. "The Competitive Position of Mesabi Range Taconite Pellets." Presented at Mid-Continent Regional Science Association, Duluth, Minnesota, June 1985.
14. Laakso, Laurie J. 1987. "The Competitive Position of Mesabi Range Taconite Pellets, January 1986 Update." Natural Resources Research Institute, University of Minnesota, Duluth.

15. Pate, James L. 1969. "Joint Venture Activity, 1960-68," Economic Review of the Federal Reserve Bank of Cleveland, July.
16. Pfeffer, Jeffery and Nowak, Phillip. 1976. "Patterns of Joint Venture Activity: Implications for Antitrust Policy," The Antitrust Bulletin, Vol. 21, pp. 315-339.
17. Roth, Timothy P. 1986. "Antitrust Policy and the Rationalization of the U. S. Steel Industry." Journal of Institutional and Theoretical Economics, 142, pp. 114-130.
18. Tollison, Robert D. 1986. "Antitrust and Rationalization of the U. S. Steel Industry: Comment." Journal of Institutional and Theoretical Economics, 142, pp. 131-133.
19. Wall Street Journal, May 21, 1987, p. 1, 8.
20. Weston, Fred and Ornstein, Stanley I. 1984. "Efficiency Considerations in Joint Ventures," Antitrust Law Journal, Vol. 53, Spring, pp. 85-95.
21. U. S. Federal Trade Commission. 1952. Control of Iron Ore. Report to the Antitrust Subcommittee of the U.S. House, 28th Congress, 2nd Session.