VERTICAL RESTRAINTS IMPOSED BY BUYERS: THE SECRÉTAN COPPER CARTEL, 1887–1889

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In 1887, Pierre-Eugène Secrétan, the manager of a large French copper fabricator,[1] convinced many European banks and investors to back a syndicate, the Secrétan Syndicate. The express purpose of the Syndicate was to corner the market for copper and to manipulate the world copper price. Within a short period of time, the Syndicate secured contracts with the major international copper producers and controlled 80 percent of the world supply of new copper. As a result, the price of copper on the London Metal Exchange (LME) doubled, and profits were made both on the physical commodity and on mining-company shares. When copper flowed into the market, however, the Syndicate was forced to acquire massive inventories in an attempt to maintain the high price. Eventually, the Syndicate failed, and the price collapsed, causing the liquidation of some investors and the suicide of one.

Secrétan's effort to control the global supply of copper revolved around his company, the Société Industrielle et Commerciale des Métaux, a large copper buyer. The Société bought copper from producers, using contracts that stipulated a price and a maximum quantity and promised to purchase all of the seller's output. The restraints were thus similar to exclusive dealing and price and quantity setting. The restraints were unusual, however, in that they were imposed by a buyer on an upstream seller, not by a seller on a downstream buyer, as is normally the case.

During the 18-month period that the Syndicate controlled the copper market, vast profits were made, equally vast losses were incurred, and a massive redistribution of income ensued. Nevertheless, unlike well-known American

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[1] Fabricators produce copper products from copper metal.

trusts of the turn of the century, such as Standard Oil and American Sugar,[2] little has been written about the Secrétan Syndicate.[3]

In this article, I discuss the formation and collapse of the Syndicate and the role of vertical restraints in enabling the cartel to survive for as long as it did. I also quantify the effect of the restraints on supply, demand, and inventory holdings.

Finally, I take a broader look at commodity market corners—why they are attempted and why they are rarely successful—and their implications for antitrust policy.

I. THE SECRÉTAN SYNDICATE AND THE RESTRAINTS

A. The Syndicate

The late 1880s witnessed an ambitious scheme to manipulate the price of copper by cornering the world market for new supply. The operation, which is considered to be the first international cartel, was conceived and executed by Pierre-Eugène Secrétan (also known as Hyacinthe), a well-known French metal merchant.[4] The Secrétan Syndicate, which lasted from October 1887 to March 1889, controlled 80 percent of new copper supply and caused the LME price to double. At the end of the period, however, the cartel collapsed, and the price fell back to pre-Syndicate levels.

Secrétan, who headed Europe's largest copper-fabricating company, the Société, noticed that despite the low level of stocks and the rise in demand, copper prices had fallen continuously between 1882 and 1886. Moreover, falling prices were probably indications that copper speculators were selling short. Secrétan concluded, however, that prices would rise, and that the rise could be accelerated and substantial profits could be made if the Société were to acquire the bulk of the world's supply of new metal. Furthermore, he was able to convince one of the largest financial organizations in Paris, the Comptoir d'Escompte, to support his scheme. The Comptoir gave the Société an initial credit of £2,500,000,[5] and other French investors followed suit, including the Paris Rothschilds, the Crédit Lyonnais, and the Banque de Paris et des Pays-Bas.[6] Finally, in early 1888, five foreign investors joined.

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[2] *See* John S. McGee, *Predatory Price Cutting: The Standard Oil (N.J.) Case*, 1 J.L. & ECON. 137 (1958) (analyzing the Standard Oil trust); Richard Zerbe, *The American Sugar Refinery Company, 1887–1914: The Story of a Monopoly*, 12 J.L. & ECON. 339 (1969) (analyzing the American Sugar trust).

[3] *But see* E. Benj. Andrews, Note, *The Late Copper Syndicate*, 3 Q.J. ECON. 508 (1889) (giving a descriptive account of the Syndicate).

[4] CHARLES E. HARVEY, THE RIO TINTO COMPANY 68 (1981).

[5] *Id.*

[6] *Id.* at 70.

In October 1887, the Société began purchasing large quantities of copper. Moreover, it made no effort to hide its activities, and the price of copper on the LME rose from £39 per ton at the beginning of October to £80 per ton by December. Except for a short spike in mid-1888, the price hovered around that level until the Syndicate collapsed 18 months later.

To secure his advantage, Secrétan began negotiations with the major copper producers in Europe and North America.[7] In January 1888, the Société agreed to purchase the specified maximum production of the leading Iberian and American producers at a fixed price.[8] Secrétan subsequently negotiated similar contracts with many smaller producers.[9] Ultimately, he entered into three-year purchase agreements with 37 producers.[10]

Since secrecy facilitates corners, the lack of secrecy was important for the cartel's performance. The *Engineering and Mining Journal* (*EMJ*) is the best contemporary source for the flow of information in the copper market. On October 28, 1887, the *EMJ* mentioned that the price of copper had risen, but attributed the rise to the normal workings of a market.[11] Just one week later, however, when the price continued to rise, the *EMJ* noted that the boom started in Paris and that people were speculating as to its cause.[12] By December 23, the details were known: the Syndicate was mentioned by name, the principal participants were listed, and the fact that they had cornered the market for Chilean copper bars was mentioned.[13]

Although the global price of copper rose quickly, the weaknesses in Secrétan's scheme soon became evident. First, when the contracts were signed, the price had already risen, forcing the Syndicate to pay a high contract price. Second, the high price generated an increase in world output of about one-sixth. That increase came not only from mines that were outside the Syndicate, it also came from mines that had signed contracts because, at the time that the contracts were signed, those mines were producing at less than full capacity. Third, producers that had not signed contracts began investing in both new and previously closed mines. However, the *EMJ* notes that it could take at least two years for new investment to come online and up to one year to open a dormant mine.[14] Fourth, the supply of secondary copper nearly doubled. Finally, the high price caused the demand for copper to fall.

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[7] *Id.* at 68.

[8] *Id.*

[9] *Id.*

[10] *Id.* at 70.

[11] *Markets*, 44 ENG'G & MINING J., Oct. 29, 1887, at 319–20.

[12] *Id.* Nov. 5, 1887, at 337.

[13] *Id.* Dec. 24, 1887, at 476.

[14] 46 ENG'G & MINING J., Aug. 11, 1888, at 121–22.

Nevertheless, the Syndicate continued to buy copper, consistent with its contractual commitments, and the Syndicate's stocks of copper quickly grew to levels that were unsustainable. To remedy the situation, Secrétan offered new ten-year contracts that paid higher prices to the producers in exchange for 20–25 percent reductions in production.[15] However, most producers were happy with the status quo, and many had doubts about the financial integrity of the Société. As a consequence, although some firms signed, the new contracts never took effect.

In early 1889, rumors began to circulate concerning the imminent collapse of the Syndicate. On March 5, Russian investors demanded that their deposits be returned. Later that day, M. Denfert-Rochereau, the managing director of the Comptoir, committed suicide, which prompted a run on the bank and precipitated the Syndicate's collapse. Both the Société and the Comptoir were liquidated shortly afterward.

The demise of the Syndicate, however, was not the end of the story, since massive stocks remained. When the bankers began to liquidate the stocks rapidly, the largest U.S. producers threatened to flood the market and cause the price to collapse still further. With this threat hanging over the market, an agreement was reached, and the inventory of copper was disposed of gradually over a period of three years.[16]

Since that time, there have been many copper cartels, both U.S. and international.[17] However, subsequent cartel action has tended to be ineffective or of short duration because, as in the 1880s, high prices have discouraged consumption, encouraged production and investment, and caused inventory buildup. Moreover, until the Sumitomo affair of the mid-1990s,[18] copper cartels had been organizations of producers.

B. THE CONTRACTS AND THE VERTICAL RESTRAINTS

1. *The Syndicate Contracts*

The Société negotiated contracts with leading copper-mining companies throughout the world. In general, it agreed to purchase each firm's maximum production at a fixed price. In some cases, it also agreed to share profits with the mining companies for its sales above that price.[19] The initial contracts were for three years and covered about 65 percent of world production. Later,

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[15] HARVEY, *supra* note 4, at 69.

[16] ORRIS C. HERFINDAHL, COPPER COSTS AND PRICES: 1870–1957, at 76 (1959).

[17] *See id.* (providing a detailed account of cartel activity between 1870 and 1957).

[18] *See* Paul Krugman, *How Copper Came a Cropper*, SLATE (July 20, 1996), slate.com/business/1996/07/how-copper-came-a-cropper.html (giving an account of the corner).

[19] SIR RONALD PRAIN, COPPER: THE ANATOMY OF AN INDUSTRY 103 (1975).

the Syndicate contracted with additional producers and brought its control to just over 80 percent of new copper supply.

The stipulated contract price ranged from £65 to £70.[20] However, producers who received lower prices were given a share of the profit in excess of the fixed price. Taking this into account, the contract price was about £70 per ton, an increase of 80 percent over the October LME price that was in place when the Société began to purchase copper. Maximum stipulated output was set at 1887 capacity. Furthermore, the producers agreed to sell all of their output to the Syndicate. The restrictive clauses in the contracts were thus similar to exclusive dealing and price- and maximum-quantity fixing. However, whereas exclusive dealing usually requires the downstream firms to purchase only from the upstream firm, the contract clauses required the upstream firms to sell only to the downstream firm. Moreover, whereas most quantity-fixing arrangements involve output reductions, this was not the case for the Syndicate, since 1887 production was below capacity.

Relative to most cartels, the Syndicate and its contracts were unusual in many respects. First, the Syndicate was a loosely organized group of a consumer (the Société) and investors (the banks). Second, unlike most vertical restraints, which are imposed by upstream sellers on downstream buyers,[21] the Société was a buyer (a fabricator) that imposed restraints on its suppliers (the mining companies). Third, there was no agreement to curtail production. Instead, the Société contracted to purchase quantities that were greater than the firms' production in the previous year. Finally, unlike most corners, the parties attempting to corner the market made no attempt to conceal their plan or intentions.[22]

2. *The LME Contracts*

Copper metal that was not contracted for was sold on the free market at prices that were principally determined by the prevailing LME price. The original LME contract was for Chilean copper bars (Chile bars). However, by the mid-1880s, Chile had been displaced by the United States as the main source of copper. Moreover, the Spanish and Portuguese mines also were ex-

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[20] Andrews, *supra* note 3, at 509.

[21] *See* Francine Lafontaine & Margaret Slade, *Exclusive Contracts and Vertical Restraints: Empirical Evidence and Public Policy*, *in* HANDBOOK OF ANTITRUST ECONOMICS 391, 391–92 (Paolo Buccirossi ed., 2008) (surveying vertical restraints imposed by sellers).

[22] In a similar context, the Hunt brothers were open about their attempt to corner the silver market. DAN DICKER, OIL'S ENDLESS BID: TAMING THE UNRELIABLE PRICE OF OIL TO SECURE THE ECONOMY app. B, at 329–30 (2011).

panding production. As a result, Chile's share of LME trade had fallen to 12.5 percent.[23]

Since Chilean copper was the material that was tenderable against an LME contract, the market had become dangerously thin, and the situation was ripe for a squeeze.[24] When the LME price rose and the exchange's inventories were virtually depleted, the situation became untenable, and the inadequacy of the Chile bar became painfully apparent. On August 1, 1888, to help deflect the corner, the LME altered the basis of its copper contract to provide more flexibility.[25] In particular, the LME replaced the original contract with one for 'Good Merchantable Brands.' This meant that any of a number of brands, including copper produced from scrap, was deliverable.[26] In other words, a specific brand was replaced by an approved set of brands that met the standard. Many factors, including changes in the geographic distribution of production and increased recycling, led to this change. However, the timing of the change was a direct result of the corner. Furthermore, since the market became thicker, it is almost certain that the change hastened the Syndicate's demise.

II. ECONOMIC MODELS OF CARTELS AND CORNERS

A. CARTELS

Cartels have received much attention from economists, both in theory and in practice, and the cartel literature is well known.[27] Moreover, many cartels have involved commodities. For example, Orris Herfindahl discusses seven copper cartels that existed between 1870 and 1956, almost one per decade.[28] Cartels can be legal—for example, an export cartel—or they can be illegal. However, in 1887, there was little legislation that restrained cartel formation, and cartels were both legal and widespread. Indeed, the Sherman Antitrust

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[23] RUDOLF WOLFF & CO. LTD., WOLFF'S GUIDE TO THE LONDON METAL EXCHANGE 6 (3d ed. 1987).

[24] Most LME contracts never result in delivery. Indeed, producers tend to use the LME for hedging, and usually purchase metal directly from sellers at prices that are based on the LME price. However, when delivery does occur, the metal must be of the type that is stipulated in the standard contract.

[25] No other metal contracts were changed at this time, as this was an attempt to remedy the illiquidity and squeeze that had developed in the copper market.

[26] The LME now lists nearly 100 approved copper brands from around the world, and any of those brands are tenderable. *Approved Brands*, LONDON METAL EXCH., www.lme.com/Trading/Brands/Approved-brands.

[27] For surveys of cartels and collusion, see Alexis Jacquemin & Margaret E. Slade, *Cartels, Collusion, and Horizontal Merger*, *in* 1 HANDBOOK OF INDUSTRIAL ORGANIZATION 415 (Richard Schmalensee & Robert D. Willig eds., 1989), and Margaret C. Levenstein & Valerie Y. Suslow, *Cartels and Collusion: Empirical Evidence*, *in* 2 THE OXFORD HANDBOOK OF INTERNATIONAL ANTITRUST ECONOMICS 442 (Roger D. Blair & D. Daniel Sokol eds., 2015).

[28] HERFINDAHL, *supra* note 16.

Act[29] was passed in the United States in 1890 as a response to cartel activity in many markets, including petroleum, copper, steel, and sugar refining; farm- and shoe-manufacturing machinery; and meat packing. Nevertheless, although at the time of the Syndicate, combinations in restraint of trade were not illegal unless they were legally enforceable, legal cartels faced the same enforcement problems as illegal cartels.

George Stigler was perhaps the first to provide a model that illustrates the observation that although perfect collusion maximizes industry profits, perfect collusion is difficult to sustain.[30] He notes that the mere fact that price is above marginal cost implies that a single participant has an incentive to detect and offer secret price cuts.[31] The cartel problem thus consists of reaching an agreement, detecting secret price cuts, and punishing the cheater.

Stigler goes on to enumerate factors that facilitate cartel formation and survival, such as homogeneity of products, buyers, and sellers; a small number of sellers but a large number of buyers; the inability to offer nonprice competition; and transparency of prices due to, for example, published price lists.[32] In the case of the Syndicate, the product was homogeneous, non-price competition was not as important as in some industries,[33] and prices were transparent.

Subsequent theories of cartel enforcement, which were often cast as repeated games of perfect or imperfect information, devised credible punishment strategies that could deter cheating. For example, with James Friedman's game of perfect information,[34] punishment consists of Nash reversion forever, whereas with Edward Green and Robert Porter's game of imperfect information,[35] since participants cannot distinguish cheating from bad-demand shocks, Nash reversion occurs for a finite period after which collusion is resumed. With both models, cartels can be sustained, and participants never cheat. Researchers have subsequently provided many credible punishment strategies that can sustain collusion.

B. CORNERS

A corner is very similar to a cartel. However, whereas a cartel usually involves producers of the commodity, a corner usually involves investors. A

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[29] Sherman Act of 1890, ch. 647, 26 Stat. 209, 15 U.S.C. §§ 1–7.

[30] George J. Stigler, *A Theory of Oligopoly*, 72 J. POL. ECON. 44 (1964).

[31] *Id.* at 46–47.

[32] *Id.* at 45–48.

[33] Nonprice competition took the form of, for example, location and timing of delivery.

[34] James W. Friedman, *A Non-cooperative Equilibrium for Supergames*, 38 REV. ECON. STUD. 1 (1971).

[35] Edward J. Green & Robert H. Porter, *Noncooperative Collusion Under Imperfect Price Information*, 52 ECONOMETRICA 87 (1984).

market is said to be cornered when an individual or group of coordinated individuals obtains sufficient control over a commodity or other asset to manipulate its price. The asset can be financial, such as a share or bond, or real, such as a commodity. For most of my discussion, however, I consider a commodity.

Price manipulation can be accomplished in more than one way. For example, investors can purchase a large share of the physical commodity in spot markets and store the commodity. Alternatively, they can purchase sufficient futures contracts. Continual buying will inflate the price, which will attract more buyers who anticipate further price increases. Increased buying will push the price still higher, thus fulfilling speculators' expectations. As a consequence, short sellers will be driven out of the market, which will further inflate the price. Eventually, the participants, knowing that the price will fall, will begin to sell the commodity, take short positions, or both.

The idea behind a corner is simple. However, like cartels, corners contain the seeds of their own undoing, and many have failed. This is especially true of commodity corners.[36] Indeed, the mere fact that participants can influence price makes commodity corners vulnerable. In particular, when knowledge of the corner becomes widespread, nonparticipants can take opposite positions in an attempt to reverse the price increase. If the non-participants are successful, prices start to fall, and it is difficult for the corners to exit their positions without exacerbating the price decline.

Investors have attempted to corner markets throughout history. For example, *Aristotle's Politics* discusses how, in the 6th century BC, Thales of Miletus cornered the market for olive-oil presses.[37] Moreover, attempted corners of commodity markets have involved copper, silver, gold, tin, onions, cocoa, soybean oil, propane, and natural gas. Despite their prevalence, and in contrast to cartels, where there is a large theoretical literature, there is little theoretical work on market corners. Franklin Allen, Lubomir Litov, and Jianping Mei's work,[38] however, is an exception.

Allen, Litov, and Mei develop a rational-expectations model of corners in which there are three sorts of participants: uninformed, arbitrageurs, and manipulators. The first set are risk averse, whereas the latter two are risk neutral and have private information. Moreover, the first two groups—uninformed

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[36] For example, Franklin Allen, Lubomir Litov, and Jianping Mei consider 14 corners, most of which were successful. Franklin Allen, Lubomir Litov & Jianping Mei, *Large Investors, Price Manipulation, and Limits to Arbitrage: An Anatomy of Market Corners*, 10 REV. FIN. 645, 658–59 (2006). However, the commodity corners that are in their data were failures. *Id.* at 659.

[37] ARISTOTLE, POLITICS, bk. 1 § 1259a (Harris Rackham trans., Harv. Univ. Press 1944), data .perseus.org/citations/urn:cts:greekLit:tlg0086.tlg035.perseus-eng1:1.1259a.

[38] Allen et al., *supra* note 36, at 649.

participants and arbitrageurs—behave competitively, whereas manipulators behave strategically. Allen, Litov, and Mei show that manipulators will want to purchase the shares of the uninformed because if there is good news, the payoff is high, and if there is bad news, the manipulators will want to corner the market. Corners thus occur during downturns when arbitrageurs are selling short. Furthermore, Allen, Litov, and Mei assume that after the second-period value becomes known, new supply becomes randomly available to short sellers, and the corner fails when short sellers are able to cover their positions.

There are a number of implications that one can draw from this model. First, corners will be attempted in bad times. Second, there must be short sellers. Third, corners fail either if the manipulator is unable to purchase sufficient shares from the uninformed or if a sufficiently large new supply becomes available to short sellers. Fourth, unlike cartels, secrecy facilitates, and transparency inhibits, corners. Fifth, illiquid markets are easier to manipulate, Finally, corners can occur when everyone is behaving rationally.

We have seen that many but not all of the factors that favor success were present during the period of the Secrétan Syndicate. In particular, the corner began in a downturn, speculators were probably selling short, and the market was illiquid. On the other hand, the failure of Secrétan and his co-conspirators to keep their effort secret likely contributed to the Syndicate's demise.

III. ECONOMETRIC MODELS OF THE COPPER MARKET

In this Part, I summarize the findings of econometric models of the copper market. Those findings are then used in an attempt to quantify the effects of the vertical restraints on demand, supply, and cartel inventories. Specifically, I use average elasticities from the literature to construct an algebraic model that can be solved under various assumptions concerning the restraints.

Many researchers have estimated econometric models of the copper market, and those studies often include equations for demand, primary and secondary supply, and equilibrium or market closure.[39] Of course, the results of those studies were not available to participants. Nevertheless, Syndicate members were experienced investors and likely had an intuitive understanding of the workings of commodity markets in general, and the copper market in particular.

In what follows, I assume that all equations are linear in logs so that the coefficients are elasticities. Furthermore, uppercase letters denote variables in levels, whereas lowercase letters denote their natural logarithms.

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[39] *See infra* Tables 1–6.

A. DEMAND

Copper is an industrial commodity, and its demand is derived—that is, it is the consequence of the demand for something else, which I assume to be aggregate industrial production. In addition, demand for copper depends on copper price and the prices of the substitutes and complements that are used in downstream production.

Let q_d be copper demand or consumption, p_c be the price of copper, p_{sub} be the price of the principal substitute, and y be industrial production, where all variables are in natural logarithms. The demand equation can then be written as

$$q_d = \alpha_0 + \alpha_{price} p_c + \alpha_{cross} p_{sub} + \alpha_{inc} y + u_d, \qquad (1)$$

where u_d is a zero-mean random variable that represents factors that are unobserved by the econometrician.

Table 1 shows estimated short- and long-run elasticities from six econometric studies of the demand for copper, as well as averages across studies.[40] There is a consensus that demand is price inelastic in both the short and long run. In addition, long-run own-price elasticities are roughly twice as large (in absolute value) as short-run elasticities, with averages of -0.4 and -0.7, respectively.[41]

All of the studies that consider substitution assume that aluminum is the principal substitute for copper. Therefore, p_{sub} is the price of aluminum. Table 1 shows that short- and long-run cross-price elasticities average 0.5 and 1.0, respectively. Moreover, the individual estimates show that all cross-price elasticities are larger than own-price elasticities, especially in the long run. However, it is not clear how relevant the cross-price elasticities are, since aluminum did not become available at a reasonable price until after the advent of cheap electricity in the early 1900s. At the time of the Syndicate, iron was probably the principal substitute for copper.

Finally, income elasticities tend to be less than one in the short run but greater than one in the long run, with averages of 0.7 and 1.3, respectively.

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[40] Long-run elasticities are usually estimated using a geometric distributed lag. In other words, a lagged dependent variable is added to equation (1).

[41] Average elasticities are rounded to the nearest tenth to avoid giving the impression of spurious accuracy.

TABLE 1: DEMAND ELASTICITIES[42]

Year	Author	Short Run	Long Run
	Own-Price Elasticities of Demand (α_{price})		
1972	Fisher, Cootner, Bailey	−0.21	−0.9
1975	McNicol	−0.33	−0.77
1978	Little	−0.47	−0.64
1980	Slade	−0.5	−0.7
2017	Stuermer		−0.4
	Average	−0.4	−0.7
	Cross-Price Elasticities of Demand (α_{cross})		
1972	Fisher, Cootner, Bailey	0.24	1.01
1975	McNicol	0.66	1.57
1978	Little	0.61	0.84
1980	Slade	0.5	0.7
	Average	0.5	1.0
	Income Elasticities of Demand (α_{inc})		
1972	Fisher, Cootner, Bailey	0.33	1.4
1975	McNicol	0.45	1.05
1978	Little	1.3	1.78
1980	Slade	0.8	1.1
1987	Tan		1.7
2017	Stuermer		0.9
	Average	0.7	1.3

B. SUPPLY

Copper supply can be divided into primary and secondary production, where primary copper is produced from mineral ores and secondary copper is produced from scrap. In addition, secondary supply can be further divided into new scrap, which is a byproduct of primary production and consumption, and old scrap, which is obtained from copper-bearing products that have been discarded.

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[42] Tables 1 through 4 are based on information from the following studies: Franklin M. Fisher et al., *An Econometric Model of the World Copper Industry*, 3 BELL J. ECON. & MGMT. SCI. 568 (1972); David L. McNicol, *The Two Price Systems in the Copper Industry*, 6 BELL J. ECON. & MGMT. SCI. 50 (1975); Margaret E. Slade, *The Effects of Higher Energy Prices and Declining Ore Quality*, 6 RESOURCES POL'Y 223 (1980); Martin Stuermer, *Industrialization and the Demand for Mineral Commodities*, 76 J. INT'L MONEY & FIN. 16 (2017); Arthur D. Little, Inc., *Economic Impact of Environmental Regulations on the United States Copper Industry* (U.S. Envtl. Prot. Agency, Contract No. 68-01-2842, 1978); C. Suan Tan, *An Econometric Analysis of the World Copper Market* 13–45 (World Bank Staff Commodity Working Paper No. 20, 1987).

Compared to the demand for copper, copper supply has received less attention from applied researchers. In what follows, I report supply-elasticity estimates from three studies.

1. *Primary Supply*

I assume that, absent a cartel, the industry is workably competitive and that, to a first approximation, producers are price takers.[43] Moreover, during the period of the Syndicate, the large upstream firms were also price takers because their price was set by the Syndicate. In addition, if increases in aggregate activity trigger investment, supply will also respond to industrial production, y, particularly in the long run. The primary-supply equation is[44]

$$q_p = \beta_0 + \beta_{price} P_c + \beta_{inc} y + u_p, \qquad (2)$$

where u_p is defined in a manner similar to u_d.

Table 2, which contains estimates of primary-supply elasticities taken from three studies, shows that although primary supply is price inelastic in the short run, on average, it is elastic in the long run, with averages of 0.3 and 1.2, respectively. It might be surprising that the short-run elasticity is positive, since new mines take time to build. However, companies often own mines that are closed temporarily and can reopen quickly.

Finally, primary supply is income inelastic in the short run but elastic in the long run, with estimates of 0.35 and 1.2, respectively.

TABLE 2: PRIMARY-SUPPLY ELASTICITIES

Year	Author	Short Run	Long Run
	Price Elasticity of Primary Supply (β_{price})		
1972	Fisher, Cootner, Bailey	0.45	1.65
1980	Slade	0.20	0.70
1987	Tan	0.25	
	Average	0.3	1.2
	Income Elasticities of Primary Supply (β_{inc})		
1980	Slade	0.35	1.2
	Average	0.35	1.2

[43] Most of the research upon which I draw makes this assumption.

[44] I have excluded exogenous shifters, such as an indicator for strikes that identify the supply and demand equations.

2. *Secondary Supply*

a. Old Scrap

Old scrap is material that becomes available when products reach the end of their useful lifetimes. The cost of reclaiming old scrap depends on the form in which the scrap metal is found. One can therefore expect an upward-sloping supply curve for old scrap. In addition to price,[45] the stock of usable scrap material, S, is a determinant of secondary supply, where S is a function of primary production in past years.[46]

The supply equation for old scrap is

$$q_{os} = \gamma_0 + \gamma_{price} p_c + \gamma_{stock}\, s + u_s, \tag{3}$$

where s is the log of S, and u_s is defined similarly to u_d and u_p.

TABLE 3: SECONDARY-SUPPLY ELASTICITIES FOR OLD SCRAP

Year	Author	Short Run	Long Run
	Price Elasticity of Old-scrap Supply (γ_{price})		
1972	Fisher, Cootner, Bailey	0.4	0.3
1980	Slade	0.4	
1987	Tan	0.6	0.65
	Average	0.5	0.5
	Stock Elasticities of Old-scrap Supply (γ_{stock})		
1972	Fisher, Cootner, Bailey	1	
1980	Slade	1	
	Average	1	

Table 3, which contains old-scrap supply elasticities from three studies, shows that supply is price inelastic in both the short run and long run, with averages of 0.5 for both. One might therefore think that there are no dynamic effects for old-scrap supply. However, there are two countervailing forces: while a high price today leads to higher primary production—which augments future scrap supply—a high price today also leads to higher secondary production, which depletes the stock.

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[45] There is a secondary price as well as a primary price. However, secondary price is usually modeled as a fraction of primary price, which implies that it is valid to simply include P^c in the supply equation.

[46] Copper products have lifetimes that range from 5 to 30 years. *See* Margaret E. Slade, *An Econometric Model of the U.S. Secondary Copper Industry: Recycling versus Disposal*, 7 J. ENVTL. ECON. & MGMT. 123, 130–31 (1980) (discussing the construction of S).

Finally, the short-run stock elasticity is one.[47]

b. New Scrap

New scrap is industrial, and is generated at various stages of the production process by primary producers, fabricators, and the manufacturers of end products. In contrast to old scrap, new scrap is of fairly high quality, and recovery takes place soon after the scrap is generated. For this reason, new scrap is usually modeled as a fraction (Θ) of primary production. The supply equation for new scrap is

$$Q_{ns} = \Theta Q_p, \tag{4}$$

where uppercase letters are in levels.

Table 4, which contains estimates of Θ taken from two studies, shows that new-scrap supply is approximately 30 percent of primary production.

TABLE 4: SECONDARY SUPPLY ELASTICITIES FOR NEW SCRAP (Θ)

Year	Author	Fraction
	New Scrap as Fraction of Primary Production	
1	Fisher, Cootner, Bailey	0.40
1	Slade	0.25
	Average	0.3

3. *Closing the Model*

Copper is storable, and inventories of metal must be taken into account. Indeed, metal stocks were particularly important during the period of the Syndicate. The model of inventories is an accounting identity—changes in inventories (ΔI) equal production minus consumption,

$$\Delta I = (1 + \Theta)Q_p + Q_{os} - Q_d. \tag{5}$$

A few general caveats are in order. First, most of the elasticities reported in Tables 1 through 4 are taken from studies that were published in the 1970s and 1980s, and econometric standards were somewhat different at the time. Nevertheless, most researchers use instrumental-variable techniques to overcome the endogeneity problem. Furthermore, the fact that parameter estimates often are not wildly different from one another lends confidence in the results.

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[47] This is an assumption, not a finding, since the dependent variable in both studies is $ln(Q_{os}/S)$.

Second, most researchers rely on data from the second half of the 20th century, not from the late 1880s. One can only hope that the estimated elasticities are capturing fundamentals of the industry and are not representative only of the period of the data. Furthermore, wherever possible, I compare my model forecasts to realizations of the endogenous variables. Nevertheless, it is clear that mining technology, copper uses, and market institutions changed over the period. One should therefore not take the model predictions as point estimates of the impact of the cartel. Rather, the model predictions should be seen as indications of the impact of strategic behavior in the market.

IV. MODEL SOLUTION

Equations (1) through (5) form a system of equations that can be solved for the endogenous variables.[48] However, since equations (4) and (5) are accounting identities, there are only three independent relationships.

I assume that the variables that are determined outside of the model—industrial production (Y), the stocks of copper scrap (S), and the substitute price (P_{sub})—are exogenous. This is clearly true of the first and, since S is large relative to old-scrap production and the Syndicate was short lived, it is approximately true of the second. However, the substitute price should rise when the price of copper increases. Nevertheless, the price of iron ore fell during the period, implying that there was probably no close substitute for copper at the time. I therefore assume that p_{sub} and S do not change as a result of the cartel,[49] whereas Y increases at its historic rate of 7 percent per year.

The length of the planning period must be chosen. If the speed of adjustment is λ,[50] after k years, the relevant elasticity is $1 + \lambda + \lambda^2 + \ldots + \lambda^{k-1}$ times the short-run elasticity. One must therefore choose the appropriate k. Most corners of financial assets take place in a very short time period. For example, Citigroup's successful corner of various Eurozone government bonds in 2004 took place in one morning.[51] In contrast, commodity market corners take more time. For example, the Hunt brothers' failed corner of the silver market in 1979–1980 lasted for over a year before it ended prematurely due to intervention by the U.S. Federal Reserve Board of Governors and the Commodity

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[48] Since I am interested in expected values, I set the errors equal to zero. With the equations in levels, this is just a change of units.

[49] Scrap stocks should increase over time, since past primary production is larger than current production from old scrap, implying that my simulations are conservative.

[50] The speed of adjustment is $\lambda = 1 - \rho$, where ρ is the coefficient on the lagged dependent variable.

[51] *See* John Plender & Avinash Persaud, *The Day Dr Evil Wounded a Financial Giant*, FIN. TIMES (Aug. 22, 2006), www.ft.com/content/144f84ca-31fd-11db-ab06-0000779e2340?mhq5j=e1.

Exchange of New York.[52] I assume that the Syndicate had a two-year planning horizon and construct medium-run elasticities using $k = 2$ and estimated adjustment speeds. However, I perform sensitivity simulations using the short run ($k = 1$) elasticities.[53]

Table 5 shows the elasticities that are used to solve the model.

TABLE 5: ELASTICITIES USED IN SOLVING THE MODEL

	α_{price}	α_{inc}	β_{price}	β_{inc}	γ_{price}
One-year	−0.40	0.70	0.30	0.35	0.50
Two-year	−0.57	1.02	0.53	0.60	0.50

There are three independent equations and four endogenous variables (P_c, Q_d, Q_p, and Q_{OS}), which means that another relationship is required. For the pre-Syndicate base case, I assume that the market was in equilibrium, so that $Q_d = (1 + \Theta)Q_p + Q_{os}$, and for the Syndicate cases, I assume that the price of copper was set exogenously by the Syndicate. Although the Syndicate did not set the free-market price, the price of copper on the LME, which doubled during the episode, was an almost constant multiple of the contract price. I therefore assume that the free-market price doubles.

A. The Base Case

The first exercise is to solve the model under the assumption that the Syndicate does not exist. This, the base case, can then be compared to all other scenarios. Without loss of generality, with the base case, I set $Q_d = (1 + \Theta)Q_p + Q_{os} = P_c = P_{sub} = Y = S = 1$. Furthermore, I assume that primary production plus production from new scrap is 0.95,[54] whereas secondary production from old scrap is 0.05.[55] Finally, I assume that prior to the Syndicate, primary producers were operating at capacity. In reality, pre-Syndicate production was lower than capacity, which implies that my estimates of inventory buildup are conservative.

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[52] *See* DICKER, *supra* note 22, app. B, at 330–31.

[53] These elasticities determine the effect of a one-time price increase. Since the price increase persists, if I were to consider the long run, the inventory buildup would be infinite.

[54] From this point forward, I use the term primary supply to mean mine production plus production from new scrap. To the extent that new scrap comes from consumers, not producers, my estimates of inventory buildup are conservative.

[55] These proportions are approximately those for the United States in 1906. THOMAS D. KELLY & GRECIA R. MATOS, U.S. GEOLOGICAL SURVEY, HISTORICAL STATISTICS FOR MINERAL AND MATERIAL COMMODITIES IN THE UNITED STATES (2014), minerals.usgs.gov/minerals/pubs/historical-statistics/.

Under these assumptions, the system of equations can be solved for the constants, which yields $\alpha_0 = 0$, $\beta_0 = -0.05$, and $\gamma_0 = -3.0$. Table 6 shows the assumed base-case values for consumption, primary and secondary production, and the change in inventories.

B. THE SYNDICATE

When the Syndicate raises price, consumption is expected to fall, production to rise, and inventories to absorb the difference. However, vertical restraints should mitigate the increase in supply and thus the inventory buildup. In this Part, I solve the model with and without the restraints to obtain an estimate of the difference between the two scenarios. This difference quantifies the importance of the restrictions.

TABLE 6: MODEL SOLUTIONS

	Q_d	$(1 + \Theta) Q_p$	Q_{os}	ΔI
Base Case: No Cartel				
	1	0.95	0.05	0
Cartel with Vertical Restraints				
Year 1	0.80	1.0	0.07	0.27
% Change	−20	5.3	40	
Year 2	0.78	1.06	0.07	
% Change	−22	12	40	
Cumulative ΔI				0.62
Cartel with No Vertical Restraints				
Year 1	0.80	1.20	0.07	0.48
% Change	−20	26	40	

Notes: Q_d denotes consumption
Q_p denotes primary production
Θ is the fraction of Q_p that becomes new scrap
Q_{os} denotes production from old scrap
ΔI denotes changes in inventories

1. *Vertical Restraints*

With the first Syndicate scenario, I model the cartel with the restraints imposed by the Syndicate. Under the restraints, 80 percent of primary production is set at pre-Syndicate levels and only 20 percent is free to expand. Furthermore, the LME price is the marginal price that determines supply from old scrap, as well as primary supply that is not under contract. Demand is also determined by the LME price, since when the Syndicate sells metal, it sells it

at the higher price and pockets the difference between the two prices. Finally, when the LME price doubles, changes in the endogenous variables are governed by the elasticities.

The middle part of Table 6 contains forecasts of the endogenous variables when the restraints are active. The forecasts are for one and two years after the cartel forms. The table also shows percentage changes in the endogenous variables. The first column indicates that demand is reduced by 20 percent in the first year and by 22 percent in the second. Given the price elasticities, the fact that the second-year reduction is only slightly greater than the first might be puzzling. However, forecast increases in aggregate income—which grows exponentially—partially offset the reductions that are due to higher prices. Table 6 also shows that primary supply increases by 5.3 percent in the first year and 12 percent in the second. Finally, supply from old scrap increases by 40 percent in both years. These changes imply that after two years, the Syndicate holds inventories that are 62 percent of world production.

Even with the restraints, estimated inventory holdings are large. Nevertheless, inventories of 62 percent of world production are less than the Syndicate's actual holdings, which were just under 80 percent prior to its collapse.[56] The difference can probably be explained by the fact that the mining companies were not producing at full capacity when they signed contracts with the Syndicate.

It is also possible to compare estimated and actual world copper supply before and during the Syndicate. Table 7 contains levels and percentage changes in actual world production for the years 1886–1888 as well as model forecasts of percentage changes in production. In 1887, the actual change (3 percent) is less than the forecast (5.3 percent). However, this was expected, since the Syndicate did not take effect until the second half of 1887. In 1888, in contrast, the actual change (15 percent) is greater than the forecast (12 percent), which, like inventory buildup, is probably due to the fact that pre-Syndicate production was less than capacity.

2. *No Vertical Restraints*

The estimates in this Part are, of necessity, speculative. Indeed, although there is only one historical Syndicate, there are many possible alternatives. In particular, it is not clear what it means to model the Syndicate without vertical restraints. I try to model the best (most conservative) case from the point of view of the Syndicate.

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[56] PRAIN, *supra* note 19, at 103.

TABLE 7: ACTUAL AND FORECAST WORLD COPPER SUPPLY

Year	Actual Production	% Change	Forecast % Change
1886	217		
1887	224	3	5.3
1888	250	15	12

Notes: World primary production is in thousands of tons. Percentage changes are relative to pre-Syndicate production (1886). Source for world supply: Andrews, *supra* note 3.

I assume that the Syndicate offers to purchase new metal at the contract price of £70 per ton, which is an increase of 80 percent over the pre-Syndicate price. However, the Syndicate does not restrict output, and the residual that would have been produced at the higher price is sold on the LME.[57]

This is obviously a naive scenario, since it is unlikely that producers would sell to the Syndicate when they could obtain a higher price on the open market. However, one can interpret the Syndicate price as the average price paid, which would start out low but would increase quickly as news of the attempted corner circulated. With this interpretation, after the first year, the Syndicate could no longer purchase metal at a price that was lower than the LME price. However, it might continue to buy, anticipating further price increases. Since I do not have a model of LME price determination, I consider only inventory holdings after the first year.

It might be counterintuitive that in the unrestrained scenario, primary supply can expand beyond capacity. However, capacity is a fluid concept. In particular, capacity is measured as the maximum amount of metal, not ore that can be produced, whereas the true constraint is on ore processing. This means that producers can choose to process higher-grade ores, which will increase metal supply. In addition, mines that contain byproducts can switch to extracting more copper-intensive veins when relative metal prices change. Furthermore, primary producers often own abandoned mines that can open quickly when the price increases. As a result, the metal capacity of a mine is not a fixed number but instead is a function of prices as well as technology.[58]

I also assume that, as in the previous scenario, the LME price doubles, which is clearly a conservative estimate. Indeed, with larger purchases by the

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[57] This is analogous to what the Hunt brothers did in the silver market in 1979. *See supra* note 22. In particular, the Hunt brothers offered to buy but signed no contracts and did not restrict output. Like the Syndicate, the Hunt brothers at one point controlled about 80% of the world market.

[58] Like capacity, reserves of a mineral commodity depend on price. In particular, reserves are defined as ore that can be profitably extracted at *today's* prices and technology.

Syndicate, the price would have been at least as high as the historical price. My forecasts of inventory holdings are therefore conservative.

Under these assumptions, primary supply consists of purchases by the Syndicate plus the additional metal that would have been supplied at prices between the Syndicate and LME prices. As before, demand and the supply of old scrap are determined by the LME price.

The last part of Table 6 assesses what might have happened in the market had there been no output, price, and exclusive-dealing restrictions, and the Syndicate had simply offered to buy. The table shows that in the first year, primary supply would have increased to 26 percent of pre-Syndicate world production, compared to 5.3 percent when the restraints were in place. As a result, the change in inventories would have been 48 percent of world production compared to 27 percent with the restrictions—almost double. Furthermore, without restraints, inventory holdings after one year would have been almost as large as holdings after two years, had the restrictions been in place.

Finally, my estimate of inventories is a lower bound. In particular, even though primary production would have been greater with no restraints, the Syndicate would have had to purchase a large share of the increase, leaving less metal that could be sold on the free market. It is thus plausible that the LME price would have been higher than assumed. It is therefore unlikely that the Syndicate could have survived the first year without restraining supply. Indeed, the restraints were instrumental in keeping it alive.

3. *Lessons from the Secrétan Syndicate*

As with any corner, the Syndicate created winners and losers. In particular, the mining companies and their shareholders benefited from the elevated prices, whereas consumers of the commodity were hurt. In addition, the Société, the Comptoir, and investors who held copper inventories lost the money that they had invested in the Syndicate. However, investor shareholding—which was substantial—partially offset losses on the physical commodity. Finally, as with any monopoly distortion, there was a deadweight loss.

A successful corner or cartel is one where the initiators of the arrangement make a profit. Unlike the Syndicate, most subsequent attempts to monopolize the copper market were organizations of producers. Like the Syndicate, however, most were unsuccessful or of limited duration. Furthermore, as is generally true, the outsiders gained at the expense of the insiders. With the Secrétan incident, as well as with most commodity corners, the major producers were the outsiders that got a free ride. With subsequent producer cartels, in contrast, the major producers were the insiders and fringe firms were the free riders.

One might wonder if, as a general rule, commodity market corners are doomed to fail. Although most have failed, failure is not inevitable. Nevertheless, success requires adhering to a number of rules. The first rule for a successful corner is to have deep pockets, and the second is to pick an illiquid market. Those rules, however, were not problems for the Syndicate. Indeed, the Syndicate was well financed, and the initial Chile bar contract guaranteed illiquidity. The third rule is to maintain secrecy. In particular, when news of the corner begins to circulate, sellers will demand higher prices. Ideally, corners should get in and out of their positions before anyone notices, but this is difficult with commodities. The fourth rule, a corollary to the third, is to keep it small. If the attempt is not too ambitious, it can succeed for many years. Violation of the third and fourth rules led to the Syndicate's downfall. Finally, the last rule is to know when to get out. For example, violation of the last rule brought down the Sumitomo copper corner 100 years later.

V. IMPLICATIONS FOR ANTITRUST POLICY

History is replete with attempts to corner commodity markets. Unfortunately for the participants, however, commodity-market corners are almost always unsuccessful, many lose their fortunes, and some face criminal charges. Nevertheless, the temptation is great, and future attempts to corner commodity markets are likely.

In the case of the Secrétan Syndicate, it seems that, absent secrecy, the vertical restraints were instrumental in allowing the Syndicate to survive for as long as it did. Nevertheless, those restrictions were not sufficient to guarantee success and, like other commodity corners, the Syndicate eventually failed. Furthermore, its demise was probably predictable. Indeed, the attempt was too ambitious and too open.

After cornering incidents, commodity exchanges have often voluntarily changed the rules under which they operate. As a consequence, exchange transactions are much more transparent today than in the past. Nevertheless, although those changes have alleviated some problems, there is still a need for external regulation.

Before turning to regulation, however, a few facts should be stressed. First, speculation is a necessary and usually a beneficial part of commodity trading. In particular, with commodities, there are often large gaps between demand and supply, and those gaps cause price volatility. Speculators, by buying low and selling high, perform an equilibrating service.

Second, for the most part, vertical restraints are efficient.[59] For example, exclusive dealing can allow upstream firms to protect their downstream investments, and price and quantity setting can be used to eliminate double marginalization. Moreover, by entering into fixed-price contracts with sellers, buyers can hedge risk. Nevertheless, when used by firms with market power in attempts to manipulate markets, speculative activity and vertical restrictions cause competitive harm. Furthermore, the fact that in this case, buyers, not sellers, imposed the restraints does not change those general principles.

The international scope of many commodity markets causes problems for regulators. For example, the Secrétan Syndicate involved consumers, banks, and mining companies from around the world. Had national regulations been in place, responsibility for policing the Syndicate's activities would still have been unclear.

In many countries, the laws that now govern regulation of corners and commodity market manipulations are not very different from those that govern attempts to monopolize other industries. For example, in the United States, the Commodity Exchange Act (CEA), which passed in 1936 and is administered by the Commodity Futures Trading Commission (CFTC), states that "[i]t shall be a felony . . . for . . . [a]ny person to manipulate or attempt to manipulate the price of any commodity . . . or to corner or attempt to corner any such commodity."[60] That wording is not very different from the treatment of monopolization under Section 2 of the Sherman Act, which states that monopoly power, combined with the willful acquisition or maintenance of that power, is unlawful.[61]

The type of evidence that can be brought to bear for corners and monopolies is also similar. For example, a corner should cause the spot and futures prices of the manipulated commodity to rise relative to the spot and futures prices of related commodities and/or relative to prices for the same commodity in other spatial markets. Moreover, the manipulated prices should plunge when the corner is dissolved. Finally, the distortion should cause excessive supply and inventory buildup.

Econometric evidence that uses, for example, event studies or difference-in-difference techniques, could be presented to evaluate whether the observed conduct distorted prices. Nevertheless, in spite of the fact that the U.S. Department of Justice and Federal Trade Commission routinely use econometric studies to complement other sorts of evidence, such evidence has rarely been

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[59] *See* Lafontaine & Slade, *supra* note 21, at 393–97 (providing an overview of the effects of vertical restraints in theory and in practice).

[60] 7 U.S.C. § 13(a)(2).

[61] 15 U.S.C. § 2.

used by the CFTC.[62] In addition, although the government has prevailed in many Section 2 monopolization cases, few CEA cases have been successful.[63] Lack of successful prosecutions is unlikely to be due to a lack of attempts to corner.

It is perhaps time to reevaluate the laws that govern the policing of commodity market corners. In particular, jurisdiction—above all, international jurisdiction—should be clarified. In addition, the sort of conduct that one expects to observe during and after a corner, as well as the ways in which that conduct can be verified, should be made clearer, perhaps through a set of guidelines. Finally, any such guidelines should include a discussion of vertical restraints or other restrictive practices that can be used to support corners. In particular, since a corner's sole purpose is to manipulate, any restrictions that are used by the corners should be viewed with suspicion. Indeed, in the context of a corner, it is highly likely that such restrictions are adopted with the purpose of bolstering price manipulation.

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[62] *See* Craig Pirrong, *Energy Market Manipulation: Definition, Diagnosis, and Deterrence*, 31 ENERGY L.J. 1, 9 (2010) (noting that while price comparisons have been used by the CFTC in some cases—notably, in *Cargill, Inc. v. Hardin*, 452 F.2d 1154 (8th Cir. 1971)—such instances are rare, and are becoming rarer).

[63] *Id.* at 3. The situation could change, however, as a result of a pending case: *United States Commodity Futures Trading Commission v. Kraft Foods Group, Inc.*, 195 F. Supp. 3d 996 (N.D. Ill. 2016). The CFTC asked the court to adopt holdings that would significantly enhance the CFTC's ability to win price manipulation cases. The case was initially settled with a gag on both sides. However, the defendant claimed that the CRTC had violated the gag and the case is headed back to court. *See* Mark D. Young et al., *CFTC Aims to Lower the Bar on Proving Manipulation in Pending Cases*, *Skadden's 2016 Insights—Financial Regulation*, SKADDEN, ARPS, SLATE, MEAGHER & FLOM LLP (Jan. 2016), www.skadden.com/insights/publications/2016/01/cftc-aims-to-lower-the-bar-on-proving-manipulation; Matthew Leising & Christie Smythe, *Legendary Chicago Trader Continues to Wait for Justice in Manipulation Case*, BLOOMBERG (Dec. 21, 2017), www.bloomberg.com/news/articles/2017-12-21/for-legendary-chicago-trader-slow-justice-in-manipulation-case; Dave Michaels, *Market Regulator Heads Back to Court Against Kraft and Mondelez*, WALL ST. J. (Jan. 10, 2020), www.wsj.com/articles/market-regulator-heads-back-to-court-against-kraft-and-mondelez-11578056400.