Abstract:
The Sécretan Syndicate controlled 80% of world copper production in the late 1880s. The
downstream firms set the price and contracted for all of the output of the leading producers.
Despite those restraints, the Syndicate was short lived. This paper describes the cartel and
the role of the restraints in disciplining the upstream firms. It also quantifies the effect of
the vertical restraints on supply, demand, and inventory holdings. Finally, it takes a broader
look at commodity market corners — why they are attempted and why they usually fail —
and their implications for antitrust policy.

JEL classifications: K21, L42, L71, N21, N23, Q02

Keywords: Cartels, Vertical restraints, Market corners, Copper market, Price manipulation

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1 Introduction

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

Secrétan’s company, the Société Industriel et Commerciale des Métaux (hereafter the Société), a large copper buyer, negotiated contracts with copper sellers, and those contracts contained several restrictive clauses or vertical restraints. In particular, the contracts, which were for all of the seller’s output, stipulated a price and a quantity. The restraints were thus similar to exclusive dealing and price and quantity setting. They 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 market, vast profits were made, equally vast losses were incurred, and a massive redistribution of income ensued. Nevertheless, unlike well known American trusts of the turn of the century, such as Standard Oil and American Sugar, little has been written about the Secrétan Syndicate.

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

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3 E. Benjamin Andrews The Late Copper Syndicate, 3 Q. J. Econ. 508-516 (1889), which contains a descriptive account of the Syndicate, is an exception.
rarely successful—and their implications for antitrust policy.

2 The Sécrotan Syndicate and the Restraints

2.1 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 Sécrotan (also known as Hyacinthe), a well-known French metal merchant. The Sécrotan Syndicate (hereafter the Syndicate), which lasted from October of 1887 to March of 1889, controlled 80% of new 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.

Sécrotan, 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, such low prices were probably indications that speculators were selling short. He concluded 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 (hereafter the Comptoir), to support his scheme. The Comptoir gave the Société an initial credit of £2,500,000. Other French investors followed suit, including the Paris Rothschilds, the Crédit Lyonnais, and the Banque de Paris et des Pays-Bas. Finally, in early 1888, five foreign investors joined.

In October of 1887, the Société began to make large purchases of copper metal. Moreover, no attempt was made to hide those activities and the price of copper on the LME rose from £39 per ton at the beginning of October to £80 by December. Moreover, except for a short spike, it hovered around that level until the collapse 18 months later.

In order to secure his advantage, Sécrotan began negotiations with the major copper producers in Europe and North America and, in January of 1888, the Société agreed to

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4 Charles A. Harvey, THE RIO TINTO COMPANY, Alison Hodge (1981), at 68.
purchase the specified maximum production of the leading Iberian and American producers at a fixed price. Subsequently similar contracts were written with many smaller producers. Each of the 37 agreements was for three years.\(^5\)

The lack of secrecy was important for the cartel’s performance and the Engineering and Mining Journal is the best contemporary source for the flow of information in the copper market. On October 28, 1887, the Journal mentions that the price had risen but attributes the rise to the normal working of a market.\(^6\) Just one week later, however, when the price continued to rise, the Journal noted that the boom started in Paris and that people were speculating as to its cause.\(^7\) 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 Chili bars was mentioned.\(^8\)

It wasn’t long after the contracts were signed before a number of weaknesses became evident. First, when the contracts were signed, the price had already risen and the Syndicate was forced 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, but also from mines that had signed contracts, since production of those firms was below capacity in 1887. Third, investment in new and temporarily closed mines was initiated. However, the E.M.&J. notes that it takes at least two years for new investment to come online and up to one year to open a dormant mine.\(^9\) Fourth, the supply of secondary copper nearly doubled. Finally, the high price caused consumers to curtail purchases.

As a result of the imbalance between supply and demand, the Syndicate’s stocks of copper quickly grew to levels that were unsustainable. To remedy the situation, Secrétan offered new 10-year contracts that paid higher prices to the producers in exchange for 20-25% reductions in production.\(^10\) 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.

\(^5\) Id. at 68.
\(^6\) 45 E.&M.J. 320 (1887).
\(^7\) Id. at 377.
\(^8\) Id. at 476.
\(^10\) Harvey, supra note 4, at 69.
In early 1889, rumors began to circulate concerning the imminent collapse of the Syndicate and, on March 5, Russian investors demanded that their deposits be returned. Later that day, M. Denfert–Rochereau, the managing director of the Comptoire, committed suicide, which prompted a run on the bank and precipitated the Syndicate’s collapse. Both the Société and the Comptoire were liquidated shortly afterwards.

The demise of the Syndicate, however, did not eliminate the problem, 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.\footnote{Orris C. Herfindahl, COPPER COSTS AND PRICES, Resources for the Future (1981) at 76.}

Since that time there have been many copper cartels, both U.S. and international\footnote{See Id. for a detailed account of cartel activity between 1870 and 1957.} 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 build up. Moreover, until the Sumitomo affair of the mid 1990s\footnote{See Paul Krugman How Copper Came a Cropper (1996) \url{http://www.slate.com/articles/business/the_dismal_science/1996/07/how_copper_came_a_cropper.html} for an account of this corner.} copper cartels have been organizations of producers.

### 2.2 The Contracts and the Vertical Restraints

#### 2.2.1 The Syndicate Contracts

The Société negotiated contracts with the leading copper mining companies throughout the world agreeing to purchase each firm’s maximum production at a fixed price, or in some cases at a fixed price plus a share of the profit in excess of that price.\footnote{Sir Ronald Prain, COPPER: THE ANATOMY OF AN INDUSTRY, Mining Journal Books, (1975) at 103.} The first contracts were for three years and covered about 65% of world production. Subsequent contracts were written that covered about 16% and brought the Syndicate’s control to just over 80% of new supply.

The stipulated contract price ranged between £65 and £70.\footnote{Andrews, supra note 3, at 509.} 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% over the October LME price when the Société began to purchase copper. 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 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, that was not the case here.

To summarize, the Syndicate and its contracts were unusual in many respects. First, in contrast to most cartels, which are made up of producers, the Syndicate was a loosely organized group of consumers (the Société) and investors (the banks). Second, unlike most vertical restraints, which are imposed by upstream sellers on downstream buyers, 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, there was no attempt to maintain secrecy concerning the cornerers’ intentions.

2.2.2 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 Chile bars. However, by the mid 1880s, Chile had been displaced by the U.S. as the main source of copper. Moreover, the Spanish and Portuguese mines were also expanding production. As a result, the Chile bar’s share of LME trade had fallen to 12.5%. Since this was the

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17 The Hunt brothers were also open about their attempt to corner the silver market. For an account, see Daniel Dicker Oil’s Endless Bid : Taming the Unreliable Price of Oil to Secure the Economy. (2011, Appendix B) http://onlinelibrary.wiley.com/doi/10.1002/9781119200727.app2/pdf
material that was tenderable against an LME contract, the market had become dangerously thin and the situation was ripe for a squeeze.\footnote{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.}

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 1st 1888, to help deflect the corner, the LME altered the basis of its copper contract to provide more flexibility.\footnote{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.} 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, were deliverable.\footnote{The LME now lists nearly 100 approved copper brands from around the world, and any of those brands are tenderable.} 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, its timing was a direct result of the corner. Furthermore, it is almost certain that the change hastened the Syndicate’s demise.

3 Economic Models of Cartels and Corners

3.1 Cartels

Cartels have received much attention from economists, both in theory and in practice, and the cartel literature is well known.\footnote{For surveys of cartels and collusion, see Alexis Jacquemin and Margaret E. Slade Cartels, Collusion, and Horizontal Merger in HANDBOOK OF INDUSTRIAL ORGANIZATION, vol. 1. Richard Schmalensee and Robert D. Willig eds. Elsevier (1989) and Margaret Levenstein and Valerie Suslow Cartels and Collusion – Empirical Evidence in THE OXFORD HANDBOOK OF INTERNATIONAL ANTITRUST ECONOMICS, vol. 2, Roger Blair and Daniel Sokol eds. Oxford (2015).} Moreover, many cartels have involved commodities. For example, Herfindahl discusses seven copper cartels that existed between 1870 and 1956\footnote{Supra, note 7.}, almost one per decade.

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 Act was passed in 1890 in the U.S. as a
response to cartel activity in many markets including petroleum, copper, steel, and sugar
refining; farm and shoe manufacturing machinery; and meat packing. Although at the time
of the Syndicate, combinations in restraint of trade were not illegal, unless they were legally
enforceable, they faced the same enforcement problems as later illegal cartels.

Stigler’s well known article[24] was perhaps the first to provide a model that illustrates
the observation that, although perfect collusion maximizes industry profits, it is difficult to
sustain. He notes that the mere fact that price is above marginal cost implies that a single
participant has an incentive to defect and offer secret price cuts. 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. In the case of the Syndicate, the product was homoge-
neous, nonprice competition was not as important as in some industries[25] 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 Friedman’s game of perfect information[26] punishment consists
of Nash reversion forever, whereas with Green and Porter’s game of imperfect information[27]
since participants cannot distinguish cheating from bad demand shocks, Nash reversion oc-
curs 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.

[25] Nonprice competition took the form of, for example, location and timing of delivery.
3.2 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 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 it. 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 will begin to sell the commodity and/or take short positions, knowing that the price will fall.

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.28 Indeed, the mere fact that participants can influence price makes them vulnerable. In particular, when knowledge of the corner becomes widespread, nonparticipants can take opposite positions in an attempt to reverse the price increase. If they are successful and prices start to fall, it is difficult for the cornerers 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. Moreover, attempted corners of commodity markets have involved copper, silver, gold, tin, onions, cocoa, soy bean 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. Allen, Mitov, and Mei,29 however, is an exception. Those authors develop a rational expectations model of corners in which

28 For example, Franklin Allen, Lubomir Litov, and Jianping Mei Large Investors, Price Manipulation, and Limits to Arbitrage: An Anatomy of Market Corners, 10 R. Finance, 645-693 (2006) consider 14 corners, most of which were successful. However, the commodity corners that are in their data were failures.
29 Id.
there are three sorts of participants: uninformed who are risk averse, and arbitrageurs and manipulators, both of whom are risk neutral and have private information. Moreover, the first two groups behave competitively whereas manipulators behave strategically. The authors 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, they will want to corner the market. Corners thus occur during downturns when arbitrageurs are selling short. Furthermore, the authors 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 if either the manipulator is unable to purchase sufficient shares of 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; and 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 Sécretan Syndicate. In particular, the corner began in a downturn, speculators were probably selling short, and the market was illiquid. On the other hand, the lack of secrecy was probably an important deterrent to success.

4 Econometric Models of the Copper Market

In this section, 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. Of course, syndicate members did not have the results of those studies
available to them. Nevertheless, they were experienced investors and must have had an
tuitive 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, upper case letters denote variables in levels whereas lower case
letters denote their natural logarithms.

4.1 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

\[
q_d = \alpha_0 + \alpha_{price}p_c + \alpha_{cross}p_{sub} + \alpha_{inc}y + u_d,
\]

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\(^{30}\). 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\(^{31}\).

All of the studies that consider substitution assume that aluminum is the principal sub-
stitute for copper, and \( p_{sub} \) is therefore 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

\(^{30}\) Long run elasticities are usually estimated using a geometric distributed lag. In other word, a lagged
dependent variable is added to equation (1).

\(^{31}\) Average elasticities are rounded to the nearest tenth to avoid giving the impression of spurious accuracy.
Table 1: Demand Elasticities

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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 but greater than one in the long run, with averages of 0.7 and 1.3, respectively.

4.2 Supply

Copper supply can be divided into primary and secondary production, where primary copper is produced from mineral ores whereas 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.

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.

4.2.1 Primary Supply

I assume that, absent a cartel, the industry is workably competitive and that, to a first approximation, producers are price takers. 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

$$q_p = \beta_0 + \beta_{\text{price}} p_c + \beta_{\text{inc}} y + u_p,$$

where $u_p$ is defined in a similar manner 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

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32 Most of the research upon which I draw makes this assumption.
33 I have excluded exogenous shifters, such as an indicator for strikes, that identify the supply and demand equations.
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 but elastic in the long run, with estimates of 0.35 and 1.2.

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4.2.2 Secondary Supply

*Old Scrap:*

Old scrap is material that becomes available when products reach the end of their useful lifetimes, and the cost of reclaiming old scrap depends on the form in which the scrap metal is found. One therefore expects an upward sloping supply curve for old scrap. In addition to price, the stock of useable scrap material, $S$, is a determinant of secondary supply, where

\[ p_c \] is the supply equation.
$S$ is a function of primary production in past years.\footnote{Copper products have lifetimes that range from 5 to 30 years. See Margaret E. Slade \textit{An Econometric Model of the U.S. Secondary Copper Industry: Recycling versus Disposal}, 7 J. Environ. E. Mgmt. (1980) for a discussion the construction of $S$.} The supply equation for old scrap is

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

(3)

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

Table\footnote{This is an assumption, not a finding, since the dependent variable in both studies is $ln(Q_{os}/S)$.} which contains old scrap supply elasticities from two studies, shows that supply is price inelastic in both the short 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: a high price today leads to higher primary production, which augments future scrap supply, but it also leads to higher secondary production, which depletes the stock.

Finally, the short run stock elasticity is one.\footnote{This is an assumption, not a finding, since the dependent variable in both studies is $ln(Q_{os}/S)$.}

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<tr>
<td>1972</td>
<td>Fisher, Cootner, Bailey</td>
<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
<td>1980b</td>
<td>Slade</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>1987</td>
<td>Tan</td>
<td>0.6</td>
<td>0.65</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Table 3: Secondary Supply Elasticities, Old Scrap
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 ($\Theta$) of primary production. The supply equation for new scrap is

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

where upper case letters are in levels.

Table 4, which contains estimates of $\Theta$ taken from two studies, shows that new scrap supply is approximately 30% of primary production.

<table>
<thead>
<tr>
<th>Year</th>
<th>Author</th>
<th>Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1972</td>
<td>Fisher, Cootner, Bailey</td>
<td>0.40</td>
</tr>
<tr>
<td>1980b</td>
<td>Slade</td>
<td>0.25</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>0.3</td>
</tr>
</tbody>
</table>

4.2.3 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 ($\Delta I$) equal production minus consumption,

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

A few general caveats are in order. First, most of the elasticities that are reported in tables [1] – [4] are taken from studies that were published in the 70s and 80s, 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 are often not wildly different from one another lends confidence in the results. 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 just representative 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 they should be seen as indications of the impact of strategic behavior in the market.

5 Model Solutions

Equations (1) - (5) form a system of equations that can be solved for the endogenous variables. However, since (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 \( P_{\text{sub}} \) — 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 \( P_{\text{sub}} \) and \( S \) do not change as a result of the cartel, whereas \( Y \) increases at its historic rate of 7% per year.

The length of the planning period must be chosen. If the speed of adjustment is \( \lambda \) after \( k \) years, the relevant elasticity is \( 1 + \lambda + \lambda^2 + \ldots + \lambda^{k-1} \) times the short run elasticity.

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37 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.

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

39 The speed of adjustment is \( \lambda = 1 - \rho \), where \( \rho \) is the coefficient on the lagged dependent variable.
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. In contrast, commodity market corners take more time. For example, the Hunt brothers failed corner of the silver market in 1979–80 lasted for over a year before it was prematurely ended due to intervention by the U.S. Federal Reserve Board and the Commodity Exchange of New York. 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.

Table 5 shows the elasticities that are used for the solutions of the model.

<table>
<thead>
<tr>
<th></th>
<th>$\alpha_{\text{price}}$</th>
<th>$\alpha_{\text{inc}}$</th>
<th>$\beta_{\text{price}}$</th>
<th>$\beta_{\text{inc}}$</th>
<th>$\gamma_{\text{price}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>One year</td>
<td>-0.40</td>
<td>0.70</td>
<td>0.30</td>
<td>0.35</td>
<td>0.50</td>
</tr>
<tr>
<td>Two year</td>
<td>-0.57</td>
<td>1.02</td>
<td>0.53</td>
<td>0.60</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Notes:

- $\alpha$ denotes demand elasticities
- $\beta$ denotes primary supply elasticities
- $\gamma$ denotes old scrap supply elasticities

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

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40 See John Plender and Avinash Persaud, *The Day Mr. Evil Wounded a Financial Giant* The Financial Times (August 22, 2006) https://www.ft.com/content/144f84ca-31fd-11db-ab06-0000779e2340?mhq5j=e1

41 See, for example, Dicker, supra note 13.

42 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 build up would be infinite.
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 London Metal Exchange (LME), which doubled during the episode, was an almost constant multiple of the contract price. I therefore assume that the free market price doubles.

5.1 The Base Case

The first exercise is to solve the model under the assumption that the Syndicate does not exist, which is the base case that can 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\(^{43}\) whereas secondary production from old scrap is 0.05\(^{44}\) 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.

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.

5.2 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 subsection, 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.

\(^{43}\) From now on, 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.

\(^{44}\) These proportions are approximately those for the US in 1906 (USGS (2012) https://minerals.usgs.gov/minerals/pubs/historical-statistics/).
Table 6: Model Solutions

<table>
<thead>
<tr>
<th></th>
<th>$Q_d$</th>
<th>$(1 + \Theta)Q_p$</th>
<th>$Q_{os}$</th>
<th>$\Delta I$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Base Case: No Cartel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>0.95</td>
<td>0.05</td>
<td>0</td>
</tr>
</tbody>
</table>

|                  |       |                   |          |            |
| **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 $\Delta I$** |       |                   |          | 0.62       |

|                  |       |                   |          |            |
| **Cartel: 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
- $\Theta$ is the fraction of $Q_p$ that becomes new scrap
- $Q_{os}$ denotes production from old scrap
- $\Delta I$ denotes changes in inventories
5.2.1 Vertical restraints

With the first Syndicate scenario, I model the cartel with vertical restraints. Under the restraints, 80% of primary production is set at pre– Syndicate levels and only 20% 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% in the first year and by 22% 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. The table also shows that primary supply increases by 5.3% in the first year and 12% in the second. Finally, supply from old scrap increases by 40% in both years. These changes imply that, after two years, the Syndicate holds inventories that are 62% of world production.

Even with the restraints, estimated inventory holdings are large. Nevertheless, inventories of 62% of world production are less than the Syndicate’s actual holdings, which were just under 80% prior its collapse.\textsuperscript{45} 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 1886–88 as well as model forecasts of percentage changes in production. In 1887, the actual change (3%) is less than the forecast (5.3%). 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%) is greater than the forecast (12%), which, like inventory build up,

\textsuperscript{45} Harvey, supra note 4, at 71
is probably due to the fact that pre–Syndicate production was less than capacity.

Table 7: Comparison of Forecast and Actual World Copper Supply

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual Production</th>
<th>% Change</th>
<th>Forecast % Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1886</td>
<td>217</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1887</td>
<td>224</td>
<td>3</td>
<td>5.3</td>
</tr>
<tr>
<td>1888</td>
<td>250</td>
<td>15</td>
<td>12</td>
</tr>
</tbody>
</table>

Notes:
World primary production in thousands of tons
Source for world supply: Andrews (1889)
Percentage changes are relative to pre Syndicate production (1886)

5.2.2 No vertical restraints

The estimates in this subsection 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.

I assume that the Syndicate offers to purchase new metal at the contract price of £70/ton, which is an increase of 80% 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.\textsuperscript{46}

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

\textsuperscript{46} This is analogous to what the Hunt Brothers did in the silver market in 1979. In particular, they offered to buy but signed no contracts and did not restrict output. Like the Syndicate, at one point they controlled about 80% of the world market.
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 only consider 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.

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 Syndicate, the price would have been at least as high as the historic 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 restrictions (no vertical restraints) and the Syndicate had simply offered to buy. The table shows that, in the first year, primary supply would have increased to 26% of pre–Syndicate world production, compared to 5.3% when the restraints were in place. As a result, the change in inventories would have been 48% of world production compared to 27% 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

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47 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.
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.

5.2.3 Lessons from the Secrétan Syndicate

As with any corner, the Syndicate created winners and losers. In particular, the mining companies and their shareholders benefitted 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 and, as is generally true, the outsiders gained at the expense of the insiders. With the Sécretan incident, as well as most commodity corners, the major producers were the outsiders who 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 failure. Although most have failed, failure is not inevitable. Nevertheless, success requires adhering to a number of rules. The first rule for a successful cornerer 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 Chili-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, cornerers 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. I conclude this section with an account of a copper market corner that succeeded for a decade but was brought down because the final rule was not respected.

The Sumitomo Corner

A century after the Syndicate cornered the copper market, there was another attempt that almost succeeded. In the mid 1980s, Sumitomo, a large Japanese trading company, owned substantial inventories of copper metal as well as copper futures contracts. Recognizing those positions, Yasuo Hamanaka, the head of Sumitomo’s metal trading division, decided to use the firm’s size and cash reserves to corner the market. Although Hamanaka never owned more than about 5% of world supply, he was able to keep the price artificially high for nearly a decade — until 1995 — when the corner collapsed.

Hamanaka attempted to hide his activities by working through British intermediaries. Nevertheless, many insiders were aware of what was happening. When they tried to short Hamanaka, however, he used his deep pockets to pour more cash in, forcing the short sellers to deliver the commodity or pay the higher price. Most decided to cut their losses. For example, the business magnate George Soros got out a few months too soon.

The collapse in 1995 was probably brought about by the resurgence of mining in China, which put pressure on the market for a correction. When the price plunged, Sumitomo announced that it had lost over $1.8 billion and that the losses could go much higher. Although Sumitomo claimed that Hamanaka was a rogue trader, most people believe that the company was complicit in implementing a deliberate corporate strategy of cornering and had profited from that strategy for years. Sumitomo responded to allegations of misconduct by implicating JP Morgan Chase and Merrill Lynch, banks that had granted loans to finance Hamanaka’s activities. After litigation, all were forced to pay fines. Moreover, Hamanaka was sentenced to eight years in prison.


49 Krugman, supra note 9.
The collapse could probably have been avoided if Hamanaka had been willing to exit gradually, but he was unwilling to sell at a loss. Indeed, in the face of evidence that the corner was unravelling, he chose to double his bet. Many attribute his downfall to hubris.\footnote{See, e.g., Krugman \textit{supra} note 9 and Treasury Today \textit{supra} note 40.}

6 Implications for Antitrust Policy

History is replete with attempts to corner commodity markets. Unfortunately for the participants, however, commodity market cornerers are almost always unsuccessful, many loose their fortunes, and some face criminal charges. Nevertheless, the temptation is too great and it is highly unlikely that there will be no future attempts.

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, output 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.\footnote{See Lafontaine and Slade \textit{supra} note 12 for an overview of the effects of vertical restraints in theory and practice.} 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 the restraints were imposed by buyers, not sellers, does not change those general principals.

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. Furthermore, a century later, the global nature of Hamanaka’s activities probably contributed to the ineffectiveness of the national regulations that had been enacted in the interim.

In many countries, the laws that 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 U.S., the Commodity Exchange Act (CEA) of 1936, which is administered by the Commodity Futures Trading Commission (CFTC), stipulates that “It shall be a felony ... for ... any person to manipulate the price of any commodity ... or to corner or attempt to corner any such commodity knowingly.”\(^{52}\) That wording is not very different from the treatment of monopolization under Section 2 of the Sherman Act, which stipulates that monopoly power, combined with the willful acquisition or maintenance of that power, is unlawful.

The sort of evidence that can be brought to bear in the two situations 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 in an effort 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 used by the CFTC\(^ {53}\) In addition, although many Section

\(^{52}\) Commodity Exchange Act, 7 U.S.C §13(a) (2009).

\(^{53}\) See, e.g., Craig Pirrong, *Energy Market Manipulation: Definition, Diagnosis, and Deterrence*, 31 Energy L. J. 1-20 (2010) at 9, who notes that price comparisons have been used by the CFTC in some cases, notably
2 monopolization cases have been won, few CEA cases have been successful\textsuperscript{54}. 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 cornerers 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 the price manipulation.