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ABSTRACT

Detailed notes on weekly meetings of the sugar refining cartel show how communication helps firms collude, and so highlight the deficiencies in the current formal theory of collusion. The Sugar Institute did not fix prices or output. Prices were increased by homogenizing business practices to make price cutting more transparent. Meetings were used to interpret and adapt the agreement, coordinate on jointly profitable actions, ensure unilateral actions were not misconstrued as cheating, and determine whether cheating had occurred. In contrast to established theories, cheating did occur, but sparked only limited retaliation, partly due to the contractual relations with selling agents.

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This paper reexamines the cartel problem by studying the private discussions within one cartel. While we find much that is in accord with George Stigler's (1964) basic insight that firms would structure an agreement conscious of their later incentive to cheat on it, we also uncover puzzles for established theory, and identify elements that a richer theory should encompass, especially regarding the role of communication in collusion.

Our window into the inner workings of a cartel is a remarkable series of notes on the weekly meetings of the Sugar Institute. This trade association was formed in December 1927, in the wake of several years of falling margins and excess capacity, by fourteen firms comprising nearly all the cane sugar refining capacity in the United States. It operated until 1936, when the Supreme Court ruled its practices illegal.

Among the top executives in regular attendance at the meetings was Louis V. Placé, Vice President of McCahan, a mid-size refinery in Philadelphia. Placé, who was "in charge of all activities of the company except production and raw sugar purchases",[1] wrote over 500 pages of single spaced detailed notes on the Board of Directors, Executive Committee, and Enforcement Committee meetings from January 1929 through mid-1930. He also reported on the informal gatherings that followed them, and private conversations with other refiner representatives and Institute personnel.[2] Since the memos circulated among only some six McCahan executives, they

are extremely candid. Under cross-examination at the trial, Placé claimed to have regularly destroyed them upon receiving the much less revealing *official* minutes.[3] Placé's own notes catch the President of American in an act of perjury,[4] and reveal both the refiners' legal strategy, and their political machinations.[5]

For economists, Place's notes are a unique information trove on cartel behavior. Participants in a modern cartel are unlikely to create such detailed and contemporaneous documents of decision-making, due to legal concerns. Moreover, although antitrust agencies can subpoena firm records and interview market participants, strict confidentiality rules keep what they learn from academic research, except by way of the rare trial.

Placé's memos serve us in two ways. First, they are a record of the *communication* among the refiners. Here are announcements of impending actions that firms did not wish misconstrued as market stealing, charges of cheating, threats of retaliation and deliberations over cooperative actions that were jointly profitable but singly unprofitable.

Second, the memos reveal the *reasoning* behind firms' actions. This is a type of evidence that economists have tended to shy away from. Milton Friedman (1953) would judge a theory solely by its predicted outcomes. But we agree with Alan Blinder (1993) that a firm's explanation of its conduct is also proof, since a theory describes the "chain of reasoning" which motivates the firm.

Indeed, participants' beliefs are an integral part of many game theoretic models. Furthermore, because like Ariel Rubinstein (1992) we view "a model [as] an approximation of [the players'] perception and not an approximation of an objective description of reality", we think it valuable to document how colluding firms viewed their environment.

The Sugar Institute never directly fixed prices nor allocated market shares. There is no indication or legal finding of either.[6] Instead, it fixed rules. These rules, whose main principles were stated in its Code of Ethics[7] and whose details were promulgated in successive Code Interpretations, covered every conceivable aspect of the distribution and marketing of sugar other than the basis price itself. In this way, the refiners eliminated the differential treatment of customers and harmonized contractual practices, thus facilitating the detection of secret price cuts.

In his seminal work on collusion, Stigler (1964) identified the ability both to *detect* price-cutting and to *retaliate* against it as the primary requirements of successful collusion. However, he emphasized detection. In contrast, more recent work, from Edward J. Green and Robert Porter (1984) on, has concentrated on the nature of optimal retaliation, and taken the detection probability as parametric. Studying the Sugar Institute refocuses our attention on detection, in revealing how firms may enhance it by altering their environment through both specific rules and

institutional structure, including communication. The costs of such a strategy in foregone profits from price discrimination and cost efficiencies are made clear as well.

We find the current formal theory of collusion wanting in three respects. First, the theory ignores the inevitable incompleteness of collusive agreements. Conclusions about the role of renegotiations are especially misleading because of this neglect. In contrast, we show that the meetings embodied a governance structure for the agreement, ensuring its adaptation to (typically endogenous) changing circumstances. Second, the theory provides no role for rich communication within the agreement. We show the crucial role provided by ex-ante notification and ex-post determination of fault at the weekly meetings.[8]

Finally, as Margaret C. Levenstein (1997) has shown, the theory incorrectly predicts that cheating (which should not even occur in equilibrium!) will always be met by competitive, or sub-competitive, conditions. We see such harsh punishments only in response to massive cheating. Occasional incidents of cheating were typically not retaliated against. Open violations, or consistent patterns of cheating in a single dimension were matched in degree and kind. We argue that the contractual arrangements for sales agents help explain the limited retaliation.

Section I presents evidence that the Institute raised margins and profits. This establishes that the collusive efforts were at

least partially successful, and so merit further investigation. Section II details the collusive mechanism, rule fixing, and the benefits and costs it entailed. Section III interprets the Institute as an incomplete collusive agreement. Sections IV and V explore how ex-ante notification and ex-post determination of fault supported the agreement, while Section VI documents firms' response to its violation. Section VII shows that the firms did not transfer market shares or infer cheating from variations in them, as existing theories predict. Section VIII concludes.

I Performance

How successful was the Sugar Institute? Table 1 lists some relevant yearly statistics. As David Genesove and Wallace P. Mullin (1997, 1998) showed, the simple production technology of cane sugar refining affords direct measures of marginal cost and so of the price-cost margin as well. To produce a pound of refined sugar, one needs 1.075 pounds of raw sugar, the price of which constitutes most of the cost of refining. Column (2) presents the "proper margin", the difference between the price of refined and 1.075 times the price of raw. Column (3) subtracts an additional 60 cents per *hundred* pounds, which represents all non-raw sugar variable costs of refining.[9] The establishment of the Sugar Institute in December 1927 is coincident with an increase of the margin of about 20 to 25 cents per hundred pounds over the

preceding three years. As column (4) shows, this increase is a more than doubling of the Lerner Index. Of course, the use of list prices runs into the obvious difficulty that the Institute was established in response to the pervasiveness of secret price cuts. However, any bias only strengthens our conclusion: so long as the Sugar Institute eliminated or at the very least did not exacerbate the secret concessions, the increase in the list price provides a lower bound for the increase in the actual price.

An increase in the price cost margin indicates only that collusion was enhanced. How close that is to fully collusive pricing depends on the elasticity of the relevant demand curve. In our earlier work, we show that the elasticity of demand for cane sugar during the 1890-1914 period was about 1.75. That would indicate a monopoly Lerner Index of 57 percent, far above the margins under the Sugar Institute. This discrepancy is explained in part by the post-War growth of beet sugar, which would have increased the demand elasticity for cane, and in part by the desire to deter both foreign and domestic entrants. A more realistic benchmark for monopoly pricing would be eleven percent. This was the margin in 1892, when both the margin and American's market share reached their greatest level (the latter at 92 percent of the market). By that measure, the refiners managed to raise the Lerner Index to about three-quarters of its monopoly level.

The quantity series, though less dramatic, is also consistent

with an increase in market power. Column (5) shows that the output of the Atlantic refiners fell with the establishment of the Sugar Institute. The decrease in output is small, as sugar demand is relatively inelastic. Output continued to fall in the latter part of the Sugar Institute period. The decline is undoubtedly due to the Great Depression, although it is much less than the 24 percent fall in total industrial output. The relative stability of sugar production is consistent with Christina D. Romer's (1990) finding that the onset of the Great Depression was associated with much sharper cutbacks in purchases of durables than of non-durables. It is also due to low prices for raw sugar, itself a consequence of rising subsidies in producer nations and the 1934 reduction in the tariff on Cuban raw sugars (Bill Albert and Adrian Graves, 1988, p.9).

As one would expect, rivals outside of the collusive agreement responded to the price increase by increasing their own output. Column (8) shows an increase in imports of refined sugar, which originated almost entirely in Cuba. Coca-Cola, the largest purchaser of refined sugar, was among those firms that shifted entirely to foreign suppliers.[10] Previously a negligible flow of less than half a percent of total U.S. consumption, foreign refined sugar increased to 6 percent in the first year of the Sugar Institute and continued to increase until it reached almost 15 percent in 1933, after which it was reduced by legislative fiat in

the Sugar Act of 1934 to 11 percent. The share of beet sugar production (column (7)), whose producers lay outside of the Sugar Institute as well, also rose, from an average share of 15.4 percent in the four years before the Sugar Institute, to an average of 17.7 percent in the first four years of the Institute before the Sugar Act, although the year to year variability here is such that one can not clearly attribute the rise to the Institute's formation.

Prices, profit margins and the like are all measures of market power. They tell us the degree to which collusion is successful. They say nothing about how it is achieved. For that, we must consider the actual mechanism of collusion, that is, the Sugar Institute - its rules, its meetings and the means by which it ensured compliance with those rules.

II Collusion by Rules

The Sugar Institute system combined implicit collusion on price with explicit collusion on business practices. The latter complemented the former, the ultimate goal, by making price cuts more transparent. In this section, we outline the agreement on business practices. In the next three sections, we explore how, through communication, explicit collusion sustained the agreement.

Rule number one of the Sugar Institute was the requirement of "open prices and publicly announced terms", and so nondiscriminatory pricing. The attendant provisions that prices be

posted on the refiners' bulletin boards, that the Institute be notified of all changes both in price and methods of pricing, and that price changes be announced no later than 3:00 p.m. merely continued existing industry practice.

The remaining rules primarily consisted of restrictions on contractual practices between the refiners and downstream firms - brokers, wholesalers and retailers -, and among downstream firms themselves. The breadth and detail of the restrictions were remarkable. For example, the Institute disallowed quantity discounts, allowances for the return of sugar bags, long term contracts and certain types of credit arrangements. It required refiners to report it all sales of damaged sugar. It drew up a list of permissible consignment points - cities where refiners stored sugar on their own account. The Institute went so far as to forbid certain downstream activities, namely brokerage and storage, being combined within the same firm! Enforcement of this last rule engaged the Institute in private investigation and auditing.

The stated aim of these rules was to eliminate discriminatory pricing. This claim was repeated as part of the refiners' legal defense, but why it would have been in their interest to do so was never explained. The defendants noted that this ensured compliance with the Clayton Act's prohibition on price discrimination, but were silent on why compliance required collective action.

To the economist, the Institute's rules smack of *facilitating*

practices. Collusive agreements are constantly in danger of being undermined by secret price cuts. Since a collusive agreement results in a price above any firm's individually optimal price, participant firms have an individual incentive to undercut this price slightly and receive a larger share of industry demand and profits. A firm that cheats will want to undercut secretly in order to avoid retaliation from other producers. Anything that makes detection of a secret price cut more likely enhances collusion. At least if they are adhered to, the requirements of "open prices and publicly announced terms" clearly make cheating more evident. Complex, differentiated contractual terms may hide price cuts under other names, and so restrictions on contracting practices would serve a similar role to the open pricing requirement. Thus, the Sugar Institute was primarily a mechanism to increase the probability of detection of secret price cuts, thereby facilitating collusion.

The refiners worked to enhance detection and not reduce reaction time, because the industry's long standing "moves" system, in effect even before the establishment of the Sugar Institute, already made the effective reaction lag nearly zero. Under this system, announced price decreases took effect immediately, while price increases took effect only after a day had passed. That gave buyers, who purchased a month's worth of sugar at a time, the incentive to refrain from purchasing immediately after a price

decrease until other, perhaps preferred, firms matched it (which they always did) and perhaps to benefit from a further fall in price. In practice, firms' reactions often came in minutes, and a day proved long enough for all reactions to be registered and for the price to settle. So price competition preceded trade. Thus by decreasing its publicly announced price a firm could not hope to `steal the market'. Only secret discounts could steal customers away from other firms.

The Sugar Institute rules were so wide ranging and detailed, because virtually every contractual term could mask a price cut. We consider five of these rules.

Water Damaged or Frozen Sugar. It seems reasonable that such sugar sell at a discount. But a refiner could ship undamaged sugar to a favored customer, invoice it for damaged sugar, and claim, if questioned later, that the sugar was damaged. So for each such sale, the rules required "full details of amount, location, reason and price to be circulated by the Institute."[11]

Likewise, favorable *credit terms* secretly extended to buyers could substitute for a price cut. A long standing industry practice granted a two percent discount for cash payment. But refiners would vary the length of the grace period necessary to qualify for the discount. The Institute forbade this.

Storage rates. Prior to the Institute's ban, many brokers also operated warehouses that stored sugar for customers. Acting

on behalf of a refiner with whom they had a long-term relationship, the broker could substitute a discount on the storage payment for a cut in the price of refined itself. The refiner would then compensate the broker by routing an un-intermediated purchase offer through the broker, for example.[12]

Delivery Time (Contract Enforcement). Customers did not have to take delivery immediately, but could spread out deliveries against a contract over 30 or more days. Allowing favored buyers to take delivery beyond the contracted date not only saved them storage and interest payments, it also constituted a preferred price if the basis price rose in the meanwhile. So the Institute insisted that delivery dates be enforced.

Freight rates offered yet another way of giving a price cut, although only on rates not regulated by the Interstate Commerce Commission (ICC). For that reason, the Sugar Institute discouraged use of private water charters by requiring every such shipment to be registered. It also asked the charters to quote uniform rates for all customers, and even demanded a written commitment from shippers not to rebate freight to customers.[13] When the lower water rates proved too tempting to both refiners and their brokers, the refiners moved to delivered pricing, as described in Section III.

Colluding in this manner was not costless. By adopting these restrictions, the firms forewent additional profits from the differential treatment of customers.[14] These lost profits, which

a monopolist would have earned, derived not only from price discrimination, but also efficiencies of various kinds, especially in shipping. When large buyers in Buffalo asked to receive delivery by water barge (technically more convenient for the buyers), even if charged at the much higher railroad rate, the Institute refused for fear of creating the opportunity for granting discounts.[15] On a larger scale, the move to delivered pricing led to refiners replacing brokers in the transportation of sugar by water barge.[16] Presumably, the original integration configuration was the more efficient one. The refiners also ran the risk of backward integration by their large customers thus denied quantity discounts, as A&P threatened to do.[17]

The prohibition of long-term contracts, and tolling contracts, where the buyer financed the raw sugar purchase, clearly also meant lost efficiencies.[18] The requirement that all purchased sugar be delivered within 30 days led to a secondary market, where "second hand sugar", offered by customers who had over bought, sold at a discount ranging between 5 and 20 cents. Any transaction costs in buying and selling would make that development a social loss.

Placé, in particular, was prepared to forego certain efficiencies from the allocation of production according to cost. He so feared different prices, that he did not want local differences in loading or shipping costs to lead to differential rates. “Those enjoying more economical loading conditions can

pocket the profits", he wrote in a letter to the Institute.[19]

Coordinated action via a trade association was not obviously illegal. Indeed, there were numerous "open price" associations at the time,[20] many inspired by Arthur Jerome Eddy's 1912 book *The New Competition* and promoted by the Federal Trade Commission. But a series of Supreme Court decisions in the early 1920s had left the legal status of trade association activities unclear. Also, the Sugar Institute's activities were clearly on the edge of the permissible.[21] Indeed, its members were extremely conscious of the legal consequences of their deliberations.[22] They had the initial Code of Ethics vetted by the Department of Justice, which nonetheless later prosecuted the refiners, obtaining a 1936 Supreme Court decision outlawing most of the Institute's practices.

II.A An Alternative Hypothesis: Quality Suppression

There is an alternative, yet still collusive, explanation for the contractual restrictions. Many of these rules can be understood as limitations on either quality or within firm variety, for contractual harmonization typically involved choosing the lower `quality' level. The grace period for payment was set at seven, and not at fourteen days, the number of consignment points were cut by half,[23] etc. In this interpretation, the rules were meant to shut down non-price competition and so were directly collusive, instead of merely facilitating collusion.

There was undoubtedly some suppression of non-price competition involved, but at best this explanation is incomplete. First, it fails to account for many of the rules. These include the prohibition on quantity discounts, the refusal to deal with warehouse-affiliated brokers or shippers that did not openly announce their rates, as well as other transportation policies. The rules on prior notification discussed in Section IV below are particularly difficult to interpret in this manner. Second, the number of different sugar grades itself was not restricted. This was so even though the proliferation of grades was costly to the smaller refineries through lost economies of scale in packaging.[24] Third, and most persuasively, the alternative argument does not capture the intermediate goal of eliminating discriminatory pricing. The Institute's Code of Ethics has as its first principle that "all discrimination between customers should be abolished." This goal is a central theme not only throughout the published Code but also in the notes on the private meetings.

Nonetheless, we do not reject this argument completely. Rather, we view the suppression of non-price competition as complementary to contractual harmonization. Both quality and variety are often over provided from the industry's point of view. If one is already choosing, and enforcing, one single contractual standard among many, one might as well limit non-price competition along the way.

III Incomplete Collusive Agreements

"Although [oligopoly] is often thought of as a market structure problem, it becomes a contracting problem when it is phrased in terms of the comparative efficacy of cartel agreements." (Oliver Williamson, 1996, p. 8)

The unavoidable conclusion from reading the Placé memoranda is that the initial agreement was *incomplete*, in the sense used in the theory of the firm. Collusive agreements are incomplete for the usual reason that it is impossible to anticipate, enumerate and work through all contingencies. Indeed, the need to "fill in gaps" in the initial agreement was explicitly recognized by the refiners in writing to the Court that the Code of Ethics was not and "could not be, self-operative. ... [I]t required interpretation and administration and consultation and the collection of information, [which] the Institute was set up to provide".[25]

The weekly meetings allowed the refiners to "complete the contract" in several different ways. Least important was the opportunity to adapt to changing external circumstances, for the technology and demand of refined sugar barely changed over the period of the Institute. Aside from the rare mention of a new demand substitute, such as liquid sugar, or a small scale innovation like bagging refined sugar in paper lined raw sugar bags, such issues do not arise in the Placé memoranda.[26]

The meetings also allowed the refiners to perfect the agreement under unchanging external conditions. This included addressing minor questions left unclear by the Code and subsequent amendments. Can damaged sugar be sold under a price guarantee? No. Is it "permissible to store in the warehouse of a broker who does not handle sugar?" Yes. May one entertain a broker? Yes. Do 30 day contracts end on the 30th day after the start of the contract, or on the same day of the next month? The former. Are contracts to be considered filled by telephone or telegraphic order, or only if invoiced? The latter.[27]

More importantly, certain rules were found to be unworkable, and had to be modified. The original Institute policy required refiners to charge the ICC regulated all-rail rate, regardless of the actual transportation mode used. Removing the discretion from refiners to set their own tariffs meant that refiners' greater market power in their hinterlands were leveraged to more competitive markets, such as the Great Lakes, where all refiners marketed their sugars.[28] However the availability of cheaper, albeit slower, water, or combined rail and water, routes offered too great an arbitrage opportunity to others. So the rules were changed to permit differential rates under a limited set of circumstances, for "inconsiderable" quantities. This new regime proved unworkable, in part because refiners themselves were tempted by these routes, which facilitated secret price concessions both on

and off the routes. So the refiners switched to a system of delivered prices coupled with a refusal to sell f.o.b. refinery. This move to delivered pricing, delayed for over a year out of fear of the anti-trust authorities, was *ostensibly* accomplished by the independent actions of the refiners, given the dubious legality of the Institute taking such a step. But the Placé memos show the move to be a coordinated act that required several meetings over a single week, in which suitable rates were discussed and a leader emerged among the firms.[29]

Perhaps the most important adaptation function lay in closing unintended loopholes. The Institute was constantly regulating some new practice, as the elimination of one method of secret price concession would give rise to a new, albeit less effective, one - much in the same way as taxpayers' or firms' response to tax or government regulations will give rise to new rules. Thus initially, only storage in a warehouse owned by a customer was prohibited. But as Institute regulations foreclosed that and other avenues for giving secret concessions, refiners began storing in broker-affiliated warehouses, and the rule had to be changed to prohibit storage there as well.

These decisions were formalized by issuing a series of Code Interpretations, which possessed a quasi-judicial character, an analogy not lost on Institute members. When C.&H. questioned the legality of enforcing adherence to the Interpretations, since only

the Code itself had been approved by the Department of Justice, the Institute Counsel deemed the former "absolutely indispensable. Even national laws must be `interpreted' by the Courts because it is impossible to foresee, at the time of writing the law, all the circumstances to which it will apply. In the same way the Code must be interpreted in the light of particular circumstances."[30]

Legal imagery permeates the Placé memoranda. The participants spoke of evidence, as we shall see, and precedent. A decision on rates to cities served by the New York Canal was later taken as applicable, "[o]n the same principle", to rates throughout the Great Lakes region.[31] Inquiries about the operation of a public warehouse for sugar were deemed "covered by the decision in the Bridgeman Russell case."[32]

Given the centrality of rules in this collusive mechanism, one should perhaps not be surprised by the imagery. But the legality also had real effects. Legal principles help `complete the contract' by extending one decision to cover many subsequent incidents, as well as minimizing disputes. They also allow participants to anticipate others' response. One might also argue that the legal approach delayed, and perhaps restricted, retaliation against violations of the agreement, as we shall see.

IV Prior Notification

Prior notification of impending actions was an integral part

of the Sugar Institute mechanism. Institute rules required a firm to notify other members before selling damaged sugar, introducing new private brands, and changing any terms of trade. While in practice the reports on damaged sugar sales took place shortly afterwards,[33] the rule on private brands - sugar marketed through a grocery chain with the latter's label, often at a discount - was clearly followed.[34]

We see numerous examples of notification of future changes in shipping tariffs or policies more generally in the Placé memos. For example, when Revere, a Boston refiner, considered reducing its rail shipments rates from the rail rate to the water rate, it first told the Institute. Arbuckle preceded its public announcement of its decrease in freight rates by a private announcement to Institute members. And C&H informed the Institute of its probable intention to spread the price guarantee to other states.[35]

But notification was used even when it was not explicitly required by the agreement. Arbuckle Brothers anticipated (preempted?) opposition by announcing that some grocers had advertised its brand and that it wanted "to go on record as stating that such ads are at the expense of the grocers".[36]

Prior notification served two purposes. First, it was an attempt to eliminate the *retaliatory lag* in the non-price domain. As such, it was complementary to the rule of "open announcement" of prices and other terms of trade to buyers, which was directed at

shortening the *detection lag*. It is well known theoretically that full collusion is possible when firms can respond to others' deviations before consumers act,[37] and the combination of frequent meetings and prior notification allowed firms to do so.

The notification rule operated on the higher level of a two level agreement. At the lower level was a precise agreement comprised of codes, amendments and resolutions that detailed permissible actions, such as described in Section II. At the higher level was an understanding of adherence to these lower level rules. This meta-understanding permitted refiners to remove themselves from the lower level rules. But they were expected to notify the other members of their intention to do so beforehand.

Of course, notification must be timely to be effective. In its Brief to the Supreme Court, the Department of Justice cited an Institute rule that notification be given at least 15 days before taking any action that violated a Board of Directors' decision. However, we have no independent verification of that claim.

Notification can also be in the individual interest of a firm. Consider an action which is privately profitable once other firms have responded to it, but which will take market share away from other firms if unanticipated by them. Taking market share away from rivals risks retaliation. In the price domain, for example, a decrease from *above* the monopoly price, if anticipated and matched, will leave the price cutter (and its rival) better off

than before; but if unanticipated and thus unmatched, the decrease will give the initiating firm the whole of the market, and though temporarily more profitable, thus risk a retaliatory price war.[38]

The Placé memos contain an explicit recognition of this function. The Godchaux representative

> praised the attitude of Savannah who, when faced with the necessity of changing their method of doing business in order to meet competition last Fall, did not rush through an announcement [to the public]. Instead, they waited for a Board meeting at which they explained conditions as they found them and discussed with other refiners the necessity for action on their part. Their subsequent announcements, because understood, did not cause any upheavals. Other refiners recently have not followed this policy with the result that, when revolutionary announcements are made, retaliatory announcement are made by other refiners thereby plunging the industry into deplorable and expensive practices.[39]

As we shall see, notification also preceded retaliatory action. Deferring action until notification was possible carried a cost of retaliatory delay, at the benefit of reduced misunderstandings.

Notice that all the cases considered here concern an easing of

the terms of trade. In the usual example of notification, the *Ethyl* case[40], prior announcement was made of an intended toughening of sale conditions - a nominal price increase in an inflationary environment. That gave firms an opportunity to see if other firms would follow them, or not. In that case, notification served as a coordinating mechanism for an action that, when taken by all firms, would benefit them, but if taken by one firm alone, would harm it.

V Ex-Post Determination

The Sugar Institute meetings also provided a forum for accusation and rebuttal. For example, in March of 1929, American charged Federal with secretly cutting prices by loading barges without charge. American argued that

> [F.O.B.] meant that the sugar must be placed within reach of the tackle of either the ship or the barge. Several people testified ... that this had been the interpretation in the past and that all loading and unloading charges had always been construed as being for account of the vessel. [Federal] took the position that F.O.B. means literally "free on board" and the condition visualized by [American] could be correctly described as "F.A.S." meaning free alongside."[41]

Reading this, one is led to ask why the firms bother arguing at all. If one firm thinks that the other has cheated, why not just retaliate? Why the need to prove the point?

There are two reasons to first investigate. First, there may have been no intention to break the agreement. Perhaps Federal did not mean to capture additional market share by loading the barges, and thought that other firms were acting as it did. As in the Green and Porter model (1984), the evidence for cheating is never unambiguous, although here it is a misunderstanding - an "`honest mistake' by rivals concerning the nature of the `agreement'" (David Kreps, 1990, p. 529) - not a drop in industry demand, that confounds. A similar difference of opinion arose about the deadline for payment of sugar shipped by barge from New Orleans.[42]

Other times, the confounding factor was indeed a change in external factors. Thus the failure to force delivery on customers at the end of 30 days was variously determined to be due not to cheating, but to the difficulty of obtaining barges, vacuum pans and other unforeseen events. The accusation could be factually wrong: a concession on one barrel of caked sugar was wrongly reported as a concession on a much larger amount of powdered sugar by a Sugar Institute investigator.[43] Or a firm employee or direct broker may simply have made an error in invoicing or shipping.[44]

Unlike in Green and Porter (1984), there is a mechanism here - the Sugar Institute's meetings - by which firms can first judge

whether cheating has in fact occurred before taking action. The Sugar Institute served as a court in which an accused firm might prove its innocence, in some cases on factual, in others on logical, grounds. In doing so, the Institute raised the signal to noise ratio of indicators of cheating, to use a more prosaic metaphor.

A second reason not to retaliate immediately is the need to first garner support among the other firms. If the accusing firm acts alone, it may stand accused of cheating itself, and be subject to retaliation. Such was the case for Godchaux in retaliating against Savannah, as described in Section VI below.

As a result, accusing firms could not rely on their own beliefs alone, but required evidence. Evidence had to be not only observable, but legally verifiable as well - to use the language of contract theory. Placé informs his readers (fellow McCahan executives) of an accusation that Godchaux was selling sugars to Edgar. This was a violation of Institute regulations because Edgar, a large, prominent, and aggressive, Detroit brokerage firm, was engaged in storage as well. An invoice uncovered by an Institute investigator that appeared to document a sale was offered as evidence. Placé examined the invoice after the meeting.

> I am afraid that [the investigators] are off on the wrong track... [T]his invoice is merely part of Godchaux's

> bookkeeping method...I do not doubt that the 20 cars are eventually to be merchandised by Edgar but ... [Godchaux] is too clever to commit a faux pas such as [the investigator] thought he had uncovered.[45]

With the invoice no longer probative, all the refiners were notified of the "the error which apparently had been made."[46]

VI Cheating and Retaliation

In the theory of implicit collusion, the response to a deviation is

> simple in the extreme. A deviation by player i is always treated the same way regardless of the nature of the deviation, the period in which it occurred, the particular path in progress, or the point on the path at which the defection occurred. There is no need to "tailor the punishment to fit the crime" (David Pearce, 1992, p. 140).[47]

What we observe is quite different. Firms did cheat. A Detroit chain store received a secret price concession when it switched from National to Spreckels. Spreckels overpaid truckers who then worked a few hours "free" for certain customers. Arbuckle

knowingly sold to a dummy corporation that fronted for Edgar.[48] All this was done secretly, then uncovered by the Institute.

Cheating was particularly bad in the South. Godchaux broke Institute regulations twice over in accepting a contract with a price guarantee for delivery by water barge, whose movements it agreed not to trace. Texas City accepted a 42 day contract - an offense serious enough that the owner offered to fire his top three executives over it. That same refiner later absorbed storage charges through a dummy corporation. Colonial offered a six cent rebate to large buyers. And in Tampa, post-dated checks were used to give credit.[49]

Yet, outside of the South, neither in prices nor in rules were these individual violations met by reversion to competitive conditions a la Green and Porter (1984), let alone sub-competitive conditions, a la Dilip Abreu et al. (1986). This is especially noteworthy as the industry did experience sub-competitive prices a generation earlier (Genesove and Mullin, 1997). Rather, deviations were either *ignored* or *matched*.

Typically, when a specific incident of cheating was uncovered, fault was determined, the refiner confessed or attempted to justify it[50]- or more likely, blamed the broker[51] - and then halted the practice. There the matter would end. One can conjecture that one refiner's cheating would encourage another's, but by the nature of such a process it is impossible to connect one incident to a

particular predecessor.

Where the cheating continued over a longer period, or there was an open violation of the agreement, the response was typically to match the practice. This is most evident in transportation pricing. When one firm openly lowered its rate for rail shipments to the lower water barge rate, other firms would respond by lowering their rail rates to the same level.[52] When the Pacific refiners gave a freight allowance on certain contracts, American announced that it would match it.[53] The punishment was indeed "tailored to fit the crime".

Matching was not only in degree but also in kind. In responding to a violation, rival firms have at their discretion not only the extent of retaliation, but the instrument as well. For example, in response to the invoicing of a rail shipment at the lower barge rate, in contradiction to the Institute rules, retaliation need not be restricted to transportation pricing, but in principle could include payment length, consignment policy, sugar grades, and even price. Indeed, just as Douglas Bernheim and Michael Whinston (1990) have shown that, where there is multimarket conduct, collusion can be enhanced when punishment encompasses all markets, so one would expect that collusion would be enhanced by punishing a deviator with all possible instruments at hand.

It is surprising, then, to observe that the response to a deviation was generally restricted to the instrument of violation.

When, for example, Southern refiners failed to prevent the diversion of shipments from states in which price was guaranteed during shipment to where it was not, C.&H. introduced a guarantee for Texan shipments and threatened to extend it to other Western states.[54] Likewise, when McCahan concluded that some refiners were not uniformly enforcing the contract time limits, Placé first threatened not to enforce McCahan's terms either[55] and then, with others, carried out his threat. Likewise, Arbuckle Brothers threatened to "meet secret competition by openly accepting contracts for delivery ... over an indefinite delayed period."[56] After several price moves over a period of months resulted in mixed success in contract enforcement, the Institute proposed that each refiner inform the trade that henceforth any sugar remaining on a contract would be shipped to customers in bulk bags on the contract's expiration date. Savannah, although agreeing to send out the letter, refused to enforce it, on the grounds that Hershey had in the past done the same. Colonial then conditioned its enforcement on that of Savannah and C.&H.[57] In yet another case, when Arbuckle Brothers temporarily stopped adhering to the Institute's sugar standards, National and Penn stopped as well.[58]

This restricted pattern of retaliation is also present in the enforcement of the separation of brokerage and storage activities downstream. Arbuckle Brothers threatened that if there were any further shipments to brokers who doubled as warehouse operators,

then it would begin supplying Edgar again.[59]

Matching was actually institutionalized in the enforcement of the 30 day delivery rule, which firms continually broke by granting extensions on the grounds of production schedules and transport availability. To deal with this problem, the Institute required refiners to report their quantity of undelivered contracts for each price move.[60] These weekly reports were circulated to all members and discussed at a dedicated weekly meeting. A large balance of undelivered contracts revealed a firm as unlikely to meet the contract due date, either because of capacity constraints in production or transportation, or because the high balances signaled an unwillingness to pressure customers to take delivery. Other refiners could then match by adjusting, or threatening to adjust, their own contract enforcement. This matching was eventually further institutionalized by a short-lived understanding "that all refiners will be free to spread their own deliveries over the same number of days as the most delayed refiner will require", which agreement was "not to be announced to the trade".[61]

These reports both sped up retaliatory matching and made it more routine. In their absence, a firm would not know precisely how well others were forcing delivery until after the due date had passed. Retaliation could only then be through refusal to enforce future contracts, or, like C&H before joining the Institute, on other contractual terms.[62] The reports permitted quick, nearly

contemporaneous responses, precisely tailored to the violation.

Where retaliation did take the form of a reversion, or threatened reversion, to competitive conditions, or worse, it was only in response to large scale cheating in several dimensions. This only occurred in the South, which was the periphery of the market. As early as June 1929, an Institute investigator reported the Code of Ethics as "dead in the water" in Texas. Compartmentalization broke down there. C&H would not discuss any single issue, but insisted that given the conditions, it would only discuss all of them together.[63] Arguing that Texan refiners "have been guilty of many different violations of the Code", C.&H. threatened to "request the entire suspension of the Code of Ethics in the Texas territory so that all refiners may be in position to fight fire with fire."[64]

Elsewhere in the South, Savannah was dissuaded from resigning from the Institute, so that it might deal with the "unethical" competition from the Cuban refiner Hershey, by a resolution which authorized members "to `meet the competition of Hershey', provided that the specific competitor and the exact territorial limits are announced to the Institute."[65] Thus the Institute agreed to suspend the collusive agreement, so long as prior notification was given.[66]

The last example illustrates again how Institute membership stymied firms from immediately responding to competition. Retaliation was to be at the discretion of the Institute as a whole

only. When in November 1929, Godchaux withdrew its authorization for the Institute to audit its stocks until Colonial ceased its storing its sugar in buyer affiliated warehouses, and withholding contract enforcement and other statistics[67], the other refiners disapproved; according to them, Godchaux was

> taking a very arbitrary position. Irrespective of Colonial's activities, Godchaux has no right to secretly indulge in unethical practices themselves ... If Godchaux desires to meet Colonial competition it must be done openly, as Savannah did in Southeastern territory.[68]

Our comments in this and the previous section paint a very different picture of the response to a deviation than that imagined in the formal theory. Instead of meeting a single deviation with immediate massive retaliation, there may be an attempt to determine if it was indeed a conscious effort to break the agreement, or rather a misunderstanding, or the product of external factors. Threats may also precede any retaliation, in part to ensure it is not misconstrued as a deviation, in part to allow the deviator to back down. Retaliation when, and if, it comes is limited to the kind of violation and is typically to match it.

Thus the refiners had chosen the opposite end of the tradeoff between Type I and Type II errors to that of the Green and Porter

(1984) equilibrium. There, firms accept that they will punish when cheating does not occur in order that cheating never occur; here, firms accept some cheating so as not to punish inappropriately. Collusion was nonetheless (imperfectly) sustained, because wholesale cheating was retaliated against massively.

One reason to desist from full scale retaliation stems from the vertical contractual arrangements in the industry. Issues of internal firm organization apparently dictated that the most efficient contract between a firm and its sales agents entailed brokerage, with brokers often dealing exclusively with specific refiners.[69] Brokers faced high powered incentives, with a fixed percentage commission earned on every sale.

This system was at odds with the collusive agreement in two respects. First, an exclusive broker had an incentive to "steal" a customer from another firm through secret concessions. Of course, because refiners made a positive profit on every sale, this would benefit the refiner as well. But being one of many, instead of one of fifteen, a broker's incentive to deviate much exceeded a refiner's. Viewed from the refiners' perspective, brokers' cheating added noise to demand, and so provided an opportunity for firms to cheat by hiding behind their brokers, much like demand shocks in Green and Porter. Collectively through the Institute, the refiners sought brokers' adherence to the agreement through blacklisting deviators (although refiners tended to protect their

own), and instilling a culture of adherence to the codes.

Not only did the system make deviations more prevalent, it made punishment more costly. It is easy to see that continual transitions between a "collusive" phase and a "punishment" phase would be difficult to enact in such an environment. One cannot easily ask selling agents to one day adhere to one set of rules, the next to another, and the day after to return to the first set of rules, especially when the first set of rules stands in the way of their (individual) profit opportunities.

Apparently, the tension between the desire of selling agents to increase sales and the firm's desire to abide by the agreement was felt inside the firm, as legally defined, as well. Arguing that "the matter of contract enforcement cannot be left in the hands of the Sales Department", one firm announced that it had established "an entirely separate department to handle contract enforcement and enforcement will be accomplished without allowing the prejudices and desires of the Sales department to interfere."

Finally, we ask: Why matching? Matching in price (where sales are made before rivals can respond) will not deter undercutting, of course, but the method can be effective for deviations in discrete choices, such as for rules. Robert Axelrod's (1984) demonstration of the robustness of a matching, or `tit for tat', strategy in computer simulations of the Prisoners' Dilemma is well known.[70] Less well known is subsequent work showing the robustness of the

`generous tit for tat' strategy (Axelrod, 1997, p.36-7) in which a percentage of deviations are assumed to be `mistakes', and so are forgiven - as seems to have occurred here. An additional appeal of matching must have been that it was consistent with the ethic of non-discrimination and symmetry that underlay the Code of Ethics.

Could what we have labeled as deviation followed by retaliation by matching be better thought of as a move to a new equilibrium, in which one firm leads, and the others follow in an optimal response, however grudgingly? There is some appeal to this interpretation, at least when the violation was done openly. But the larger point remains. We do not see the use of massive retaliation to protect the original equilibrium, which the Folk Theorems of implicit collusion would suggest could be sustained by such response, and would be, when collusion is less than perfect.

VII What Firms Did Not Do: Inference from Market Shares and Market Allocation

Since in the Green and Porter model and its offshoots cheating is inferred from an increase in a firm's market share, it is natural to ask, as some readers of earlier drafts of this paper have, whether refiners used such information to police the accord. Market share information was available to them, although at somewhat low frequency (Genesove and Mullin, 1999), but was rarely used in that fashion. The one such inference in the Placé

memoranda is the observation that Arbuckle had not been obtaining its "proper quota of business", apparently because brokers regarded it as "too strict" in enforcing contracts. The possibility that American's advertising is at fault instead is dismissed, since other refiners' sales had not fallen. Half a year later, the Arbuckle representative blamed its low share on its not being "as liberal in meeting competition as McCahan" had been. Placé retorted that the "premise" was wrong.[71]

In Green and Porter (1984), a fall in market share, whatever the reason, leads to a price war. In the Placé memoranda, the reason for the decline is crucial. In a rather dramatic incident, the president of C&H, not yet a member of the Institute, threatened to "break the price" *if*, upon returning to San Francisco, he were to discover that its sales had been low *because of* the failure of Eastern refiners to enforce the 30 day limit.

In Dilip Abreu et al. (1990), Drew Fudenberg et al. (1994) and Athey and Kyle Bagwell (2000), a firm that registers a decrease in market share is compensated with additional market share in future periods. There are a couple of discussions along these lines in the memoranda. Colonial having stated that "it will consider itself at liberty `to meet the competition' as it meets it .. The consensus of opinion was that Colonial ha[d] suffered such a large decrease in distribution that some means must be found to allow them to catch up."[72] Because at this point the memoranda become

quite spotty in their coverage of the meetings, we do not know why Colonial's sales had declined, and do not know whether "some means" was found and acted upon (we suspect not). Elsewhere, Placé hears that American is forbidding second hand sugars from being transferred to Boston, presumably to stop Revere, the local Boston refiner, from dropping its price.

Note, however, that as we pointed out in Section II, there was no easy mechanism for reallocating market shares.

There are thus imperfect echoes of these models of collusion under imperfect public information in the memoranda, but they are rare. These four incidents are the only such ones in nearly a hundred meetings over the eighteen month period. Market share is a noisy indicator of cheating; and with direct evidence available, the refiners evidently preferred to rely on that instead.

Throughout the course of the Institute's life there were calls for a stronger agreement that would go beyond rules to exercise control over production. Indeed, that was the members initial purpose in organizing, before their counsel told them they could not do so. Nonetheless, twice American proposed a market sharing scheme. In April 1929, it suggested a "formula" holding each refiner's output to its capacity under "War-time `control' plus 50 percent of any subsequent increase in capacity." The issue "was discussed at great length but no decision was arrived at". Then on August 29 of that year, having waited for the official meeting to

adjourn, the American representative proposed a specific market share for each firm (with a decrease in every share except American's). For neither proposal was any enforcement mechanism offered, and, in fact, nothing came of either, so that almost a year later, one participant complained "that, in spite of all the pretty speeches which have been made on [self-regulation], there is no evidence of this principle being put into practice." He was answered that "unfortunately, the Institute's attorney does not allow discussion of this subject on a basis which could bring actual results."[73]

A couple of refiners called for consolidating the industry. The C.&H. president spoke of removing two or three refiners.[74] Spreckels called for "three or at most four companies control[ling] all the refineries of the country."[75] But there were no mergers or acquisitions during this period.

Calls for coordinated market withdrawals were left unfulfilled as well. C.&H. prepared a map "to show that, if the Western territory is not invaded by Atlantic Coast and Gulf refiners, Western producers would be able to distribute these products without coming south or east."[76] But the eastern refiners were hardly prepared to cede the important market of Chicago. Placé demanded a "deliberate plan for the curtailment of the operation of the [then non-member] C.&H.", and in response the Institute decided to ask the Hawaiian planters to sell a larger part of their raw

sugar to the Eastern refiners, rather than C.&H. But there is no further mention of this, and C.&H.'s production was not cut back.[77]

These are the only discussions of stronger collusive schemes in Placé. The Sugar Institute was at the edge of allowable behavior, "pioneers" at the "frontier", as its counsel was to say on the eve of the trial, "beyond anything" the courts had approved, although not necessarily yet forbidden.[78] Through its communicative organs it could do much better than simply inferring cheating from public information. To collude more explicitly, would clearly have been illegal. To merge was impossible, given the government's 1910 anti-trust suit against American. Unfortunately for the refiners, the Court would decide that their practices were also illegal, and push back the "frontier".

VII Conclusion

We have emphasized the Sugar Institute's role as a mechanism for governance and a forum for communication among the refiners. However, it fulfilled two additional functions. The more important of the two was its role as a neutral party among the firms. That allowed the Institute to audit them. It also collected information while protecting its confidentiality, aggregating self-reported firm-level statistics into industry totals that were then reported back to the firms. Genesove and Mullin (1999) considers this role, and so we have not pursued it here.

There was an additional, strategic value to the embodiment of the collusive agreement in an institution outside of the individual firms. In their bargaining with brokers or buyers, the refiners sometimes used the Institute as a scapegoat. More formally, firms could commit to policies by having them formalized as Institute rules. However, this manoeuver was limited by the Institute's counsel's warning that such claims would paint the Institute as a consolidation and thus risk anti-trust prosecution.

It is useful to compare what we have learned here about communication with a number of recent theoretical papers that have explored the issue.

We have stressed the adaptation value of frequent meetings. It could be argued that such flexibility would come at the cost of less credible punishment schemes, for frequent meetings might allow firms to renegotiate their way out of punishments. The theoretical literature on renegotiation is inconclusive, although Barbara McCutcheon (1997) has argued that the ability of colluding firms to meet once an initial agreement has been reached would constrain the agreement. Certainly, that would help explain why retaliation seems so weak in this market.

However, we think that renegotiation was not a serious impediment to collusion. Clearly, the refiners did not see it as so. In choosing to have weekly meetings, the refiners obviously valued the adaptation function higher than any risk of

renegotiation of punishment. The meetings continued at that frequency, or higher at least until mid-1930, when the Placé memos end. No one ever suggested less frequent meetings.

Also, we see no evidence of renegotiation out of punishment. The threats we document are never retracted. Nor do we see firms bargain out of any punishment. Of course, the possibility that a punishment might be renegotiated might nonetheless determine the structure of the agreement; in theoretical terms, one can always construct a non-renegotiated equilibrium from the path of any renegotiation-proof equilibrium. But, (a) we have already noted that in meeting so frequently the refiners must have been either unaware or unconcerned with the possibility of renegotiation, and (b) that theoretical conclusion presupposes an environment in which all contingencies are foreseen. This non-renegotiated equilibrium is more properly seen as an artifact of the models, in the same sense that the models predict that there will be no cheating in equilibrium. McCutcheon herself acknowledges that her model lacks "incomplete contracting, imperfect monitoring, and meetings in equilibrium" - all features of the Sugar Institute.

In their recent paper on price collusion with private information, Athey et al. (2000) touch on certain issues that we have emphasized here. Thus they note that in the pursuit of a workable collusive agreement, firms will often choose to give up cost efficiencies. We stressed the same point in Section II, but

it is important to understand the difference between our paper and theirs. The foregone efficiencies in their model are privately observed; whereas those we document here - delivering sugar by water rather than rail, for example - are publicly known, and so, as the authors themselves note in their conclusion, their collusive scheme could easily and profitably accommodate them. Thus a different explanation for the foregone efficiencies is required. We have offered the explanation that exploitation of these efficiencies would threaten the homogeneity of business practices that made pricing transparent.

In their conclusion, Athey et al. (2000) argue that their model could rationalize a hypothetical situation in which one firm openly lowers its price drastically and yet evokes no response. They cite an earlier draft of this paper as providing support, in the non-price domain, for such occurrences. We think this is a mistaken application of their model, for the cheating we describe in Section VI are clearly "off-equilibrium". They are taken secretly, and typically uncovered only by the Institute's costly investigation.

We have found the current theories of collusion to be inadequate for representing what transpired in the Sugar Institute. Existing theory has little to say about communication in collusion, and those models that exist do not capture the richness of the content of that communication. Furthermore, the nature of

retaliation for cheating is much more restrained than that imagined by the existing theories. We have also argued that the internal organization of the firms, more specifically, the selling agents' high powered incentives, help explain the limited retaliation. Nonetheless, one should not lose sight of the overall success of Stigler's original insight in capturing the essentials of collusion in this market. The Sugar Institute and its rules were constructed by firms in pursuit of the common goal of collusion but each well aware of their individual, *ex post* incentive to undermine the agreement once in place.

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1.Testimony of Louis Placé, Transcript of Record, Volume II p. 827, District Court Record.

2.The Placé memoranda are deposited in the Rionda Family Archives at the University of Florida, Gainesville (see Carl Van Ness, 1995). We supplement them with the voluminous trial record. Both sources are described in David Genesove and Wallace Mullin (1999).

3.Paragraph 7712, Volume VI, Supplemental Transcript of the Record.

4.He actively participated at a meeting in which the move to delivered pricing was coordinated (Placé, 4/18/29) but denied that the refiners ever discussed it (Defendants Fact Brief, p. 212.).

The memos also show Arbuckle Brothers shipping to a bootlegger (Placé, 2/20,/30: 6).

5.Placé, 1/29/29, 2/15/29, 5/11/29. In the last case, the refiners discuss asking the beet sugar refiners association to petition the government to regulate transportation pricing in the sugar cane refining industry.

6.The anti-trust authorities realized this early on (Harry A. Babcock, 1930, p. 14).

7.This is reproduced in the appendix of Genesove and Mullin (1999).

8.Recent work that uses communication as a technical device to form public histories to solve for the equilibrium does not demonstrate the need for communication (Olivier Compte (1998) and Michihiro Kandori and Hitoshi Matsushima (1998)). Also, the messages in these models are simply retrospective reports of the private information, i.e., firm outputs, and miss the richness that we describe below. Laurits R. Christensen and Richard E. Caves(1997) and Maura P. Doyle and Christopher M. Snyder (1999) show how firms coordinate through public announcements of intended capacities and production, respectively.

9.This is 26 cents (per hundred pounds) in 1898 dollars, the value used in the earlier studies. These costs remained remarkably stable as well. McCahan's internal documents indicate these costs amounted to 63.6 cents per hundred pounds in 1927 (Placé correspondence, December 12, 1932 letter to Manuel E. Rionda.) The corresponding

industry average in 1927 was 55.3 cents. (Brief for the Defendants on the Facts, p. 455, in District Court Record). The economic significance of these differences across firms or time is slight.

10.James Fly to O'Brien, February 26, 1932, DOJ Correspondence, Case File No. 60-104-13. Foreign refiners attributed their increased exports to the higher U.S. margins brought by the Sugar Institute (Walter L. Rice to James Fly, May 16, 1932, DOJ Correspondence, Case File No. 60-104-13).

11.Placé, January 17, 1930.

12.Placé, August 2, 1929.

13.Placé, 4/4/29, 4/11/29, 2/20/30, 2/27/30. For similar reasons, trucking posed continual problems for the Institute.

14.In his ruling, the District Court Judge stated the matter succinctly: "the refiners preferred to have all sugar sold in any given trade areas at precisely the same prices and terms rather than to effect economies in its sale and distribution." Andrew R. Dick (1996) notes that in colluding via a common sale agency, some U.S. export cartels must forego marketing specialized to the needs of individual firms' products.

15.Placé (June) 06/13/29.

16.Between 1928 and 1931, barge shipments by refiners increased by 400 percent, while those by customers fell by two-thirds. "Denies Sugar Group Enforcement Rule", Journal of Commerce, May 6, 1932, clipping in DOJ Correspondence, (Box 422).

17.DOJ Correspondence, Box 421, Lamb memo to Colonel Donovan, June

15, 1928, p. 1. Michael Katz (1987) shows how price discrimination can deter backward integration by large downstream buyers (indeed chain stores in his example). The successful backward integration of Arbuckle Brothers from sugar packaging to refining in 1898 after American refused it a quantity discount would have lent some credibility to A. & P.'s threat (Genesove and Mullin, 1997).

18.NARA DOJ Correspondence (Box 422), July 11/1931 interview with Edgar.

19.Placé, April 3,4 1929.

20.There were 150 such associations in 1921, (Federal Trade Commission Survey, cited by Simon Whitney, 1935, p. 40). Ironically, over 400 open price associations were operating under the National Recovery Administration at the time of the Supreme Court decision (F. M. Scherer and David Ross, p. 348).

21.See *American Column and Lumber Co. et al. v. United States*, 257 U.S. 377 (1921); *United States v. American Linseed Oil et al.*, 262 U.S. 371 (1923); *Maple Flooring Manufacturers' Association et al. v. United States*, 268 U.S. 563 (1925); *Cement Manufacturers' Protective Association et al. v. United States*, 268 U.S. 588 (1925).

22.American, the largest firm, was particularly wary of any discussions of prices. Upon the reading of a broker's letter complaining about non-uniformity in the previous week's price announcement, its representative complained that "such a letter

should never have been read at a meeting of the Institute and should never have been placed on the agenda." (Placé, December 19, 1929.) See also Placé, July 18, 1929: 6 and March 13, 1930. The initial Department of Justice report on the Institute noted that "If we may deduce anything from the invitation issued by the Institute to the Department of Justice to send a representative to attend its meetings, no discussion of price takes place at them" [NARA DOJ 60-104-13, Box 421, Contents of Bundle, December 1, 1928, p. 20]. The refiners did discuss fixing brokerage rates (12/12/29; 1/30/30).

23.Whitney, December 1, 1928, in DOJ Correspondence.

24.This is evident from a series of letters between Placé, who was in charge of marketing, and the production manager, e.g. Letter from Kavanagh to Placé, July 24, 1930, Placé Correspondence -- Costs and Melts, R.G. IV -S. G. 3 Series 151 - Box 1. The Institute's Standardization Committee concerned itself only with defining a few of the widely available commercial grades, and monitoring the refiners' accurate labeling of their own sugars for sale (a logical complement to the `open prices' rule). It was not particularly successful.

25.Answer of the Defendants, United States of America, Petitioner, v. The Sugar Institute, et al., Defendants, in the District Court of the United States for the Southern District of New York, Filed August 1, 1931, p. 59.

26.Placé, 2/25/29, 2/13/30.

27.Placé, 2/28/29, 9/19/29,9/25/30, 9/26/29,1/17/30.

28.Dennis Carlton (1983) and Jacques-François Thisse and Xavier Vives (1988) show that while spatial price discrimination is a dominant strategy for a duopolist, the firms are better off when prior agreement forbids it.

29.Placé, several meetings, April, 1929.

30.Placé, 7/24/30, (9).

31.Placé, 4/4/1929, (8).

32.Placé, 7/19/1929 and 2/20/1930. In his study of 19th century railroad pools, T. S. Ulen (1979, p. 82) found parallels in their institutions to an executive, legislature and judiciary, though he makes no mention of legal imagery in their discussions.

33.Placé, 2/20/30, p.6.

34.For example, Federal announced to its fellow refiners that it might consider packing "private brands" but would take no action without notifying the Institute. Later, Imperial objected to the large number of private brands offered by Texas City, and threatened to "meet the competition." Three months after this threat, Imperial announced to the Institute that it would indeed pack private brands, at which time Texas City complained that it had discontinued two of its private brands. (Placé 08/02/29, 02/13/30, 05/15/30).

35.Placé 3/31/29, 3/8/29.

36.Placé 8/15/29, 3/27/30.

37.See, e.g., Bashkar (1989).

38.Notification is desirable even when the rival firms are left worse off after they match the price cutter, as when a low cost firm undercuts an initial price that is equal to a high cost firm's monopoly price (Robert H. Gertner, 1994). Also, compare Margaret Slade (1992), in which price wars are seen as transitions to the new equilibrium when privately observable costs change.

39.Placé, 3/13/30, p.3.

40.*E.I. DuPont de Nemours Co. et al. vs. FTC*, 729 F. 2d 128, 1984.

41.Placé, 3/14/29.

42.Placé, 3/13/30. Placé notes to his readers that he "recognized the truth of Mr. Moog's reasoning".

43.Placé, 1/30/30.

44.Placé, 5/29/30, 9/26/29, 1/27/30.

45.Placé, 3/20/30, (6).

46.Placé, 3/27/30.

47.Pearce is referring to public information models only. But Susan Athey et al. show that in a private information model, all "off-schedule" deviations are also treated the same.

48.Placé, 05/16/1929: 22. 3/13/30. The Arbuckle representative volunteered the information to prove a point. Upon hearing it, one of the National representatives "jumped to his feet and in an excited tone of voice asked the Institute to elect another chairman as he refuses to be a member of an organization whose members brazenly admit the violation of its regulations. I caught an

exchange of glances between [him and the other National representative] and the former immediately calmed down. It was evident that the National had [done the same]."

49.Placé, 03/27/1930: 9, 8/22/29, 12/19/29, 10/3/29, 2/14/30.

50.Placé, 5/27/30.

51.E.g. Placé, 8/29/29, 9/26/29, 12/19/29.

52.Placé, 3/28/29.

53.Placé, 5/22/30.

54.Placé, 3/8/1929: 3.

[14]Placé, Letter filed with the memoranda, 2/15/29.

56.Placé 6/15/29.

57.Placé, 8/1/29 (4).

58.Placé, 2/8/29.

59.Placé, 5/9/29 (6).

60.The willingness of refiners to supply these figures is striking given the failure to collect actual sales figures from members, as described in Genesove and Mullin (1999).

61.Placé, 11/17/29.

62.See Section VII.

63.Placé, 7/18/29: 8.

64.Placé, 11/21/29, page 1.

65.Placé. The date is unclear in the original, but is probably July or August, 1929.

66.Hershey was not a member of the Institute, but, like the beet sugar association and C.&H. before joining, had adhered to some of

the Institute's regulations and its requests for market statistics.

67.Placé, 22/08/1929, 19/09/1929 and 3/10/1929.

68.Placé, Executive Committee, 11/7/29: 7.

69.American's attempt to sell directly to buyers without intermediaries from 1918-1922 was apparently a complete failure.

70.Levenstein (1997) documents a tit for tat clause in the collusive agreement between Dow Chemical and Deutsche Bromkonvention.

71.Placé, 9/29/29; 2/20/30.

72.Placé, 9/26/30.

73.Placé, 4/11/29, 8/29/29, 2/6/30.

74.Placé, 3/8/29.

75.Placé, 2/13/30.

76.Placé, 03/08/1929: 10.

77.Placé, 04/11/1929: 2.

78.Placé, 1/17/30; 3/8/29: 6.

Table 1

(1) Year	(2) Proper Margin	(3) Proper Margin -.60	(4) Lerner Index	(5) Output	(6) Profits	(7) Beet Share	(8) Foreign Refined Share
1914	0.99	0.39	0.047	106	3.7		
1915	0.95	0.35	0.036	114	3.9		
1916	1.04	0.44	0.041	118	4.3		
1917	1.31	0.70	0.068	103	7.4		
1918	1.04	0.44	0.048	93	3.9		
1919	0.88	0.27	0.029	121	4.2		
1920	1.94	1.34	0.129	113	12.2		
1921	1.06	0.46	0.073	128	6.0		
1922	0.97	0.36	0.060	157	5.9		
1923	0.88	0.28	0.033	123	3.3		
1924	1.06	0.45	0.061	128	5.4	15.3	0.5
1925	0.80	0.19	0.035	143	2.6	16.1	0.5
1926	0.79	0.18	0.034	142	2.7	15.4	0.5
1927	0.74	0.14	0.023	130	2.0	14.7	2.5
1928	1.00	0.40	0.071	122	4.9	18.7	6.2
1929	1.00	0.39	0.077	128	5.1	14.7	8.3
1930	1.04	0.44	0.091	126	5.6	17.0	8.0
1931	0.96	0.36	0.071	107	3.8	20.5	9.6
1932	1.07	0.47	0.093	103	4.7	21.0	12.8
1933	1.14	0.54	0.093	99	5.3	21.6	14.7
1934	1.17	0.56	0.104	94	5.3	25.1	11.0
1935	1.07	0.47	0.083	96	4.4	22.1	11.1
1936	1.03	0.42	0.072	98	4.2		
1937	1.03	0.43	0.077	108	4.9		
1938	0.98	0.37	0.077	100	3.7		
1939	1.01	0.41	0.079	99	3.9		
1940	1.01	0.41	0.086	100	3.9		
1941	0.85	0.25	0.048	116	3.0		

Columns (2) through (6) are weekly averages. Column (2) shows the difference between the price of refined sugar and 1.075 times the price of raw sugar, in cents per pound. Column (3) shows the difference between column (2) and .60, the non-raw sugar component of variable cost per pound. Column (4) presents the ratio of that margin to the price of refined sugar. Column (5) shows the output of the Atlantic refiners, in millions of pounds. Column (6) shows the sum of the variable profits of the Atlantic refiners, in millions of dollars. Columns (7) and (8) present the annual shares of domestic beet sugar production and imported refined sugar in total U.S. sugar consumption. All prices are in December 1927 dollars. The Sugar Institute was established in December 1927.
Source: Prices of refined (standard granulated) and raw (96 centrifugal) and output are taken from the weekly reports of Willett and Gray's *Weekly Statistical Sugar Trade Journal*. The shares of domestic beet sugar production and imported refined sugar are taken from the January issues of Willett and Gray's *Weekly Statistical Sugar Trade Journal*.