Chapter
11

EXCLUSIVE DEALING AND VERTICAL INTEGRATION: THE EFFICIENCY OF CONTRACTS IN THE TUNA INDUSTRY

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1. OVERVIEW

The procurement of tuna by U.S. processors relies on a complex set of formal and informal contractual arrangements between tuna processors and captains. Domestic processors make investments in modern tuna vessels in return for exclusive supply contracts and a share of the net earnings of the vessel. Each captain generally co-owns his vessel with a processor and is largely responsible for the fishing operations of the vessel. In return, the captain earns a share of the net earnings of the vessel, a wage for being a crew member, and a bonus for exceptionally large annual catches.

What initially motivated this inquiry was the observation that the price processors paid for domestic tuna was typically below the (delivered) price paid for comparable foreign tuna. Although this price differential suggested the possibility of monopsony power among processors in the procurement of domestic tuna, an FTC investigation found that the price difference reflected, in part, the nonprice payments that processors extended to captains. Consequently, there was insufficient evidence to support a case against the major processors. Its structural characteristics notwithstanding, the industry appeared to behave competitively.

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The FTC finding that a significant portion of the observed price differential is explained by the nonprice payments on U.S. landed tuna raises two questions: (1) what explains the remaining portion of the price differential and (2) why do processors make nonprice payments for domestic tuna? At issue is whether the remaining price differential and the nonprice payments are consistent with competition in the U.S. tuna industry.

The first objective of this study is to show how contracting for U . S. tuna promotes efficiency and therefore competition despite structural and behavioral characteristics which may suggest the contrary. One possible explanation of the remaining differential between the U.S. price and the relatively higher foreign price is that the foreign price reflects the higher costs of marketing tuna through competitive auctions. The theory is quite simple: The U.S. market differs from foreign markets in that most consumption in the U.S. is of canned tuna rather than raw tuna. As a result, the inspection, sorting, and grading required for the fresh fish market (in foreign ports) represents an unnecessary cost in the U.S. market. To reduce these costs to efficient levels, it would be preferable for processors to simply buy the boatowner's entire unsorted catch at a price reflecting average quality. However, if processors tried to do this without restricting the boatowner's ability to sell part of his catch elsewhere, boatowners would have an incentive to sell the higher quality tuna to competing processors (at higher prices) and thus increase the sorting and inspection costs of marketing tuna. Exclusive dealing contracts between boatowners and processors that require that a boat's entire catch be sold to a particular processor prevent the duplicative inspection and sorting costs that would otherwise result.

The second objective of explaining the emergence of nonprice payments is achieved by noting that nonprice payments emerged with the introduction of a major technological change in the method of domestic harvesting. The fishing technology changed from a pole-and-line method to a mechanized net retrieval system. Joint ownership of modern tuna vessels by U.S. captains and processors also increased due to this change. Both nonprice payments and vessel co-ownership became necessary because the technological change in fishing increased the costs of using exclusive dealing arrangements to procure domestic tuna. The principal hypothesis is that the change in technology increased the expected contract costs of exclusive dealing to such an extent that vessel co-ownership emerged as an additional efficient form of organization. In turn, nonprice payments by processors are an efficient response by processors to correct the malincentives of the captain that result from co-ownership of a technologically improved vessel. Thus, an understanding of nonprice payments requires an understanding of vessel co-ownership.

Since vessel co-ownership is only one of several institutions which simultaneously emerged in the modern period, however, it cannot be analyzed independently of the other new institutions. Additional new institutions are (1) the provision of vessel financing by processors, (2) a change in the method of determining tuna prices, and (3) the levying of demurrage fees on processors for delays in vessel unloadings. Accordingly, another objective of the study became the explanation of the emergence of all these institutions. Although the analysis is necessarily more complex, its implications are richer and more easily tested.

The study is therefore broader than the initial questions that motivated it. In brief, this is a study of contracting for the supply of U.S. landed tuna. The study demonstrates that the efficiency of such contractual arrangements justifies a differential between U.S. and foreign tuna prices. The emergence of vessel co-ownership and other institutions are methods of minimizing the costs of maintaining the exclusive dealing arrangements between captains and processors. But the use of vessel co-ownership or any other institution is not costless. One cost of vessel co-ownership, for example, is that it provides the captain with an incentive to over-use the vessel. Nonprice payments are a means of reducing this cost of vessel co-ownership. The ultimate effect of exclusive dealing and its ancillary institutions is to increase the supply of U.S. landed tuna and to increase the quantity of canned tuna available for U.S. consumption.

2. THE SPECIALIZED ASSETS HYPOTHESIS

2.1. Introduction

Since at least the early 1950s, the procurement of domestic tuna by U.S. processors has relied on exclusive dealing contracts with U.S. harvesters. In the mid-1960s, however, a major technological change in the method of harvesting stimulated the construction of modern tuna vessels. The introduction of these new vessels was associated with a number of institutional changes in the industry. For example, some processors became joint owners in the new vessels while others provided second mortgages and guarantees on the vessel mortgages issued by banks. The method of determining the tuna price was changed from the time of delivery to the time of departure (to the fishing grounds). Demurrage fees (or fines) were also levied on processors who failed to off-load a vessel within ten days.

One major purpose of this inquiry is to provide an explanation of these new institutions. The hypothesis is that the institutional changes are a response to the increase in costs of exclusive dealing produced by the new fishing technology. The general theory is that exclusive dealing is necessary if certain costs in the procurement of U.S. tuna are to be avoided. The technological change increased the costs of using exclusive delivery contracts and thereby threatened to increase tuna procurement costs. In response, several institutions emerged to reduce these contract costs and to maintain the efficiency of the U.S. tuna marketing scheme. The lower costs of marketing domestic tuna relative to foreign tuna may explain why the domestic tuna price is typically below the foreign price.

2.2. Contracting in the Bait-Boat Period

Until the early 1960s, the domestic tuna fleet was comprised of a large number of "bait boats."[1] Tuna was caught with live bait fish using hooks and line. Captains wholly owned their boats and contracted with processors[2] for delivery of the catch. Why processors contracted for the delivery of tuna is not obvious. In fact, it may seem that a competitive auction could efficiently allocate each incoming tuna delivery among the several competing processors. An understanding of this contracting incentive is fundamental to our understanding of the competitive nature of the industry. Thus, we first consider the major provisions of the contract and attempt to identify the principal motivation for contracting.

The fishing contract generally provided for the following:

1. the method of determining the tuna price,
2. the limits, if any, on the quantity delivered,
3. the services to be provided by the processor such as financial, accounting, and legal, and
4. the exclusive delivery of the catch to the processor.[3]

The tuna contract price was typically a daily posted price offered by each processor to U.S. captains (under contract) upon their return to port with a harvest available for immediate processing[4] Although the price often remained relatively stable over several months, there was never an ex ante commitment by processors to guarantee a price on future tuna deliveries. Throughout the bait-boat period, the price of domestic tuna was always determined at the time of delivery. This method of pricing reflects the processor's requirement for a continuous supply of tuna. If the rate of incoming boats was less than expected by the processor, his posted price would rise until some captains found it profitable to stop fishing and return to port with their current harvests. Conversely, if processors anticipated an abnormally long queue of boats ready for off-loading, the posted price would fall until the rate of incoming boats declined to the rate consistent with the processing requirements of the tuna plant.

If processors were concerned only with procuring a steady inflow of tuna to maintain desired rates of canned tuna production, competitive contracting

[1] Marasco (1970: 12–17, hereinafter referred to as the Marasco Study).

[2] Throughout this discussion, the term *processors* will always refer to U.S. processors. For emphasis, the term *domestic* or *U.S. processors* is sometimes used. All other processors will be referred to explicitly (e.g., foreign, European, or Japanese processors).

[3] Adams and Hamlisch (1952: 19–26, hereinafter referred to as the FTC Report); Forbes, Stevenson and Co. (1968: 4–5, hereinafter referred to as the Forbes-Stevenson Study); and the Marasco Study (30).

[4] Tuna processors had no in-plant freezer capability and therefore could not accept frozen tuna. Thus, the processing technology required that tuna deliveries be thawed so that the tuna could be directly off-loaded into the plant for immediate processing. See Forbes-Stevenson Study (IV-5).

for tuna deliveries appears to be inefficient relative to a competitive auction. That is, it is unclear why processors would prefer to contract with a subset of the tuna fleet, given the option to bid for each catch of the entire fleet. The decision of the captain to return to port would depend on the expected daily price determined by all processors (and incoming deliveries), in contrast to a daily posted price offered by a single processor to his contracted boats. The processor with the highest opportunity cost of running short of tuna (and reducing his rate of canned tuna production) would be able to outbid all other processors for the next incoming tuna delivery. The auction would therefore seem to allocate each tuna delivery to its highest valued user. From an efficiency point of view, such an open competitive auction appears to be preferred. Consequently, the motivation for competitive contracting is unlikely to be found in the pricing provision.

Throughout the 1950s, U.S. boatowners attempted to obtain minimum volume guarantees (Forbes-Stevenson Study (Chapter IV, 1–2); and Marasco Study (chapter II, 13–15)). Processors sometimes opposed such quantity guarantees since they tended to reduce the ability of the processor to procure tuna from foreign suppliers. During times of abnormally low foreign tuna prices, U.S. processors sought to acquire the right to "tie-up" its domestic contract boats. That is, deliveries of imported tuna could be substituted for the expected future deliveries of domestic tuna by requiring U.S. contract boats to remain in port (or tie-up) and not resume fishing for a specified number of days. Thus, tie-up orders represented an attempt by processors to limit the (maximum) annual harvest of U.S. contract boats and to substitute cheaper imported tuna. More recently, however, contracts in this period generally omit an explicit quantity provision, with the apparent understanding that the processor will accept the entire harvest of each U.S. boat under contract.

The fishing contract also recognizes that the processor may provide advance money for each fishing trip (and/or accounting and legal services to the boatowner). The term of the contract is a stated number of years or as long as the boatowner or boat remains in debt to the processor, whichever is longer. Generally, if the processor extended a trip advance (loan) to the captain, the expected harvest on that trip would be taken as collateral, and the principal and interest would be deducted from the gross revenues of the harvest upon delivery to the processor (Marasco: 47). Thus, the provision of trip advances by the processor would not extend the length of the contract unless the size of harvest was unusually small. Such changes in the term of the contract could often be avoided by obtaining short term (operating capital) loans from commercial banks.

Exclusive Dealing

The principal motivation for U.S. fishing contracts appears to be reflected in the exclusive-dealing provision. The U.S. tuna marketing arrangement, which relies on exclusive-dealing contracts by captains, is a means of eliminating some of the marketing costs inherent in competitive auctions.

Competitive bidding among tuna processors in the U.S. market is likely to result in excessive sorting of tuna into "blocks" and duplicative inspections of each "block" of tuna offered for sale. A block of tuna refers to the number of tons of a given tuna category. For example, a 100-ton block of skipjack tuna may refer to 100 tons of frozen, whole skipjack weighing between 10 and 13 pounds each. One initial cost of a competitive auction is to sort tuna into blocks. Although sorting costs would be minimized by offering each harvest as a single block, prepurchase inspection costs would be substantial since the units within the block would be extremely heterogeneous. Further, the harvest may be so large and diverse that the winning bidder may sort out units he cannot use and resell them in one or more blocks. Consequently, each harvest is likely to be sorted into a number of blocks. Whether the competitive auction is socially desirable will depend, in part, on whether sorting costs are socially desirable.

Another cost of a competitive auction is prepurchase inspection costs incurred by the bidders. In a competitive auction, it is quite possible for several potential buyers to bid on the same block. Each bidder therefore inspects the same block to determine its value. Yet only one bidder will purchase the block. The costs of such duplicative inspections may be justified if the bidders possess different tastes. For example, if fresh tuna is not sufficiently categorized by number of days after harvest (e.g., $\frac{1}{2}$ day, 1 day, or 2 days), some bidders my search among otherwise similar blocks until a particular degree of freshness is found. Buyers my disagree on the value or alternative uses of fresh tuna as its degree of freshness diminishes. In this instance, competitive search would be socially desirable.

On the other hand, if some average amount of search by all bidders would result in each bidder placing the same value on each block, duplicative inspections would be socially wasteful. There would be no social gain from the aggregate inspections performed by all potential bidders relative to the one inspection by the bidder who ultimately acquires the block. In a canned-tuna market such as the U.S., duplicative inspections of tuna are socially undesirable. There is no social value of such competitive bidding oversearch by tuna processors because they would all agree on the value of each block, given some minimum amount of prepurchase inspection. U.S. canners (potential buyers) are unlikely to disagree on the quality attributes of tuna (such as its freshness, yield, taste, and use) or on the value of any given set of attributes. Under these conditions, there is a strong incentive to eliminate competitive bidding oversearch and to reduce other marketing costs of procuring domestic tuna. If sellers or buyers could prevent such wasteful activity, they could potentially gain an amount equal to the real resources expended in competitive bidding oversearch. To the extent that the alternative marketing scheme can also reduce the sorting of tuna into blocks, an additional savings in marketing costs may be realized.

Although prices preset by the captain (seller) or the processor (buyer) may eliminate the potential for competitive bidding oversearch, each pricing scheme introduces the potential for another type of oversearch. If the captain

attempted to set some average price over a tuna catch of varying quality, processors would tend to search out the higher quality and to reject the lower quality units.[5] As long as the captain had less than perfect information about the market value of each unit, processors would attempt to obtain an information advantage over the captain in order to search out the underpriced units.[6] In response, the captain may sort the catch into more homogeneous blocks, each with an average price closer to the average market value of the units within each block. However, as long as the preset price differs from the market clearing price for each quality within a block, processors will continue to search out the higher-quality units. Consequently, such buyer oversearch results in duplicative inspection and excessive sorting costs. Perhaps more importantly, since the captain is not the final user of the tuna, he would never be able to fully communicate the quality of the catch to the processor. Regardless of the amount of search performed by the captain to determine average quality and price, the processor would have to fully reinspect the catch to determine, for himself, the true average quality of the harvest.

If, on the other hand, a processor inspected a captain's entire catch and made a one-time offer of a single price reflecting the average quality or value of all units in the catch, sorting and inspection costs might be dramatically reduced. Such a pricing scheme, however, provides the captain with an incentive to supply only the below-average quality units and to offer the remaining higher-quality units to another processor. As a result, sorting costs are not significantly reduced, and duplicative inspections are not eliminated. As long as the harvest is not homogeneous, a single price (based on the average value of all units in the harvest) will always create this form of adverse selection.

This adverse selection, however, can be constrained by an exclusive-dealing contract. The purpose of the exclusive-dealing provision of the fishing contract is to reduce oversearching and its associated costs. Throughout the term of the exclusive supply contract, the captain must deliver all catches to the contracting processor. The price of each catch is determined at the time of delivery after the processor makes a prepurchase inspection. Although the price still reflects the average value of all units in the catch, the exclusive delivery requirement prevents the captain from sorting out the above-average quality units and offering them to another processor. In this way, exclusive dealing minimizes sorting costs and eliminates duplicative inspections

[5] The quality of tuna varies with its size, condition, and species. For canning purposes, one major quality attribute is size: larger tuna can be processed more quickly and cheaply and in this production sense are of higher quality. Similarly, tuna delivered in a semiprocessed condition (e.g., gilled and gutted) represent a higher quality since the remaining processing time and cost is reduced relative to round (or whole) tuna. In the consumption sense, white-meat or albacore tuna is considered higher in quality because it possesses a less "fishy" taste than the lightmeat species, such as yellowfin and skipjack.

[6] The tuna example is analogous to the example of the wholesale marketing of rough uncut diamonds in Kenney and Klein (1983). Kenney and Klein refer to such buyer behavior as Gresham's Law oversearching; see Kenney and Klein (502–5).

initiated by domestic tuna harvesters. The incentive for processors to accept the captain's entire catch, to minimize prepurchase search, and to eliminate duplicative inspections is provided by an exclusive dealing contract that enables processors on average to earn rents (see Kenney and Klein: 505–9). In effect, the domestic tuna price is discounted below its (costly search) market price to processors who require exclusive delivery contracts. This discounted price is necessary to encourage processors to accept all tuna contract deliveries, including occasional deliveries of below-average quality. In this way, prepurchase search costs are minimized by keeping the inspection sample small, and duplicative inspections are avoided by eliminating sales to noncontracting processors.

This tuna price discount is reflected in the processor's share of the cost savings under the U.S. marketing scheme. In essence, the price discount is "paid" or offset by the avoidance of excessive inspection and sorting costs.[7] As long as the present value of these expected price discounts (over the term of the contract) exceeds the present value of sorting and competitively bidding for substitute blocks of tuna (that are undervalued by other bidders), exclusive dealing arrangements will be required by processors, ceteris paribus.

U.S. captains agree to exclusive delivery contracts because such contracts reduce sorting costs and, in turn, the marginal cost of harvesting. Since skipjack and yellowfin often share the same fishing grounds, and since each species can vary substantially in size (quality), harvesting costs could be saved if the catch could be marketed with minimal sorting.[8] Each harvest, for example, might be delivered as "run of the catch" (i.e., without sorting by size or species). As the harvest is off-loaded for sale to processors, sorting limited to species and damage (e.g., crushed, bruised, or broken fish) could be performed. Thus, for any given tuna price, a reduction in sorting costs would be expected to lead to larger and more profitable annual harvests. Competition among captains to supply processors, however, will result in the passing of this cost saving on to processors in the form of lower prices and larger deliveries of domestic tuna. Ultimately, such reductions in processing costs benefit consumers in the form of lower prices and higher quantities of canned tuna.

[7] In a perfectly efficient marketing arrangement, the "rents" merely reflect the distribution of the cost savings (per unit of output) to the buyer (processor). Such payments should not be interpreted as a bribe or side payment offered by the seller (captain) that, in turn, increase his costs of production. Rather, the improved efficiency of the marketing scheme relative to a competitive auction, for example, is expected to result in lower production costs to the seller and lower input prices to the buyer. The ultimate effect is greater output of the final product to consumers.

[8] It appears that U.S. captains perform a minimal amount of sorting. The major types of sorting are (1) to remove all nontuna species from the catch and (2) to remove tuna that are under the legal size limit. The remaining tuna are believed to be further sorted only to minimize damage in the storage wells until delivery to the cannery. The larger tuna, for example, are generally placed in the bottom of the wells to avoid crushing the smaller tuna. Based on Orbach (1977), and McNeely (1961).

In short, exclusive dealing contracts are efficient in the marketing of U.S. landed tuna because they avoid unnecessary marketing costs. Some of the marketing cost saving will be retained by captains and processors to offset the costs of exclusive dealing, and the remainder of the cost saving will passed on to consumers.

The Potential Appropriation of Quasi Rents by Tuna Processors

The quasi rent of an asset is any payment in excess of that necessary to keep the asset in its current use (or market). Since the highest-valued alternative use of an asset is its salvage value, the quasi rent of an asset is simply any payment over its salvage value.[9] For example, if a newly restored "classic" automobile can be used as a taxi at a daily rental value of $180 or as an exhibit in a museum at a daily rental of $100, the quasi-rent earned by the automobile is $180 − $100 = $80 per day.

Whether the quasi rent is appropriable depends on the alternative *users*, if any, of the asset in the same *use*. Thus, if I bid $180 to use the car as a taxi and you bid $150/day, the potentially appropriable quasi rent is $180 − $150 = $30 per day. That is, I can contract with the owner to rent the automobile as a taxi for $180/day and then impose costs on (or "hold up") the owner up to $30/day. Since the next highest-valued user of the automobile is only willing to pay $150/day, the owner is no worse off renting the car to me. If I was the only user of the automobile in the taxi market, I could potentially appropriate $180 − $100 = $80, or the entire quasi rent earned by the automobile in its current use (Klein, Crawford, and Akchian, 1978). On the other hand, if there were several taxi drivers who valued the automobile at $180/day, the quasi rents would not be appropriable.

One consequence of the exclusive delivery provision of the fishing contract is that it makes each delivery of tuna a specialized asset. A U.S. captain who agrees to an exclusive delivery contract must deliver his tuna catches to a specific U.S. processor. Exclusive dealing therefore eliminates all alternative *users* (processors) of tuna harvested under contract. In addition, the principal alternative *uses* of tuna are pet food and industrial products such as fish meal and body oil. These products are dramatically lower in value relative to canned tuna and, equally important, they are typically produced as by-products by the tuna processors. Hence, freshly caught tuna under contract to a processor represents an extremely specialized asset, the quasi rent value of which is potentially appropriable.

Under these conditions, U.S. processors have an ability to hold up U.S. harvesters in the sense of opportunistically taking advantage of some unenforceable provision of the contract (see Klein, 1980; and Williamson, 1975). Processors were in a position to renege on their contracts in at least two ways: (1) by imposing costs on captains in the form of unnecessary

[9] Thus, the size of the potential holdup may be overestimated if we ignore the possibility that the asset may switch to another use (market). This is why it is necessary to distinguish between alternative users and uses.

off-loading delays and (2) by refusing to accept the catch unless the (implicit) contract price was lowered. Let us consider each in turn.

Throughout the bait-boat period, processors were able to impose unloading delays on boats under contract despite the captains' beliefs that such delays were often abitrary and/or unnecessary. The legitimate reasons for delaying vessel off-loadings are so numerous and varied that the processor could always claim a "legitimate" reason, when in fact he was acting opportunistically. The degree of bargaining power held by domestic captains varied inversely with the arrival of imported tuna at domestic ports. That is, the greater the number of foreign deliveries arriving at a processor's dock, the weaker the ability of U.S. captains to avoid off-loading delays and lengthy price negotiations.[10] Consequently, the order in which a domestic vessel arrived into port was no indication of the order in which it would be off-loaded. Between 1964 and 1966, for example, the monthly average unloading time for U.S. vessels ranged from a low of 3 days to a high of 33 days.[11]

Perhaps more important, the typical fishing contract has always provided the processor with an escape clause allowing him to refuse delivery. The FTC report finds that in 1952, the typical contract contained the following escape clause (FTC Report: 22):

> In the event the canner is unable to accept delivery of fish by reason of strikes, fire, labor difficulties, breakdowns or any cause beyond the control of the canner, the canner has the privilege of refusing to accept such deliveries provided the canner shall immediately use due diligence in finding another canner or canners who will accept immediate delivery; otherwise the fishermen, at their option, may make delivery of fish to such other canner or canners as they may desire until such time as the canner notifies the fishermen that he is ready and able to accept further deliveries.

The fishing contracts in the mid-1960s contained a similar provision:

> If, as a result of any condition or cause beyond the reasonable control of canner, canner is unable at any time to accept or pack fish caught by boat owner, canner shall have the right to refuse to accept fish hereunder and shall not be required to pay for any fish not accepted or canned. Without in any way limiting the generality of the foregoing, plant breakdown, shortage of labor or materials, fire, government regulations, force majeure, strikes, boycotts and other union activity preventing prompt delivery and processing of fish, shall be deemed to excuse canner from accepting or packing fish hereunder.[12]

[10] FTC Report (22–30); interviews with industry sources during the FTC industry-wide tuna investigation; Forbes-Stevenson Study, chapter III; deGraeve and Forbes (1954: 8), (hereinafter referred to as the Tuna Imports Study); and the Marasco Study (chapter II, 14).

Between 1950 and 1965, the percentage of imported to total U.S. tuna deliveries increased fivefold and represented 50 percent of the processors' tuna requirements by the early 1960s.

[11] FTC Report (22–23); and data provided by the American Tunaboat Association (ATA), cited in the Forbes-Stevenson Study, Table 11 (III-18).

[12] Tuna fishing agreements subpoenaed in FTC industry-wide tuna investigation, document numbers BE3-1 and BE3-2.

In one respect, the escape clause seems reasonable because processing plants throughout the bait-boat and early purse-seiner periods had no freezer storage capability and therefore processed tuna as it was off-loaded from incoming boats. At the same time, however, such an escape clause provides the processor with a means of refusing delivery unless the price is lowered (i.e., to behave opportunistically).

It seems clear that with exclusive contracts tuna processors had the potential to hold up U.S. captains. The high contract costs to specify the necessary contingencies to prevent the processor from behaving opportunistically, to police and detect a contract violation, and to prove the violation in the courts made it unlikely that an explicit contract could eliminate the holdup potential of processors. Even if an explicit contract could eliminate opportunistic behavior, the costs of doing so were likely to make this form of organization prohibitively costly.

Since the *potential* holdup is created by the exclusive delivery provision of the fishing contract, it may seem irrational on the part of the captain to agree to such a provision. If there is no *incentive* to behave opportunistically, however, it would be quite rational for captains to enter into exclusive deals with processors. Recall that the motivation for exclusive dealing is to eliminate excessive sorting and inspection costs. Thus, both captain and processor should expect to share in the net benefits of a lower-cost marketing scheme for domestic tuna. The costs of eliminating the holdup incentive can be simply viewed as a cost of exclusive dealing. If the savings in marketing costs exceed the cost of preventing the holdup, exclusive dealing remains efficient. What is required, then, is a viable alternative to explicit contracting.

One alternative to explicit contracting that may eliminate the holdup incentive of the processor is implicit contracting.[13] Implicit contracts or guarantees are market-enforced by the threat of termination of future business if opportunistic behavior occurs.[14] The captain, for example, could offer the processor a future premium (or extra payment) sufficient to assure contractual performance. If the processor violates the contract, all future business is immediately withdrawn and all expected future premiums are lost by the processor.[15] As long as the captain and processor both agree that the present value of the future premiums exceeds the present value of

[13] The distinction between explicit and implicit contracts is more fully described in Klein, Crawford, and Alchian (303–7).

[14] A model of how a market enforcement mechanism can assure contract performance is provided in Klein and Leffler (1981).

[15] If both parties are assumed to know the length of the current contract, then it is also assumed that neither party can determine with certainty the last transaction in the contract period. Alternatively, if both parties can identify the last transaction within the current contract, then there must exist some positive probability that the contract will be renewed. Under these assumptions, a finite uncertain horizon is assured, and implicit contracting becomes a rational alternative mode of organization. See, for example, Telser (1980).

the short-run gain from reneging on the implicit contract, the opportunistic incentive of the processor will be eliminated.[16]

A possible alternative or partial substitute to the pure price-premium method of assuring contract performance is the use of nonsalvageable production assets (Klein and Leffler: 627–33). The normal return (quasi rents) to such an asset also acts to assure contract performance. One competitive equilibrium would be defined where the present value of the nonsalvageable production assets owned by the processor equaled the present value of his reneging on the implicit contract. Given this condition, if the processor were to behave opportunistically, all U.S. captains would refuse to deal with him, and he would be forced to procure tuna from more costly sources. The increase in production costs would result in losses and eventually drive the processor out of the industry. Although capital inputs (e.g., buying a tuna-canning machine rather than buying cans from an independent supplier) increase standard production costs, such expenditures may reduce the price premium paid by captains (and the corresponding brand-name assets acquired by processors) to assure contractual performance. Competition among processors to contract with captains may therefore substitution of nonsalvageable production assets for brand-name assets.

Since the carrying capacity of bait boats is small relative to modern tuna vessels,[17] and since the smaller boats make numerous deliveries (or "repeat sales") to the same processor each year,[18] the expected short-run profit from holding up the captain is not substantial.[19] Assuming that U.S. captains costlessly communicate among one another, a holdup of any U.S. tuna boat will result in a termination of business by all captains delivering to the opportunistic processor. The costs of being branded an opportunistic

[16] The premium stream does not create excess profits in the long run. One condition for a zero-profit equilibrium is that the present value of the premiums offered by the captain equal the present value of the nonsalvageable brand-name assets (or collateral) acquired by the processor to guarantee his contractual performance. The premiums include a normal rate of return to the brand-name assets. See Klein and Leffler (626–27).

A second condition for a no holdup equilibrium is that the present value of the premiums not exceed the present value of the savings in marketing costs, net of the present value of price discounts necessary to encourage processors to accept *all* tuna deliveries under the exclusive-dealing contract, including occasional deliveries of below-average quality.

[17] The weighted average carrying capacity of bait boats over the 1946–66 period is approximately 200 tons. Based on data reported in Broderick (1973, Appendix Table 7: 343, hereinafter referred to as the Broderick Study).

[18] The largest bait boats (commonly referred to as clippers) average four to five trips a year. In contrast, smaller bait boats have been reported to make over 30 trips in a 90-day period. See FTC Report (13–15); U.S. Department of Commerce, NOAA, NMFS, *Tuna 1947–72: Basic Economic Indicators*, Current Fishery Statistics No. 6130, (Washington, D.C.: June 1973: 3); and U.S. Department of Commerce, NOAA, NMFS, *Analysis of the Operations of Seven Hawaiian Skipjack Tuna Fishing Vessels, June–August 1967*, by Richard N. Uchida and Ray F. Sumida, Special Scientific Report, Fisheries No. 692 (March 1971: 6).

[19] Further, the bait boats built before 1945 were of wooden construction and therefore relatively short-lived. Dry rot, sea life, and tropical storms tended to damage the wooden hulls. See, for example, Roesti (1960: 82; sometimes referred to as the Roesti Study).

processor by the industry would therefore include (1) the loss of all expected future premiums paid by captains delivering to the processor under implicit contracts at the time of the holdup, (2) the loss of all nonsalvageable assets employed to produce brand-name capital and tuna at the harvesting stage, and (3) the additional costs of procuring greater proportions of annual tuna requirements from the foreign export market (due to the reluctance of U.S. captains to renew or negotiate supply contracts with the processor).[20] The present value of these costs is likely to be substantially greater than the present value of a one-time holdup on a single delivery of tuna harvested by a bait boat. A processor who reneged on such a contract would therefore be worse off. Consequently, the incentive to behave opportunistically is not likely to be strong. In this case, exclusive dealing is not only rational, it is also socially efficient.

Thus, in the bait-boat period, exclusive-dealing arrangements appear to be efficient. What remains unexplained, however, is why U.S. processors began to commit assets to the harvesting sector in the late 1960s. Beginning in 1967, processors began to hold equity interests in vessels, to extend second mortgages to harvesters, and to guarantee vessel loans. Other major institutional changes included the pricing of tuna before the vessel departed for the fishing grounds (instead of upon its return with the catch) and the imposition of demurrage fees on processors who failed to unload vessels within a specified number of days. Although exclusive dealing contracts continued to prevail throughout the 1960s and 1970s, the increasing involvement of the processors in the harvesting operation was unquestionable. Since these new institutions appear at the same time as a technological change in the method of fishing, we consider how the change in technology might have affected the costs of exclusive dealing in the modern (purse-seine) period.

2.3. The Technological Change in Fishing

The first major impact of the new technology was observable between 1958 and 1963: the larger bait boats were modified to permit fishing with a technologically improved, mechanized net retrieval system. It was not until 1967, however, that newly constructed purse-seine vessels were added to the U.S. fleet on a significant scale. (See Table 11.1.) For this reason, 1967 marks the beginning of the modern purse-seiner period. The technological change in fishing provided captains with the opportunity to transform labor-intensive, hook-and-line vessels into more capital-intensive purse-seine (net) vessels.

One major effect of the technological change was to dramatically increase the tuna-carrying capacity of the new purse-seine vessels. Throughout the last 20 years of the bait-boat period (1946–66), the average carrying capacity

[20] If this cost becomes prohibitive, any nonsalvageable assets in the processing stage will also be lost.

TABLE 11.1
Gross Additions to Carrying Capacity of U.S. Purse-Seine Fleet
(measured in tons and number of vessels)

	Conversions		New Seiners		Total Additions	Total Additions divided by Fleet Capacity
Year	Tons	Vessels	Tons	Vessels	Tons	Percent
			Transition Period			
1958	0		0		0	0
1959	3,979	(13)	0		3,979	59.9
1960*	14,684	(52)	0		14,684	141.1
1961	8,324	(20)	460	(1)	8,784	36.5
1962	4,319	(10)	779	(1)	5,098	15.9
1963	4,659	(6)	779	(1)	5,438	15.5
1964	0		779	(1)	779	1.9
1965	0		550	(1)	550	1.4
1966	0		550	(1)	550	1.4
			Modern Period			
1967	0		4,030	(5)	4,030	10.5
1968	0		6,214	(9)	6,214	15.5
1969	1,860	(3)	6,810	(10)	8,670	19.9
1970	0		7,700	(7)	7,700	15.4
1971*	0		18,950	(17)	18,950	34.0
1972	900	(1)	16,850	(14)	17,750	25.2
1973	0		13,300	(12)	13,300	15.4
1974	0		9,605	(9)	9,605	10.0
1975	0		11,650	(11)	11,650	11.3
1976	0		6,900	(5)	6,900	5.9

Source: "Description of the United States Tuna Fleet: December 31, 1976," by the American Tunaboat Association, 1976 Summary of Newly Constructed Tuna Purse Seiners: Chronological Listing.

* Peak year within period.

of a bait boat was 200 tons. During the first 10 years of the modern purse-seine era (1967–76), 105 newly constructed seiners entered the U.S. tuna fleet. The carrying capacities of these vessels ranged from a remarkable high of 2,175 tons to a low of 150 tons. On average, the technologically superior purse seiner possessed a carrying capacity of 1,000 tons—five times the capacity of a bait boat.

The increase in the carrying capacity of purse-seine vessels contributed to a substantial increase in total fleet capacity, despite the reduction in the number of vessels in the fleet.[21] The average fleet capacity of 42,809 tons during the bait-boat period increased to 73,560 tons by 1971 (or by 72

[21] Fleet capacity is defined as the maximum tonnage that can be harvested if every vessel in the fleet makes one fishing trip and returns to port with a full load of fish.

percent) with purse seiners accounting for 95 percent of total fleet capacity.[22] At the same time, the average number of boats in the fleet declined from 215 to 158, or by approximately 25 percent.

In short, the major effects of the new fishing technology on the size and composition of the U.S. tuna fleet were as follows:

1. to increase the carrying capacity of the new vessels entering the fleet,
2. to increase total fleet capacity and,
3. to almost eliminate bait boats from the fleet.

2.4. Contracting in the Purse-Seiner Period

The Potential Holdup of Purse-Seine Tuna Deliveries and the Emergence of Countervailing Institutions

One effect of the technological change was to disturb the no holdup equilibrium in the bait-boat period. The dramatically larger carrying capacities of the modern purse seiners increased the potentially appropriable quasi rents on each tuna delivery. The maximum delivery by an average seiner was 1,000 tons. This represented five times the maximum delivery of a typical bait boat. From the viewpoint of the contracting processor, the potential short-run gain from postcontractual reneging was five times greater in the purse-seine period than in the bait-boat period. The change in fishing technology therefore increased the expected gain and, at the same time, reduced the expected costs of opportunistic behavior. Consequently, there was much less incentive for the processor to honor the implicit contract. Under these conditions, captains would be unlikely to agree to the same exclusive delivery contracts as in the bait-boat period. Moreover, without some form of exclusive dealing, the marketing costs saved under the U.S. tuna-marketing arrangement could be lost.

In addition, the introduction of modern purse seiners to, and the displacement of numerous small bait boats from, the tuna fleet resulted in less frequent deliveries or "repeat sales" to each contracting processor. A reduction in the frequency of deliveries, ceteris paribus, reduces the present value of the expected future premiums under the implicit contract. The present value of $12 received at the end of one year, for example, is less than the present value of $1 received at the end of each month for twelve months, assuming a positive rate of interest. Similarly, if a processor receives a single 1,000 ton delivery from a purse seiner at the end of 60 days, the present value of a $1/ton premium on the seiner delivery will be less than the present value of the same $1/ton premium on 10 bait-boat deliveries, each for 100 tons and

[22] Compiled from data reported in the Broderick Study, Appendix Table 7: 343. By 1978, total fleet capacity reached a high of 115,546 tons and represented a 170 percent increase over the average fleet capacity in the bait-boat period. *Annual Report of the Inter-American Tropical Tuna Commision: 1978* (La Jolla, Calif.: 1979, Appendix II, Table 4: 158).

arriving every 6 days over the 60-day period. The cost of behaving opportunistically therefore decreases.

In response to the adverse effects of the technological change on exclusive dealing, countervailing institutions[23] emerged in the purse-seiner period to reduce the processor's incentive to behave opportunistically. Let us consider the effects of four new institutions: (1) joint ownership in the vessel, (2) guarantees on vessel mortgage loans, (3) price determination prior to each fishing trip, and (4) demurrage fees for delays in vessel off-loadings.

In sharp contrast to the bait-boat period, processors generally held an equity interest in the new purse seiners entering the U.S. fleet. Most processors typically held at least a 20 percent minority interest in the vessel. Under joint ownership, any costs that the processor may impose on the harvesting operation will also reduce the return to his vessel equity. More specifically, the (dollar) return on the processor's equity will fall in direct proportion to his ownership interest. If the processor owns 40 percent of the vessel, for example, a $100,000 reduction in vessel earnings imposes a $40,000 reduction on the return to his equity. Co-ownership in the new seiners therefore reduces the processor's incentive to behave opportunistically.

Unless the processor wholly owns the vessel, however, joint ownership may be insufficient to fully offset the increased holdup potential of the modern purse seiner. From the perspective of the processor, joint ownership represents a partial integration backwards into harvesting. If the processor is only a minority owner in harvesting but a majority owner in processing, he may still have an incentive to hold up the captain under an exclusive delivery contract. This is because the loss on his vessel equity will be more than offset by the gain in equity on his processing operation. Consider, for example, a processor who holds a 40 percent ownership interest in a purse seiner and wholly owns a tuna processing plant. A $100,000 reduction in the cost of tuna due to an unexpected price concession by the captain reduces the processor's earnings in harvesting by $40,000 but increases his earnings in processing by $100,000. The net gain to the processor is $60,000. Without the co-ownership interest in the vessel, the processor would have realized a net gain of $100,000. Thus, the joint ownership requirement does reduce the likelihood of postcontractual reneging.

The additional provision of mortgage guarantees, however, further reduces the likelihood of the holdup. One effect of the mortgage guarantee is to limit the ability of the processor to shift earnings from the harvesting to the processing operation. That is, the earnings of the vessel must always be sufficient to cover the loan payments to the bank. If the loan goes into default, the assets pledged by the processor under the loan guarantee are subject to sale by the bank to the extent necessary to retire any outstanding debt under

[23] Fundamentally, an institution is any means of decreasing a transaction cost. Harold Demsetz, for example, treats an institution as a means of internalizing transaction costs. The nonexistence of an institution in the bait-boat period implies that it had no relative advantage. See Demsetz (1964; 1967).

the loan agreement. Thus, the effects of joint ownership and mortgage guarantees are reinforcing and, to some extent, substitutable.

From the perspective of the captain, the joint provision of a guarantee and a second mortgage may represent a stronger substitute for equity held by the processor. The provision of guarantees on first mortgages is most important when the processor does not hold an equity interest in the vessel. Whereas the guarantee limits the ability of the processor to shift earnings from the harvesting to the canning stage, the expected payments of interest on the second mortgage limit the processor's ability to reduce earnings at the harvesting stage. Second mortgages without guarantees, however, represent a weaker substitute for equity. The reason is that the default provision of the second mortgage agreement is likely to give the processor (lender) the right to repossess and sell the vessel and to keep the sale proceeds net of the principal on the first mortgage. As a result, the processor may not lose his principal on a second mortgage. On the other hand, if the processor held equity instead of a second, a reduction in vessel earnings resulting in default on either the first or second mortgage could impose an equity loss on the processor (and the captain). Thus, the guarantee is able to limit the greater potential to shift earnings to the canning stage when the processor holds little, or no, vessel equity. By requiring the processor to guarantee the first mortgage and to also hold the second, any opportunistic behavior by the processor that reduces vessel earnings also increases the probability of bankruptcy and the possible loss of his assets pledged under the guarantee plus the interest income and principal on the second. The following empirical observation is thereby suggested: the provision of equity is expected to be inversely related to the joint provision of guarantees and second mortgages by the processor.

Another major institutional change was to determine the domestic price of tuna *prior* to the vessel's departure to the fishing grounds. In the bait-boat period, processors offered prices on delivered tuna ready for immediate processing. This apparently put the harvesters at a great disadvantage, since their catch was subject to deterioration in the holds of their vessels while they were negotiating prices or waiting to be off-loaded. In 1967, the American Tuna Sales Association (ATSA), a marketing cooperative, was established to assume the sales responsibilities for the domestic tuna fleet, with the exception of those vessels wholly owned by processors. Since 1968, the price of domestic tuna received by each ATSA member is determined prior to its departure on a new fishing trip. As a result, the ability of the processor to renege on the (implicit) contract price for tuna is substantially limited.

In addition, the potential for unnecessary delays in vessel off-loadings appears to be restrained by a fourth major institutional change. Off-loading delays had been a principal source of dissatisfaction among captains in the bait-boat period. Beginning in 1968, however, the ATSA was permitted to charge the processor a demurrage fee of $1 per ton for each day that tuna remained on board eleven or more days after returning to port. On a

1,000-ton purse seiner, for example, the fee could be as high as $1,000/day. Thus, the ability of the processor to hold up the captain by threatening to delay off-loading his vessel was reduced in the purse-seiner period.

The Malincentives of the Countervailing Institutions and Their Nonemergence in the Bait-Boat Period

Malincentives associated with vessel co-ownership and mortgage guarantees discouraged adoption of these institutions during the earlier bait-boat period. The malincentives of vessel co-ownership are analogous to those of share-cropping in which the agent has an incentive to undersupply his labor and overuse the principal's assets, in this case, the jointly owned boat (Cheung, 1968).[24] Mortgage guarantees, meanwhile, increase the captain's ability to obtain loans, which, like debt, distort an agent's investment incentives. In the tuna industry, a captain with a majority equity interest in the vessel may promise lenders that he will operate his vessel in a particular manner. Once the loans are approved, however, the captain may undertake much riskier operations in an attempt to substantially increase the return on his equity despite the increased risks (costs) imposed on the lenders. Consequently, lenders may attempt to specify in the loan agreement how the vessel will be operated. Such provisions are unlikely to cover all contingencies and may seriously limit the ability of the captain to operate the vessel efficiently (Macaulay, 1963). To the extent that lenders anticipate these incentives, the terms of the loan will be modified. A higher rate of interest, additional collateral, and a larger guarantee may be required. As long as these costs are less than the opportunity loss of not fishing for tuna, the captain will accept the loans, despite their higher cost.

The (malincentive) costs of providing guarantees in the bait-boat period appear to be high. Captains generally invested their entire personal savings to own their own boat. Their personal savings, however, rarely exceeded the minimum loan requirements set by commercial banks. Thus, the mortgage on the boat was large relative to the captain's equity. As a result, additional loans secured by processor guarantees were likely to create the incentive for the captain to take greater risks with his boat. Given that the modern bait boats had a cruising range of 10,000 miles and that a single trip could take up to 100 days,[25] the costs of monitoring the activities of the captain were quite high. In addition, the refrigeration, navigation, communication, and foreign repair capabilities throughout most of the period were significantly

[24] More generally, co-ownership creates agency costs (which include monitoring costs) between the principal (processor) and the agent (captain) (see Jensen and Meckling, 1976). To offset the underfishing incentives of captains under vessel co-ownership, processors began to offer bonuses for exceptionally large seasonal catches. In addition, processors assumed some of the responsibility of the harvesting operation as a way to restrain or counter vessel overuse, including paying for (and sometimes arranging for) repairs and maintenance of the vessel, unloading crews at dockside, and insurance on the vessel. The additional costs incurred by the processor were deducted from the tuna price.

[25] U.S. Department of the Interior, Fish and Wildlife Service (1953: 31; hereinafter referred to as the DOI Survey); and Orbach (3).

inferior to those available in the modern period. Consequently, the possibility of (1) the boat sinking, (2) delays in foreign ports due to unavailability of repair parts, (3) the catch spoiling, or (4) problems with the availability or condition of the live bait (DOI Survey: 220–22) was much higher in the bait-boat than in the purse-seiner period. A captain who attempted to increase his catch by fishing more distant waters or by extending the length of the trip was therefore increasing the riskiness of the harvesting operation.

The high transaction costs of establishing a tuna price for each bait boat before it departed for the fishing grounds rendered the "empty boat auction" method of pricing too costly relative to the (ex post) posted price system used throughout the bait-boat period. For any given annual harvest, the smaller carrying capacity of the boats in the bait-boat fleet required that they complete more trips.[26] As a result, the number of ex ante price determinations would be substantially greater in the bait-boat period than in the modern purse-seiner era. Since the costs of estimating the ex ante prices vary directly with the number of trips (and are independent of the size of the harvests by individual boats or the entire fleet), the empty boat auction would be more costly to operate in the bait-boat period.[27]

There are a number of transaction costs associated with an empty boat auction. One significant transaction cost is precontract search costs.[28] By fixing an ex ante price for each fishing trip, the captain and the processor are, in effect, agreeing on how to distribute the expected gain from each trip. Consequently, both the captain and the processor have a stronger incentive to search for information about future costs and prices than under an ex post pricing scheme. Thus, the ex post pricing arrangements utilized throughout the bait-boat period can be viewed as a means of reducing pre-contract search costs. In addition, contract enforcement and renegotiation costs are likely to be higher under ex ante pricing. As the expected contract price rises above the market price at time of delivery, the processor has a greater incentive to renege on the price agreement. Similarly, as the contract price falls below the market price, the captain has a greater incentive to renegotiate a higher price. The ex post pricing provision together with the relatively short length of the contracts used in the bait-boat period served to lower such costs.[29] A third possible cost of the empty boat auction relates to the

[26] Although the carrying capacity of tuna fleets operating during the 1948 to 1959 period was larger than the capacity of the modern purse-seiner fleets, the average capacity of a bait boat was substantially below that of a modern purse seiner.

[27] Since the empty boat auction permits the captain and the processor to *individually* determine the price for each fishing trip, such an ex ante pricing scheme may also enable the processor to price discriminate among the incoming deliveries. In contrast, the (ex post) posted price system makes it more difficult to price discriminate since the processor would have to change his posted price for all deliveries rather than for the deliveries of an *individual* captain.

[28] In the market for petroleum coke, this cost is explained by Goldberg and Erickson (1982).

[29] The shorter the length of the contract, the less likely is a substantial divergence between contract and market prices and the incentive for postcontractual reneging. This positive relationship between contract length and enforcement costs is suggested in Cheung (1969).

processor's inability to inspect the catch prior to agreement on its price. Such "blind" selling arrangements way provide the captain with an incentive to lower the quality of the catch (below the average quality expected by the processor), in an attempt to increase the size of the catch.[30] The captain, for example, may harvest tuna that are smaller than the average size implicit in the ex ante price. From the processor's viewpoint, this represents a reduction in quality because smaller tuna require more processing than larger tuna.[31] Under ex post pricing arrangements, however, the costs of blind selling can be reduced substantially.

The institution of demurrage fees clearly recognizes the ability of the processor to arbitrarily delay vessel unloadings. The malincentive (cost) introduced by such a levy is to encourage captains to return to port prematurely in order to "earn" the demurrage fee. Since the demurrage fee is a substitute for net income, the captain will stop fishing before catching a full load if the opportunity loss (of a larger catch) is at least offset by the gain in demurrage fees. Thus, boats approaching full capacity and fishing along the coastlines of California and Mexico could easily increase their earnings by returning to port during times of unusually long unloading queues. In the bait-boat period, a demurrage fee would have been extremely costly because of the small capacities of many of the boats, the numerous deliveries made by the smaller boats, and the local nature of the fishing operation for many of the boats in the fleet.

The malincentive cost of the demurrage fee explains why the fee was set below the exact level of the true damages necessary to compensate the captain. The fee was introduced in 1967 and was set at $1 per ton for tuna that was not unloaded after 10 days in port. This closely approximates the cost of additional refrigeration and rejects (spoilage) due to unloading delays.[32] The setting of the demurrage charge equal to the refrigeration and reject costs of a delay is therefore a means of compensating the captain for additional operating costs attributable to the delay without also providing the captain with the incentive to return to port prematurely.

3. SUMMARY AND IMPLICATIONS

The principal motivation for exclusive delivery contracts in the bait-boat period is to avoid duplicative inspection and sorting costs in the marketing of U.S. tuna. Exclusive dealing, however, transforms the domestic tuna harvests into a specialized asset. The return to a specialized asset, by definition, is a quasi rent. Consequently, the contracting processor has an incentive to renege on the contract and attempt to appropriate the quasi rents

[30] For a discussion of "blind" selling and seller brand names, see Kenney and Klein (515–16).

[31] In the modern purse-seiner period, processors did, in fact, complain about the problem (cost) of correctly anticipating average size of the catch; see Forbes-Stevenson Study (IV-4).

[32] In 1956, the layover costs of the larger bait boats were estimated at 75 cents per ton; see *California Fisheries Trends and Review for 1956* (4).

of the tuna catch. The processor could, for example, threaten not to accept the entire delivery unless the captain conceded to some nominal price for his tuna. Alternatively, the processor could threaten to prolong price negotiations and/or vessel off-loading unless the captain agreed to a lower price. Under these conditions, captains would not likely agree to exclusive deliveries.

The possible loss in marketing cost savings yielded by the U.S. tuna-marketing arrangement, however, provides the processor and captain with the incentive to reduce the size of the potential holdup. Since explicit contracting appeared to be too costly an alternative, implicit contracting was considered. The two necessary conditions for a no holdup equilibrium are: (1) that the captain and processor both agree that the present value of the future premiums (or quasi rents on nonsalvageable production assets) exceeds the present value of the short-run gain from reneging on the implicit contract, and (2) that the present value of the future premiums not exceed the present value of the savings in marketing costs. Both conditions appeared to be met because bait boats tended to make numerous small deliveries throughout the year. Consequently, the potential gain from a one-time holdup of a bait-boat delivery was likely to be small. Hence, the implicit premiums were likely to be small and the net savings in marketing costs were likely to be substantial.

The technological change in the method of harvesting disturbed the no holdup equilibrium in the bait-boat period. By reducing the frequency of tuna deliveries and by increasing the carrying capacity of the new vessels, the processor's incentive to behave opportunistically increased. Under these conditions, captains would be unwilling to accept exclusive delivery contracts.

As in the bait-boat period, the possible loss in marketing cost savings provided processors and captains with the incentive to reduce the increased holdup potential. Within the first year of the purse-seiner period, four new institutions emerged. Possible contractual disputes regarding price and unloading delays were specifically recognized by instituting an "empty boat" pricing scheme for tuna, and demurrage fees for unloading delays. Joint ownership more generally discouraged postcontractual reneging by imposing a cost on the processor for any reduction in vessel earnings. Lastly, mortgage guarantees limited the incentive of the processor to hold up the captain by shifting earnings from the harvesting to the canning stage of production or by reducing vessel revenues below the value of the next scheduled mortgage payment. As long as all contract costs (including the costs of institutional changes) do not exceed the savings due to the avoidance of excessive inspection and sorting costs (under the U.S. tuna-marketing arrangement), exclusive delivery contracts remain efficient in the purse-seiner period.