DANGO: JAPAN'S PRICE-FIXING CONSPIRACIES

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February, 1991

Abstract

This paper addresses two questions about collusion in the Japanese construction industry. First, what mechanisms are used for enforcing the collusive agreement, for dividing the spoils among themselves, and for preventing the entry of new firms seeking a share of the collusive profits? Second, how much are prices raised as a result of the collusion?

1. Dango

Dango is a negotiation among bidders for a Japanese public-works contract in which it is decided which firm will get the job. The designated firm submits a high bid and its "rivals" bid still higher, maintaining the illusion of competition. For the firms this is a congenial way to do business. Under *dango* each firm knows that it will eventually "win" a contract, without having to go to the trouble of competing; and *dango* spares the firms the discomfort of low prices.

How costly is *dango* to Japan's taxpayers? In what follows I shall develop some speculative analysis which suggests that the excess profits from collusion in a public-works project typically amount to 16% to 33% of the price. Since the Japanese government awards $100 billion worth of construction contracts annually,[1] and since collusion is rife in Japan's public-works bidding, 16% to 33% translates into billions of dollars.

Construction has been one of the stickiest areas of U.S.-Japan trade friction, with the U.S. negotiators arguing that *dango* is a barrier to trade. Although there have been repeated rounds of negotiations since 1986, progress toward an agreement on how to open the Japanese construction market has been slow, with dissatisfaction on both sides.[2]

This essay, a case study in the economics of collusion, addresses two questions. First, how does *dango* work? Any conspiracy to raise prices must neutralize the incentives for both member firms and nonmember firms to take actions that would destabilize the collusion. The conspirators must devise mechanisms for enforcing the collusive agreement, for dividing the spoils among themselves, and for preventing the entry of new firms seeking a share of the collusive profits. Some evidence about how Japanese construction firms overcome the hindrances to collusion is assembled in what follows. (The evidence is anecdotal, much of it coming from the reports of investigative journalists.) The second question is: how much does *dango* cost? The data that would be needed for econometric estimation of *dango*'s effects do not exist. In place of hard data, a simulation model will be used to provide some rough calculations of the extent to which *dango* raises prices.

2. How Does Dango Work?

As in other areas of the economy, Japanese practices are more similar to European and U.S. practices than appears at first glance. The Organisation for Economic Cooperation and Development has documented collusive tendering practices in Sweden, the Netherlands, the United Kingdom, France, Germany, the United States, and Ireland, noting that "such practices are the direct cause of unduly high prices in bids and are incompatible with the sound management of procurement policy".[3] In the United Kingdom, construction firms belong to regional business associations, to which they report information on any building work for which they bid. Similar arrangements existed in Germany until 1973, when the Federal Cartel Office declared them illegal on the grounds that they allowed the firms to fix prices. This did not stop collusion among German construction firms, which have often been the target of price-fixing prosecutions, the most spectacular of which involved police raids in 1973 and 1982 on the offices of all the large construction firms, resulting in fines of several million Deutschmarks. The U.S. construction industry does not refrain from conspiratorial bidding: it has its own equivalent of *dango.* During the Reagan era, when the Department of Justice took a tougher stance than before toward price-fixing, two-thirds of the criminal cases filed were against bid-rigging by construction firms, mainly relatively small roadbuilders and electrical contractors.[4]

The main difference between Japan and the U.S. is in the strength of the antitrust laws and the assiduity with which they are enforced. While *dango* is illegal in Japan under the Antimonopoly Act, sanctions against bid-riggers are weak. The investigative capacity of the Japanese authorities is more limited than that of the U.S. authorities: the Fair Trade Commission secretariat has a staff of 470, less than a quarter of the 2,000 employed by the U.S. Federal Trade Commission and the Justice Department's Antitrust Division. Administrative surcharges levied by the Japan Fair Trade Commission amount to only 0.5% to 2% of the contract value. The average fine levied by the Japanese antitrust authorities between 1985 and 1988 was $38,000, one-sixth the $224,000 average fine in the U.S. over the same period. Criminal cases are filed at a rate of about

80 a year in the U.S. Convictions in the U.S. regularly result in prison sentences: 20 between 1985 and 1988, compared with none in Japan in the same period, although prison terms are provided for in Japanese law.[5]

Even if the legal authorities can be evaded, collusion is -- in any industry in any country -- difficult to achieve. With a few conspicuous exceptions (such as the de Beers diamond cartel, the American Medical Association, and -- temporarily -- OPEC), attempts by producers to fix prices have failed to achieve genuine, lasting price increases. Three difficulties must be overcome. First, the conspirators must devise some mechanism for dividing the spoils. Each has an incentive to argue for a bigger share. One of the most common reasons for the breakdown of cartels has been squabbling over how to share the profits.[6] Second, an agreement is worthless without some way of enforcing it. Since contracts to fix prices cannot usually be written, any collusive agreement must be designed to be self-enforcing. Third, collusion contains the seeds of its own destruction. The high profits earned in a successfully colluding industry attract new firms into the industry. The competition from these new entrants then tends to destroy the collusive arrangements. Competition from nonmembers is, along with internal disagreements, the main reason why cartels have broken down in the past.[7] The success of *dango* in the face of these formidable obstacles is an impressive achievement, a tribute to the ingenuity of the conspirators. As we shall see, however, certain government policies advertently or inadvertently make their task easier.

It takes (at least) two to *dango.* To initiate a *dango* an inter-firm association is formed, supposedly with innocuous goals such as promoting safety in construction works. One company is nominated to organize the *dango* group. This company sets out the bidding rules that the participating companies are to follow. Each of the companies notifies the *dango* organizer which public projects it is interested in. The *dango* organizer sends fax messages to every company stating the time and location of the *dango* conference. Part of the *dango* organizer's job is to keep track of which companies have been assigned contracts and to ensure the work is spread evenly. It must also perform mediation in the event that there is quarreling over which company should be assigned to win.[8]

Dango is a sociable process. The conspirators hold their meetings in restaurants, tea rooms, and golf clubs, thus bringing to life Adam Smith's dictum: "Merchants of the same trade seldom meet together, even for merriment or diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices".[9] According to the National Tax Agency, the construction industry in 1985 spent $4.5 billion on entertainment.[10] That is a lot of merriment and diversion.

Not all is fun, however, as a Japanese journalist points out. "The *dango* organizers in the local areas have their hands more than full, not only adjusting bids between parties; they must also maintain relations with the various power holders, the *yakuza* [gangsters], etc. Their evenings are filled with incessant eating and drinking bouts, often to the point of getting physically weak, even ill. ... It's not an easy job, by a long shot."[11] One sympathizes.

During the negotiations over the division of the spoils, it must be agreed which firm is going to win the particular contract; what price it should bid; and how the other firms are to be compensated.

How is the designated winner chosen? The group has an incentive to try to ensure that the firm that has the lowest cost for this particular project be the designated winner, for this ensures that the profits to be divided among the conspirators are maximized. But the negotiations are complicated by the fact that production costs are private information to the firm, and each seeks to gain bargaining advantage from this private information. The group must develop negotiating procedures that are not susceptible to manipulation by group members.[12]

Under *dango*, firms that meet repeatedly over a series of contracts devise procedures for deciding the winner. In some cases the winner is simply allocated by turn. This is not, however, from the participants' point of view, the ideal way to collude, for it is unlikely to select the lowest-cost firm. In other cases separate negotiations are held before each contract to decide the winner. In still other cases, formal *dango* rules evolve. The contract goes to, for example, the company located closest to the delivery point, or the company that is making the strongest efforts to receive this particular order. When there are successive contracts for the same job, later contracts go to the company that received the initial contract. Each of these rules can be interpreted as attempts to ensure that the winner is likely to be the lowest-cost bidder, and therefore to maximize the total profits to be shared among the conspirators. An alternative *dango* rule for allocating the winner works by giving points to each bidder according to (a) the number of times in the past the firm has participated in bidding, and (b) the size of the firm's bid on the occasions it won a contract in the past.[13] These mechanisms do not always work to everyone's satisfaction: periodically, a *dango* is exposed when a member, dissatisfied with the share of the spoils he is offered, leaks details of the *dango* to the press.

How do the conspirators agree how high the winner should bid? Here the government makes the decision easy. In advance of the bidding it sets a ceiling price. The optimal collusive bid is clearly at or close to this ceiling. Often the ceiling price is leaked to the bidders, typically via former Ministry of Construction officials now employed by the bidding firms. In many *dango* cases, according to a Japanese newspaper, "local government officials effectively have helped hide the abuse by setting estimates that include generous profit margins for the contractors".[14]

How are the losers compensated? During the *dango* negotiations, cash and gifts are exchanged. Upon winning the bidding as planned, the designated firm pays money to the other bidders. These bribes are euphemistically called "cooperation money" or "compensation money". (The former refers to sums that are fixed before the bidding; the latter to sums that are percentages of the winning bid.) In a *dango* among kitchen-equipment suppliers against the Matsuyama City government, for example, which yielded $35,000 total profit on a winning bid of $114,000 according to court estimates, the profits were shared equally. The winning firm paid each of the six other *dango* participants $5,000 each, and kept $5,000 profit for itself.[15]

The Japanese construction industry is less hampered than the U.S. construction industry by the need for secrecy. Because of active antitrust enforcement, U.S. conspirators have often been forced to use clumsy methods of resolving the negotiation difficulties. To avoid leaving a paper trail, the colluders have all submitted identical bids, leaving it to the government to pick the winner by a random draw. Or they have used more fanciful techniques, like the electrical-equipment conspiracy's assigning the winner according to the phases of the moon.[16]

In Japan, also, there is some need for secrecy. Within a construction company, only a few managers are involved in *dango* relationships. By the account of a mid-level manager of a construction firm, organizing *dango* resembles a John le Carre operation:

> The real *dango* specialists are somehow divorced from the direct company line so that nobody, not even inside the company, can establish easily who is a *dango* organizer. That is because *dango* is not the kind of activity that

> is to be done openly and in a stately manner. If the press learns of a *dango* arrangement, the reporters' investigations must be localized quickly and handled at the *dango* specialists' level only. The system is designed to allow for deniability at the top levels, and so structural arrangements are made in order for the company's upper management not to have a hand in it.[17]

In the bidding for a contract, any firm other than the designated winner has an incentive to depart from the collusive agreement, bidding a little less than the designated winner's agreed bid and earning a large profit. What is *dango*'s enforcement mechanism? The ongoing nature of the firms' interaction makes it possible for agreements to be self-enforcing. Firms do not deviate because they know that they will suffer retaliation in future bidding contests; the cost of deviating now is the loss of future profits. Ongoing relationships are found in most industries in any country, however, so this retaliation capability is clearly not enough in itself to generate collusion. Gangsters, it is alleged, are sometimes an additional and more immediate means of *dango* enforcement.[18] The government aids *dango*'s enforcement by requiring that all bids be made known to all bidders after the bids are opened,[19] with the result that each bidding firm is aware that, if it deviates from its specified bid, all the others learn of its deviation immediately. Bidders for sewage-works contracts in East Osaka were once found by the authorities to have colluded, and were punished by being banned from bidding. But the new firms that the government invited to bid all pulled out, under pressure from the banned group.[20]

How are new entrants, seeking part of the collusive profits, excluded? Once again, government policy comes to the aid of the conspiracy. In the most commonly used tendering system (used in about 90% of Japanese public-works contracts), some selected firms are invited to bid for the contract.[21] Only firms officially listed as qualified are invited to bid. This policy has a public-safety rationale: it is designed to ensure that the selected firm is capable of doing work of acceptable quality. But it has the side effect of making it difficult for new firms to enter the industry. Conveniently for the conspirators, the government solves one of the trickiest problems in running a cartel, how to prevent entry by newcomers. (Selective tendering of this kind is not unique to Japan, however: it is a common practice in many OECD countries.[22])

In most public-works projects in the U.S (and very occasionally in Japan), open tendering is used: any firm qualified to do the work is permitted to bid. During the U.S.-Japan Structural Impediments Initiative talks of 1989-90, the U.S. negotiators advocated that Japan replace the system of invited bids (which U.S. Trade Representative Carla Hills called a "hotbed of *dango* practices") with open competition. The *dango* organizer's problems would be multiplied with open competition: he could not be sure of knowing in advance the identity of all the bidders to be organized; and some untrustworthy outsiders might enter the bidding.[23]

Ministry of Construction officials who restrict the entry of new competing firms are probably not corrupt; they may be honest but motivated by simple bureaucratic caution. An official knows that if something goes wrong -- say, the bridge that is to be built later falls down in an earthquake -- then he will suffer blame if he awards the contract to an outsider firm, even if he has thoroughly checked the firm's competency.

For a firm to be put on the list of qualified bidders, only work it has done in Japan is taken into account.[24] This procedure prevents entry into the market by foreign firms, for they do not have a history of work in Japan. It has the elegant logic of Catch-22: you cannot win a contract unless you bid; but you are not allowed to bid unless you have won a contract.

Dango is an elaborate mechanism. But is all this scheming for nought? Does *dango* matter? It is conceivable that the conspiracy raises prices only marginally, and so its existence is of little consequence. In order to evaluate *dango* we need some way of measuring its effects.

3. How Much Does Dango Cost Taxpayers?

We cannot directly estimate how much *dango* costs Japan's taxpayers. It is difficult to get data on *dango*. The participants are understandably sensitive about outsiders' prying. Even if data on construction bidding were available, they would be of limited use, for two reasons. The data would represent collusive bidding; they would not show what would happen if the bidding were truly competitive. Also, any data that are available are skewed. To the extent that what is known about *dango* comes from Fair Trade Commission actions against the conspirators, we are seeing only the unsuccessful collusions. Those firms that are prosecuted are the less skilled at *dango*; they are the ones that have been caught.

As a substitute for quantitative inside information on the collusions, I shall explore a mathematical model, based on some recently developed economic theory, which compares competitive bidding with *dango* bidding.[25] This model depicts, under some simplifying assumptions, the outcome of a competitive bidding process. The price so obtained is then compared with the price under collusion. (The technical details of the model are given in the appendix.) This exercise is speculative and we must be cautious in drawing empirical conclusions from it, but it will help us to get some feel for the numbers involved in *dango*.

A simulation of the consequences of introducing genuinely competitive bidding is shown in Table 1. Here n represents the number of bidders. The parameter k measures the potential spread of bidders' costs: it is the ratio of the government's ceiling price to the the lowest production cost that a bidding firm could possibly have. If all the firms' production costs are clustered close to the ceiling price, k is slightly above one; the more widely spread costs are, the larger k is. The numbers in Table 1 (computed as described in the appendix) are the difference between the collusive price and the competitive price, as a percentage of the collusive price. In other words, they are the average savings that could be realized if competition replaced collusion. These numbers have the common-sense property that they increase as the number of bidders *n* increases: the more bidders, the larger the effect of competition would be if it were allowed to operate. The table also shows that the loss from collusion increases as *k* rises; that is, as the range of possible production costs widens. This is because, with a wide range of possible costs, it is likely that some of the firms invited to bid are very efficient, having production costs much lower than the government's ceiling price. If there is a reasonable number of bidders, then competition will force the most efficient firm to bid low. But with collusion, the price will be at or close to the ceiling price, regardless of how far any firm's production cost is below the ceiling. As the table shows, the loss from collusion varies widely from contract to contract, depending on both the number of bidders and the range of their production costs. If the model is to be believed, the costs of *dango* can be very large, possibly being around 50% on occasions. Which of the numbers in the table can we expect to show the typical loss from *dango*?

Usually 10 firms are invited to bid for Japanese public-works projects. In 1982 the Ministry of Construction raised this number to 20 in an effort to stimulate competition; but the number was returned to 10 as a result of political pressure.[26] Hence the typical value of *n* is 10. (As the table shows, however, these loss estimates are not very sensitive to the choice of *n*: for any given value of *k*, increasing the number of bidders from 10 to 20 or reducing it from 10 to 5 would change the loss estimate by 5 percentage points or so.)

It is less easy to find the appropriate value to assign to the other parameter, *k* (the range of the bidders' costs), because it is not directly observable, and because it varies from contract to contract. This number has, however, been computed for a sample of construction contracts tendered by the Ontario government; it was inferred from contract-bid data that *k* ranged from 1.1 to 5.0, in most cases being between 1.3 and 1.7, and averaging about 1.4. [27] Let us assume, therefore, that a reasonable range for the typical size of *k* is 1.3 to 1.7. This can be put in more interpretable terms by noting that the size of *k*, together with *n*, determines what the average spread of the bids would be if the bidding were competitive; and bid ranges (unlike cost ranges) are observable. If *k* is 1.3, then -- according to the model -- under competitive bidding with 10 bidders the typical difference between the highest bid and the lowest bid is about one-fifth; if *k* is 1.7, the average spread between high and low bids is about one-third. Bid ranges of one-fifth to one-third are roughly of the size usually observed in competitive bidding for public-works contracts in various countries.

It follows that the most plausible case is that of 10 bidders and *k* between 1.3 and 1.7. Thus, from Table 1, the estimated typical loss from *dango* is 16% to 33%. (Another estimate of *dango*'s effects, incidentally, comes from the nationalistic LDP politician Shintaro Ishihara, who in his book with Akio Morita *The Japan that Can Say "No"* -- generally regarded as United States-bashing -- argues that *dango* must be stopped: "Japanese general contractors have been maintaining prices as much as 40% higher in comparison to foreign bidders, due to bid-rigging traditions to assure a monopoly on business for themselves."[28])

Of course, these estimates are to be believed only to the extent that the simulation model approximates actual bidding behavior with tolerable accuracy. Some particular cases give evidence that these estimates are reasonable. One is a 1989 U.S. Justice Department action against a group of Japanese construction companies which had worked on a U.S. Navy base in Japan. The group called itself, in an allusion to the American flag, the Star Friendship Association -- although overcharging is hardly an act of friendship. After the Japan Fair Trade

Commission ruled that the companies had colluded in the bidding for contracts and fined them $2 million -- only 1.5% of the total value of the contracts -- the U.S. threatened to sue the conspirators for damages. The U.S. initially demanded $35 million, which a U.S. official described as a "low-end estimate" of the U.S. Navy's losses from the bid rigging. An agreement was eventually negotiated, under which the companies were to pay $32.6 million. This settlement represented 24% of the total value of the contracts, which is in the middle of our estimated range of typical losses from *dango*. The builders' predilection for conspiracy was little dampened: on the companies' insistence, it was left to them to decide for themselves how much each would contribute to the collective fine. The payment of the fine was assigned among the 100 firms by *dango*.

A second example is a 1982 case in which Matsuyama City purchased kitchen equipment. The bidding firms were convicted of colluding to raise prices. The winning bid was $114,000; the court estimated that the cost of the equipment supplied plus installation and transportation costs came to $79,000. The bid incorporated, therefore, 31% profit; if a normal profit rate is subtracted from this, the excess profit is still within our estimated range.

In a third example, a 1979 river-dredging project in Tsukuba City, the three bidders devised a scheme under which the winner subcontracted the entire job to one of the other firms, and all three shared the profits. This was so blatant that the case was brought to court. The prosecution charged that the excess profits amounted to 27% of the contract price.

In a fourth example, companies supplying soil to build the Kansai airport -- the world's largest man-made island -- charged a price of $7.90 per cubic meter, compared with the airport authorities' estimate of $7.20. Under the generous assumption that the official estimate is approximately what the price would have been with competition, *dango* raised the price by 9%. This is below our estimated typical range; nevertheless the excess profit shared among the *dango* participants amounted to a tidy $35 million.[29]

The estimates reported in Table 1 understate the losses from *dango*, for the model assumes that firms' production costs remain the same whether there is collusion or competition. Two effects work to raise production costs under *dango*, and therefore further to inflate the prices the government pays.

First, as Sir John Hicks quipped, "The best of all monopoly profits is a quiet life".[30] Firms lacking the discipline of competition tend to produce inefficiently: they fail to search for cost-reducing innovations, pay inflated wages and salaries, and spend money on lavish perquisites for the executives. Some evidence corroborating Hicks's proposition comes from a study by a Tokyo economic-consultancy firm which concluded that productivity in the Japanese construction industry is lower than in the U.S. and German construction industries (in marked contrast to Japan's relative performance in manufacturing-industry productivity).[31] This low productivity might be attributable to *dango*. A caveat is needed here, however. Japan's construction industry has a dual structure. Some of the larger firms are highly sophisticated technologically, as is evidenced by the conspicuous success in international competition of firms like Kumagai-Gumi. Small construction contracts, especially those offered by local governments, are reserved for small firms, on the grounds that they could not win contracts in open competition with the more efficient large firms.[32]

Second, if the colluding firms cannot completely deter entry by inefficient newcomers seeking a share of the profits, industry costs will be higher than they would be under competition. It has been noted that, if competition were introduced into the Japanese construction industry, there would be a shakeout, forcing thousands of the smallest firms into either bankruptcy or takeover by the more efficient firms. The *dango* organizers reserve certain projects for small firms, excluding large firms, to ensure that all firms receive contracts at some time.[33] It follows that the government is currently covering unnecessarily high average production costs.

The estimated costs of *dango* can be compared with estimates for the U.S. The losses from collusion can be presumed to be less in the U.S. than in Japan because of the U.S. government's hostility toward it. Charles F. Rule, the Reagan administration's antitrust chief, said of bid-rigging: "The cost of building roads in this country was increased by 10% or more as a result of these crimes". In the above table, a 10% loss is consistent with there being 2 bidders with a *k* value of 1.4, or 20 bidders and a *k* value of 1.1. It implies, therefore, a relatively small spread of production costs. The 10% figure is likely to be an underestimate, however. In a sample of three U.S. cartels in which, unlike with *dango*, collusion alternated with competition so the effect of collusion could be measured directly, collusion raised prices by 25%, 35%, and 60%.[34]

We can conclude from the foregoing analysis and cases that a conservative estimate of the excess profits attributable to collusion in Japan's construction industry is between 16% and 33% of industry revenue. Where do all the profits go? To what extent do the construction industry's owners and employees benefit?

The average remuneration of construction-industry employees is significantly higher than the average remuneration in Japanese firms in general.[35] The employees of large firms weight this comparison. A worker (male, high-school graduate) in a large firm (with more than 1,000 employees) on average earns 14% more in the construction industry than in industry generally. A similar worker in a small firm (with 10 to 99 employees) earns only 1% more in the construction industry.[36] The extra earnings of (at least some) construction workers might come from the construction employees' sharing in the collusive profits. This inference should be treated with some skepticism, however, for the difference in remuneration might innocuously reflect inherent differences between the construction industry and other industries. Construction firms have in fact often been observed to pay higher-than-average wages in countries other than Japan: 12% higher in the U.S., and 9% higher in Australia, for example.[37] Thus there is no compelling evidence that construction workers receive much of the *dango* profits.

An inter-industry comparison of firms' profits does not suggest that the construction firms' owners are benefiting from *dango*. Between 1966 and 1989, the average reported profit rate in the construction industry was 4.7%. This is actually less than the 5.9% average profit rate in Japanese industry as a whole in that period. In two sectors of the construction industry that are public-sector oriented, civil engineering and electrical plant construction, average profit rates were respectively 5.6% and 7.9%. [38] Comparison of aggregate profits, therefore, gives no evidence that, as a whole, the shareholders of construction firms are earning abnormally high profits (with the possible exception of electrical plant construction). This might be because any excess profits earned by shareholders are hidden by creative accounting. Since many construction firms are managed by their owners, excess profits can be remitted to the owners in the form of luxury cars and housing paid for by the firm. Alternatively, measured profits might be low because actual profits are low: it might be that few of the returns from *dango* actually accrue to the firms' owners.

In their quest for monopoly profits, the firms may be on a treadmill: they must try so hard to earn them that they end up with little net gain. This is an application of the general hypothesis, proposed by Richard Posner and others,[39] that firms use up resources in competing for monopoly profits; and the entry of new firms into this profit-seeking competition can result in the resources expended rising to become equal to the monopoly profits themselves. Entry into the construction industry seems to be relatively easy: the industry contains over half a million firms, and this number increases steadily over time.[40] Anecdotal evidence suggests that many of the existing smaller firms are so inefficient they would not survive the introduction of genuine competition. Total industry profits would be higher if the industry were to exclude these high-cost firms, so presumably it is not feasible to exclude them.

Free entry, then, means that any excess profits that would remain with the firms are competed away. Where do the dissipated *dango* profits go? As noted, a surprisingly large amount, $4.5 billion, is used up in entertainment (reported to the tax authorities as deductible expenses). More significantly, the construction industry is the largest single source of political contributions. (Political contributions are costs in accounting terms,[41] but are profits in terms of Table 1's *dango* profit estimates.) According to a member of the Japanese negotiating team for the U.S.-Japan trade negotiations, public works expenditures "provide the necessary lubrication to the Japanese political process".[42] If the profit-dissipation hypothesis is correct, much of the *dango* profits end up in the hands of politicians. The size of political contributions is not known; as the political scientist Takeshi Sasaki said, "The system is so complex that no one can really follow it". Japan's Home Ministry reported that in 1989 political organizations raised more than $2 billion. In addition, many contributions go unreported: one estimate is that reported contributions make up one-half of the total; another is that they are only one-fifth. It is further estimated by journalists that the construction industry accounts for about 50% of total contributions to the LDP. (The exact amount cannot be known, because of the unreported donations.) It follows that a very rough guess of the construction industry's political contributions is between $2 billion and $5 billion.[43]

Because of the inconclusiveness of inter-industry comparisons of profits and wages and the uncertainty about the size of political contributions, however, where the *dango* profits go must remain an open question for further research.

4. Conclusion

This paper has analyzed how *dango* is able to function in the face of incentives for both member firms and nonmember firms to take actions that would undermine the collusion. We have estimated that *dango* raises prices by surprisingly large amounts.

The practice of *dango* does not require revival of the cliches about Japan's cultural uniqueness. Firms that conspire to fix prices are, after all, hardly unknown in the United States, Europe, and elsewhere. That collusion is more widespread and more overt in Japanese public construction than in the U.S. might be attributable simply to Japan's weaker legal sanctions.

Appendix: A Model of Bidding

The model that underlies the foregoing computations is as follows. Each firm is depicted as knowing its own cost of doing the particular job, but not any of the other firms' costs; each firm perceives the others' costs as being drawn from some probability distribution. To keep the number of parameters small, let us assume that these costs are uniformly distributed on $[a, A]$: that is, any firm's cost lies somewhere between the numbers a and A, with all values in between being equally likely. (The uniform distribution has been found to be a reasonable approximation to Canadian government competitive-bidding data.[44]) The parameter a is to be interpreted as the lowest cost a firm could in principle have for this job. The parameter A is the government's predetermined ceiling price, which -- if known to the bidding firms -- effectively truncates the top of the distribution of bidders' costs. (A more complete model would incorporate the political and bureaucratic determinants of the ceiling A. These are left out of account here, but notice that if, as was quoted earlier, the government sets ceilings that "include generous profit margins for the contractors", then the costs of *dango* are still higher than the estimates to be derived here.) Finally, let us assume there are no correlations among the different firms' costs.

The outcome of competitive bidding is represented by a Bayes-Nash equilibrium, derived as follows. Consider firm 1's decision on how high to bid. Suppose it hypothesizes that its rivals follow the decision rule: bid an amount $B(c)$ when cost is c. If firm 1's own bid is b_1 then it wins if $b_1 \leq B(c)$ for all others' costs c. Firm 1 does not know any of its rivals' costs, but it does know their probability distribution, so it can compute its expected profit from bidding the amount b_1. This expected profit is

$$\pi(b_1, c_1) = (b_1 - c_1)Prob[b_1 \leq B(c_i), \text{ for all } i=2,...,n],$$

where n is the number of competing bidders. Given that the cost distribution is uniform, this expression can be rewritten as (denoting by $C(b)$ the inverse function of $B(c)$; i.e., $C(b)$ is the cost c corresponding to the bid b, given the bidding rule B):

$$\pi(b_1, c_1) = (b_1 - c_1)\{(A - C(b_1))/(A-a)\}^{n-1}.$$

The firm, assumed to be risk neutral, chooses its bid to maximize this expected profit. The Envelope Theorem implies that

$$\frac{d\pi}{dc_1} = \frac{\partial\pi}{\partial c_1} = \{(A - C(b_1))/(A-a)\}^{n-1}.$$

This defines firm 1's best response to the decision rule $B(c)$ being used by the other firms. This decision rule is, so far, arbitrary; but we now impose the (symmetric) Nash requirement that the rivals' use of the decision rule $B(c)$ be consistent with the rivals' themselves acting rationally. That is, we set $b_1 = B(c_1)$. Upon integrating the previous equation, we find that the optimal decision rule is

$$B(c) = c + (A-c)/n.$$

In other words, each firm computes its bid by adding a profit factor $(A-c)/n$ to its production cost c. The profit built into the bid is smaller the more bidders are competing. And it is smaller the less efficient the firm; that is, the closer its cost is to the ceiling price, A.

To an outsider, not knowing any of the firms' costs, what is the expected winning bid under competition? The probability distribution function of the lowest of the n costs is $1-\{(A-c)/(A-a)\}^n$, so the density function is $n[A-c]^{n-1}/[A-a]^n$. The expected value of the winning bid, which we shall denote $E[b_w]$, is the integral of $B(c)$, defined above, with respect to this density function. This integral reduces after manipulation to

$$E[b_w] = a + 2(A-a)/(n+1).$$

This, then, is the average price with competition. (Notice that, for large numbers of bidders n, this expected price is just above the lowest possible cost, a.)

Under collusion, on the other hand, the rational amount for the cartel's designated winner to bid is the highest price the government will accept, A. Thus the expected difference between collusive and competitive prices is $A-E[b_w]$, or $(A-a)(n-1)/(n+1)$. Define a new parameter k by $k = A/a$; thus k measures the spread of possible production costs. Then the expected difference between collusive and competitive prices, as a percentage of collusive price, is $(k-1)(n-1)/k(n+1)$. This is the quantity reported in the table in the text.

Footnotes

* I thank Martin Bronfenbrenner, Bruce Chapman, Peter Drysdale, Aurelia George, Takeo Hoshi, Chalmers Johnson, Seiichi Kawasaki, David Kramer, Susumu Kuriowa, Mark Machina, Hiromichi Mutoh, Hugh Patrick, Amelia Porges, Mark Ramseyer, Frances Rosenbluth, Hong Tan, a Tokyo-based businessman who prefers to remain anonymous, and two referees for comments and for materials on *dango*, and Yoshito Sakakibara for valuable research assistance. This work was completed while I was a Visiting Fellow at the Australia-Japan Research Centre, Australian National University.

1. According to Economic Planning Agency (1988, p.41), contracted public works totaled ¥14294 billion in 1987.

2. Coles (1989), Cutts (1988), Krauss (1989), Krauss and Coles (1990), Lee and Walters (1989, pp. 80-87).

3. Organisation for Economic Cooperation and Development (1976a).

4. Grant and Streeck (1985), Hershey (1988), Schlesinger (1989).

5. *Asahi Evening News* (1990), Hershey (1988), Ramseyer (1985), Schlesinger (1989).

6. See, for example, Eckbo (1976, Ch.3) and Lovasy (1946).

7. Again, see Eckbo (1976) and Lovasy (1946).

8. Peterzell (1990), *Zaikai Tenbo* (1989a).

9. Smith (1976, Vol 1, p.144).

10. van Wolferen (1989, p.119).

11. *Zaikai Tenbo* (1989b)

12. Cramton and Palfrey (1990), Graham and Marshall (1987), Mailath and Zemsky (1990), McAfee and McMillan (1991).

13. Higuchi (1982).

14. Organisation for Economic Cooperation and Development (1976b, p.69), *Asahi Evening News* (1989a, 1989b), Shozo (1982), Koizumi (1990).

15. Higuchi (1982); *Kensetsugyo Dokukin Mondai Kenkyukai* (1984, pp.204-205); Makino (1984, pp.58-68); Roscoe (1987), p.71.

16. Mund (1960), Smith (1961).

17. *Zaikai Tenbo* (1989b).

18. *Economist* (1990b); Higuchi (1982); Stark (1981, p.39) *Zaikai Tenbo* (1989a).

19. Hippoh (1983, pp.120, 234) OECD (1976b, p.69).

20. *Zaikai Tenbo* (1989b).

21. Hippoh (1983, p.234).

22. OECD (1976a, p.12); OECD (1976b).

23. Hippoh (1983, p.234), Ito (1990, p.21).

24. Rubinfien (1988), p.12.

25. The model is based on Myerson (1981) and Riley and Samuelson (1981).

26. Hippoh (1983), p.121; van Wolferen (1989), p.118.

27. McAfee and McMillan (1988, pp.50, 51). Of the 40 construction and maintenance contracts, 28, or 70%, had an estimated k of 1.3 to 1.7; the remainder were equally distributed between being less than 1.3 and larger than 1.7.

28. Morita and Ishihara (1990, pp. 57-58).

29. On the U.S. Navy case: Peterzell (1989); Sanger (1989); Schonberger (1989), *The Economist* (1990a). On the Tsukuba City case: *Asahi Evening News* (1989c). On the Matsuyama City case: *Kensetsugyo Dokukin Mondai Kenkyukai* (1984). On the Kansai airport case: *Zaikai Tenbo* (1989a).

30. Hicks (1935, p.8).

31. Cited by Hasagawa (1988, pp. 46-47). Another study that finds that Japanese construction firms have on average higher costs than construction firms in other countries is Sidwell et. al. (1988).

32. Coles (1989), pp.52-60; Enderwick (1990).

33. Nagano (1989), Roscoe (1987), p.71.

34. Hershey (1988), p.29; Erickson (1976).

35. The evidence on remuneration comes from the following simple regression:

$$w_{it} = a_0 + a_1 d,$$

where w_{it} is the mean wage paid by firm *i* in *year t* and *d* is a dummy variable, set equal to one when firm *i* belongs to the construction industry and zero otherwise. The data, from the Nikkei Electronic Databank System's Comprehensive Corporate Databank, cover a sample of firms from all Japanese industries except financial institutions. (Wages include overtime but not bonuses.) The regression results for 1988 and 1989 are that the coefficient of the dummy variable is significantly larger than zero (having a t-value of 7.730 for 1988 and 7.353 for 1989). I thank Takeo Hoshi for these statistics.

36. Computed from Ministry of Labor (1986).

37. Examples of studies that find that construction wages are higher than other industries' wages, controlling for such variables as schooling, experience, sex, race, etc., are Katz and Summers (1989), which finds (for the U.S.) that construction wages are 12% above average; and Chapman and and Mulvey (1986), which finds (for Australia) that construction wages are 9% above average.

38. The data, computed from the Nikkei Electronic Databank System's Comprehensive Corporate Databank, represent a sample of firms listed on the Tokyo stock exchange. "Profit" is here defined to be pre-tax operating income as a fraction of assets. (Operating income excludes gains and losses from extraordinary transactions like the purchase and sale of tangible assets; and it excludes gains and losses from financial transactions.)

39. Bhagwati (1982), Krueger (1974), Posner (1975), Tullock (1967).

40. Cutts (1988), p.48. The number of construction firms increased at an average rate of 7% each year from 1975 to 1980 (computed from Hippoh, 1983, p.17).

41. Curtis (1988, p.186); Tax Bureau (1985, p.79).

42. For more on the construction industry's political ties, see Coles (1989); Curtis (1988), Hrebenar (1986), Krauss and Coles (1990), Roscoe (1987), van

Wolferen (1989), pp.118-119; *Zaikai Tenbo* (1989a). The Japanese negotiator is quoted in *Mainichi Shimbun* (1990).

43. The reported-contributions number comes from Weisman (1990). The unreported-contribution fractions are given by Weisman (1990) and Hrebenar (1986), p.64. The estimate of contributions to the LDP comes from *Asahi Shimbun* (1990); see also Cutts (1988, p.50).

44. McAfee and McMillan (1988), p.62.

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Table 1: Simulated *dango* profits

n	2	5	10	20
k				
1.1	3%	7%	8%	9%
1.3	6%	13%	16%	19%
1.4	10%	20%	25%	27%
1.7	13%	27%	33%	36%
2.0	17%	33%	40%	45%
2.5	20%	40%	49%	54%

Source: See the appendix.