

**WHO WILL BE THE WINNER WHEN A PROFIT-MAXIMIZER MEETS A
REVENUE-MAXIMIZER? - THE CASE OF US-JAPAN AUTO TRADE**

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August 31, 1996

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Abstract

This paper attempts to provide a new explanation of the huge trade deficit of US against Japan based on an analysis of different strategic behaviors between US firms and Japanese firms. It is argued that while US firms tend to be more profit-orientated, Japanese firms are revenue-maximizers. Using a Cournot (quantity adjustment) model for a duopolistic market, we show that a revenue-maximizer will be the winner when it meets a profit-maximizer; it should obtain a larger market share and a higher profit. Whether the current cultural-institutional equilibrium between Firm 1 (the Japanese firm) and Firm 2 (the US firm) is also a Nash equilibrium depends on potential market size, which is determined by demand shift parameter and cost structure. The case of US-Japan auto trade is investigated and the results are found to be consistent with the predictions of our model. Finally, some possible solutions to the trade dispute between Japan and US are discussed.

1. INTRODUCTION

The rapid expansion of Japanese export of manufactured goods, such as automobiles and semiconductors, has given rise to disputes with its trading partners, especially, with US. Although Japan was a latecomer in the US market, the pace of expansion of its market share in these industries has been exceptionally fast. While many tend to attribute Japan's huge amount of trade surplus against US to Japanese protectionism, unfair trade practices, or other non-tariff barriers, such as the *keiretsu* distribution system, this paper seeks a different explanation. We are interested in the following questions: (1) How do business culture and institutional arrangements affect a firm's strategic behavior? (2) Who will be the winner when a profit-maximizer meets a revenue-maximizer under a simple duopolistic competition framework? (3) What are the policy implications of this analytical framework for the US-Japan bilateral trade? To facilitate our analysis, we will re-examine and further argue the

revenue-maximizer dominance hypothesis¹ [in our terminology], proposed by Blinder (1992, 1993).

This paper is organized in the following manner. In Section 2, we argue that strategically the Japanese firm tends to be a revenue-maximizer because of institutional practices that are particularly Japanese. We will then in Section 3 develop a payoff table showing the results of interactions of duopolistic competitors with optional strategic behaviors, using a simple Cournot model. We show that a revenue-maximizer will be the winner when it meets a profit-maximizer. The condition for Nash equilibrium is identified for each case, and the relationship between Nash equilibrium and the so-called cultural-institutional equilibrium is discussed. Section 4 examines the stylized facts of the US-Japan bilateral auto trade which support the predictions of our model, and discusses the implications of the model for the US-Japan trade issue. Section 5 summarizes this paper.

2. THE GOALS OF THE LARGE JAPANESE COMPANIES: ARE THEY REVENUE-MAXIMIZERS?

Over the past few decades, orthodox microeconomic theory postulates that the sole objective of a firm is profit-maximization. This profit-maximization dogma has been criticized by a number of economists, such as Baumol (1959), Cyert and March (1963), Galbraith (1967). Indeed, the relevance of *pure* profit-maximization is less obvious for modern corporations when ownership (i.e., stockholders) and controls of the firm (i.e., top management) are separated. In the US, Berle and Means (1932), and Larner (1966), for instance, found that “there are no dominant owners” that merely maximize their profits, as described in the traditional microeconomic textbook. Rather, giant corporations usually require a huge amount of capital that causes extensive dispersion of their ownership among

¹ A more general situation is dealt with in Tabeta and Wang (1996), where a “*relative*” revenue-maximizer dominance hypothesis is proposed.

many investors. In Japan, Hirose (1963), Uekusa and Caves (1976: 10-12), Miyazaki (1976), Komiya (1987, 1994) have reported that the separation of ownership and controls causes a deviation of management from the *pure* profit-maximization principle. In fact, many experienced Japanese executives have suggested that this separation between shareholders and professional management provides a considerable degree of decision-making autonomy for managers.²

In an oligopolistic market, each firm may set up its own goal: maximizing revenue or maximizing profit. This difference in strategy may be explained by corporate culture and institutional arrangements. For example, Kagono et al. (1985: 27-28) pointed out that Japanese firms show relatively strong growth-preference, while US firms emphasize more on investment returns and capital gains.³ According to *Keizai Hakusho [Economic Survey of Japan]* (1992: 228 - 231), the principal objectives of American companies are: (1) return on equity or investment [ROE], and (2) capital gains for stockholders; while those of Japanese companies are: (1) gaining market-share, and (2) introducing new products. In the case of the Japanese auto industry, Shimokawa (1994: 38) pointed out: “Japanese automobile company unions settled for a consensus approach with the aim of raising wages and welfare,” and employers were concerned more about employees’ welfare so as to establish a better cooperative long-run labor-management relationship.

Blinder (1993) has developed a model to show that a typical large Japanese firm will behave like a revenue-maximizer if it seeks to maximize employees’ utility or welfare, in addition to profit (See Appendix I). More specifically, the firm emphasizing employees’

² For example, Sony’s Akio Morita (1987: 225) wrote: “Companies will go after an increase in share of market by cutting prices to the bone, sometimes to the point where there is no chance of anybody making a profit on the product.”

³ This survey result is consistent with the popular view among American and British managers that the stock price is affected more by short-run profitability than by long-run consequences. This “managerial myopia” argument is, for instance, discussed in Stein’s article (1988).

welfare will produce more output than a *pure* profit-maximizing firm. He concluded that as long as it has a secure source of capital, a revenue-maximizer is at a distinct advantage when competing with profit-maximizers. Moreover, the revenue-maximizer is likely to drive its profit-maximizing rivals out of business if either (a) average costs are declining or (b) learning is a function of cumulative output (See Appendix II).

There are several reasons to explain why Japanese firms are in general able to act like revenue-maximizers. First of all, in Japan, expansion in firm-size is a necessary condition to maintain the life-time employment system and internal promotion. In order to provide more jobs and promotion opportunities for employees, firm-size must be continuously expanded. Most of the firms are managed and controlled by managers who do not possess corporate-stocks and have been promoted from within. As a result, the managers' top priority is to maintain harmony in the firm. This can be achieved only through providing more jobs and promotion opportunities, and hence a continuous expansion in firm-size. Secondly, under the seniority system where both the wages and the position of an employee are dependent on the years of service, hiring more graduates from colleges or high-schools is more crucial to reducing costs, as it eventually leads to a build-up of advantages in respect of labor costs by keeping the average age of the employees young. Obviously, this process must be accompanied by a faster growth of the firm. Thirdly, Japanese firms pursue the growth-orientated strategy also because there is little external pressure for short-term earnings. It is true that "the duty of management [for both American and Japanese managers] is to use their funds effectively and to give them a return on their investment greater than they could have realized (Morita, 1987: 190)." This does not, however, mean higher dividend returns in the case of Japan. It is more important for managers to pay attention to the growth of the value of the stocks, since tax rates on capital gains are lower than tax rates on dividends. Thus,

Japanese companies could reinvest retained earnings to expand plant capacity, instead of paying out higher dividends to shareholders. Furthermore, in Japan, stockholders' influence on corporate strategy is rather weak, and the threat of a take-over on the public stock exchange is negligible due to the cross-share-holding of common stocks. Especially, after the dissolution of the *Zaibatsu*, a decline in shareholders' influence on management allows professional managers to act on motives other than profit-maximization. Lastly, there is some possibility that administrative guidance and controls lead Japanese firms to act like revenue-maximizers. As Schumpeter (1942: 88) has mentioned in his book, "a car with brakes of course is driven faster than one without." In this sense, administrative guidance and controls ironically create "excess competition." Nakamura (1978, 1981) claimed that administrative guidance and controls play a role as a "shelter from the storm." Japanese firms in their competition for market share tend to invest more than their own capital permitted, thereby bringing about rapid growth of the industry as a whole. This is because they normally expect that when at some point, there arose excess production and firm profitability declined sharply, "administrative guidance" would come to the rescue.

3. COURNOT DUOPOLY MODEL WITH HOMOGENEOUS PRODUCT⁴

In this section we employ a Cournot (i.e., quantity adjustment) model to analyze the interactions of two firms with different strategic behaviors in an duopolistic market. Klemperer and Meyer (1986) adapted reaction curve models to endogenize the choice

⁴ We deal with a simple model with a homogeneous product and identical cost because our intention is to analyze what happens in the market even if two firms with different strategic behaviors are on a "level playing field." Before

between price and quantity as a decision variable of the firm. They concluded that firms are indifferent as to the choice between price-setting and quantity-setting if there are “constant returns to scale.” In fact, according to Friedlandaender, Winston, and Wang (1983), the “typical” firm in the US auto industry, at the sample means and in 1979, appears to produce under constant returns to scale. More recently, Fuss and Waverman (1992) have also reported that scale elasticities of the auto industries in the US and Japan are 1.09, and 1.07, respectively. These empirical results imply that there is not much difference between the Cournot quantity competition model and the Bertland price competition model.⁵ We, therefore, assume that the competing Japanese and US firms both choose quantity-setting.

For simplicity but not losing generality, we deal with a simple Cournot duopoly model with a linear demand curve, $P = a - b\sum q_i$ for $i = 1, 2$. Assume that both Firm 1 and Firm 2 have the same marginal cost, c , which equals average cost. Suppose that each firm can potentially adopt either the profit-maximizing strategy or the revenue-maximizing strategy, and compete on quantity (market share) and profit. Depending on the combination of strategies chosen by each firm, the outcome of competition may be very different.

Case I: profit-maximizing strategy vs. profit-maximizing strategy

Suppose that both Firm 1 and Firm 2 initially adopt profit-maximizing strategy. Both firms simply maximize the following objective functions:

$$(1): \pi_1 = (P - c)q_1 = [a - b(q_1 + q_2) - c] q_1;$$

$$(2): \pi_2 = (P - c)q_2 = [a - b(q_1 + q_2) - c] q_2.$$

First order conditions of (1) and (2) yield the following firms’ reaction functions:

the G5 meeting in 1985 Japanese firms had cost advantages, but since then the dramatic appreciation of Yen against the US dollar has narrowed the cost gap. For the case of cost differences, see Appendix II.

⁵ We also know that price will approach to marginal cost or competitive price level if Bertland price competition model with a homogeneous product is used. The case of price competition is of interest only if we consider the two goods are imperfect substitutes.

$$(3): q_1 = (a - c)/(2b) - q_2/2;$$

$$(4): q_2 = (a - c)/(2b) - q_1/2.$$

Solving these two reaction functions simultaneously yields the symmetric Nash equilibrium:

$q_1^* = q_2^* = (a - c)/(3b)$, $P^* = (a + 2c)/3$, and $\pi_1^* = \pi_2^* = (a - c)^2/(9b) \equiv \pi$. So, both firms earn a positive profit and produce a positive output level, if $a > c$.

Case II: revenue-maximizing strategy vs. profit-maximizing strategy

Suppose now Firm 1 (e.g., the Japanese firm) is driven to adopt revenue-maximizing strategy by factors such as the life-time employment system with the seniority payment, and Firm 2 (e.g., the US firm) maintains the orthodox profit-maximizing strategy. What happens in the market? Since Firm 1 adopts revenue-maximizing strategy, its objective function becomes:

$$(5): R_1 = Pq_1.$$

On the other hand, Firm 2 continues to follow (2). Therefore, we obtain the following reaction functions:

$$(6): q_1 = a/(2b) - q_2/2;$$

$$(7): q_2 = (a - c)/(2b) - q_1/2.$$

Solving these two equations simultaneously, we obtain the optimal levels of quantity and price as follows:

$$(8): q_1^* = (a + c)/(3b); q_2^* = (a - 2c)/(3b); P_1^* = (a + c)/3.$$

It is worth noting that the revenue-maximizing firm's output (q_1^*) will be obviously larger than the profit-maximizing firm's output (q_2^*), since $q_1^* - q_2^* = c / b > 0$, and that the market price will decline from the level determined in Case I, since $P_1^* = (a + c)/3 < P_0^* = (a + 2c)/3$.

Let us consider each firm's profit level. Since firm i 's profit function is $\pi_i = (P - c)q_i$, each firm's profit level is obtained as:

$$(9): \pi_1^* = (a + c)(a - 2c)/(9b) \equiv T; \pi_2^* = (a - 2c)^2/(9b) \equiv S.$$

From (9), if Firm 1 is to earn a positive profit (i.e., $T > 0$), then a more stringent market condition, $a > 2c$, (in comparison with Case I where the condition is $a > c$) must be satisfied. If the same condition holds, Firm 2 will be able to make a positive profit and therefore to survive in competition (if $a > 2c$, then $q_2^* > 0$, and hence $\pi_2^* > 0$). However, one must recognize that it is the revenue-maximizer that can normally obtain a higher profit than the profit-maximizer (i.e., $T > S$) because $T - S = [(3c)(a - 2c)]/(3b) > 0$. This is a crucial result from case II. Obviously, the profit-maximizer in this case is in an unfavorable position.

Case III: revenue-maximizing strategy vs. revenue-maximizing strategy

Suppose that both firms adopt revenue-maximizing strategy. Firm 2's objective function now becomes: $R_2 = Pq_2$. Then we obtain the following reaction functions:

$$(10): q_1 = a/(2b) - q_2/2;$$

$$(11): q_2 = a/(2b) - q_1/2.$$

Solving (10) and (11) simultaneously gives optimal levels of quantity, price and profit as follows:

$$(12): q_1^* = q_2^* = a/(3b); P^* = a/3; \pi_1^* = \pi_2^* = a(a - 3c)/(9b) \equiv R.$$

Now, from (12), $a > 3c$ is the condition for a positive profit, since each firm's profit is $R = a(a - 3c)/(9b)$. Thus, the market condition of acquiring some positive profit is the most stringent when both firms adopt revenue-maximizing strategy. As a generalization, we can conclude that the existence of a revenue maximizer in a duopolistic market creates a stringent market condition for the profit maximizer to earn some positive profit, and the competition

between two revenue maximizers results in a even more stringent market condition for them to earn some positive profit.

Finally, we summarize the above three cases in Table 1:

Table 1 Payoff Table: A Revenue- vs. a Profit-maximizing Strategy

Firm 1 \ Firm 2	Profit-maximizing Strategy	Revenue-maximizing Strategy
Profit-maximizing Strategy	Case I: (π, π) $q_1^* = q_2^* = (a - c)/3b$ $P_0^* = (a + 2c)/3$	Case II': (S, T) $q_1^* = (a - 2c)/(3b) <$ $q_2^* = (a + c)/(3b)$ $P_1^* = (a + c)/3$
Revenue-maximizing Strategy	Case II: (T, S) $q_1^* = (a + c)/(3b) > q_2^* = (a - 2c)/(3b);$ $P_1^* = (a + c)/3$	Case III: (R, R) $q_1^* = q_2^* = a/3b$ $P_2^* = a/3$

Note: $\pi \equiv (a - c)^2/9b$; $T \equiv [(a + c)(a - 2c)]/9b$; $S \equiv (a - 2c)^2/9b$; $R \equiv [a(a - 3c)]/9b$.

A Nash equilibrium⁶ or a cultural-institutional equilibrium?

Case II in Table 1 may be called the cultural-institutional equilibrium since it is an outcome of the interaction of Firm 1's revenue-maximizing strategy and Firm 2's profit-maximizing strategy, since this interaction is mainly determined by cultural and institutional factors. What we have obtained from this equilibrium is that Firm 1 with revenue-maximizing can normally obtain a higher profit level than Firm 2 with profit-maximizing strategy, $T > S$. At the same time, it can also acquire a larger market share than its rival firm. Thus, we provide the following revenue-maximizer-dominance hypothesis.

⁶ John F. Nash defined: A set of strategies is called a Nash equilibrium if, holding the strategies of all other firms constant, no firm can obtain a higher profit by choosing a different strategy. Thus, in a Nash equilibrium, no firm wants to change its strategy.

Revenue-maximizer dominance hypothesis:

A firm with revenue-maximizing strategy has a “natural competitive advantage” over its rival firm with profit-maximizing strategy, where the natural competitive advantage means:

- (1) The firm with revenue-maximizing strategy will obtain a larger market share than its rival firm with profit-maximizing strategy, and the market price will be lower than in the case where both firms adopt profit-maximizing strategy.
- (2) The firm with revenue-maximizing strategy will obtain a higher profit than its rival firm with profit-maximizing strategy under any market conditions as long as $a > 2c$.
- (3) With the market condition becoming tight such that $c < a < 2c$, the Firm 2 with profit-maximizing strategy will make a loss and eventually be driven out by the firm with revenue-maximizing strategy.

It is interesting to note also that revenue-maximizing strategy is beneficial to consumers and society because the reduction of market prices leads to an increased consumers' surplus, and hence an increased net social welfare (NSW), although from the American or European perspective, the revenue-maximizing behavior may look like predatory pricing or dumping.⁷

⁷ The expansion of Japanese exports does not always negatively affect the US economy from the long-run point of view. It may increase the incentives for US firms to put more effort into raising productivity and improving quality of products. Especially, in an oligopolistic market like the automobile industry, where technological innovations and improvements in the production system are important, Japanese exports might result in raising US competitiveness. Furthermore, these improvements lead to an reduction in cost and price, which also provides benefits for US consumers. Another comment is that, strictly speaking, Westerners' claims may not be true for Japanese firms, since these firms acquire positive profits through their strategic behavior of revenue-maximization, but not through predatory pricing nor dumping where firms would sell their products at prices lower than production costs, and would have to bear negative profits in the short-run.

Is the cultural-institutional equilibrium in Case II a Nash equilibrium in which each firm is doing the best it can given what its rival is doing? To answer this question we have to assume that in finding a Nash equilibrium, each firm (1) is searching for the possibly highest profit; and (2) is able to change culture and institutions so as to form either revenue-maximizing strategy and profit-maximizing strategy. From Table 1 it is found that, starting from Case II, a necessary condition for Firm 2 to change its strategy so that Nash equilibrium is shifted from Case II to Case III is $R > S$, which requires $a > 4c$, and a necessary condition for Firm 1 to change its strategy so that Nash equilibrium is shifted from Case II to Case I is $\pi > T$, which requires $a < 3c$. Thus, the condition for Case II being a Nash equilibrium is given as $3c < a < 4c$. It is important to realize that the cultural-institutional equilibrium can be a Nash equilibrium, but is not necessarily so. Only the cultural-institutional equilibrium that satisfies $3c < a < 4c$ is a Nash equilibrium.

Unlike in Case I and III, in Case II Firm 2 (the US firm) suffers in terms of market share and profit when compared with Firm 1. Why can this still be a Nash equilibrium in the context of the US-Japan auto trade issue? or why would the US firm not adopt a “tit for tat” strategy⁸ by following the strategy of its Japanese rival? Using a tit-for-tat strategy in this case may lead to a long-standing mutual loss because $S > R$ in Table 1 unless $a > 4c$ is satisfied. This means, if the market condition, $a > 4c$, is not satisfied, Firm 2 will also suffer from penalizing Firm 1. Thus, even if we assume that the US firm is willing and able to shift its strategy, it may be too late in terms of satisfying $a > 4c$ as the right stage of market development might have been unfortunately missed a long time ago.

⁸ Tit-for-tat is a variation of the “eye for an eye” rule of behavior: do unto others as they have done unto you. More precisely, the strategy cooperates in the first period and from then on mimics of the rival’s action from the previous period (Dixit and Nalebuff, 1991: 106).

Another explanation is market uncertainty. This would make it more difficult for Firm 2 to clear the stringent condition, $a > 4c$, in order to earn some positive profit. In other words, fluctuations of demand for a product (e.g., automobiles), or variations of the shift parameter of the demand curve, a , for given the range, $a \in [c, \infty)$ in the short-run would be more likely to result in an unstable profit. As a result, Firm 2 may likely maintain the profit-maximizing strategy (i.e., Case II) which requires a less stringent condition, $a > 3c$ for profit. Thus, the profit-maximizer will eventually avoid a “head to head collusion” in a chicken game. Therefore, in our model, Case I, II and III may be Nash equilibrium, depending on market conditions. Using a/c to indicate potential market size⁹, Table 2 shows the conditions for three types of Nash equilibrium in our model:

Table 2 Nash Equilibrium Condition

Nash Equilibrium	Case I	Case II	Case III
Condition	$1 < a/c < 3$	$3 < a/c < 4$	$a/c > 4$
Market Stage	declining market	matured market	growing market

Approximately, we categorized Case I, II and III as into three stages of market development: declining market, matured market and growing market. If each firm can change culture and institutions so as to form a desirable strategy, then, corresponding to different stages of an industry in terms of potential market size, the dynamic path of Nash equilibrium is from Case III to Case II, and then to Case I.

Case II may be a cultural-institutional equilibrium, but not a Nash equilibrium. This happens when $a/c < 3$, and Firm 1 still maintains its revenue-maximizing strategy. The reason for Firm 1 to do so is that there exists a trade-off between obtaining a higher level of

⁹ Usually, potential market size is given as $(a-c)/b$. By holding b (the slope of demand curve) constant, we can also

profit and maintaining job security under the life-time employment system. Firm 1 may be able to acquire a higher level of profit by shifting its position to Case I where $\pi > T$, but this also requires Firm 1 to reduce the level of output from $(a + c)/3b$ to $(a - c)/3b$, resulting in over-investment and unemployment. Therefore, if Firm 1, constrained by this trade-off, is unwilling or unable to change its revenue-maximizing strategy when $a/c < 3$, Case II is no longer a Nash equilibrium.

4. THE CASE OF US-JAPAN BILATERAL AUTO-TRADE: EVIDENCE AND POLICY IMPLICATIONS

Many factors other than strategic behavior can be identified for the rapid expansion of the Japanese share in the world automobile market over the last three decades (See **Figure 1** and **2**). However, strategic behavior of different firms with different business cultures is more important in terms of analyzing the long-term pattern of the US-Japan bilateral auto-trade. In this section, our main intention is to present some evidence of the outcomes of the US-Japan competition in the auto industry and to discuss the policy implications of our analysis for the auto-trade issue.

We concluded from Section 2 that Japanese firms tend to be revenue-maximizers due to their unique corporate culture and institutional arrangements. This implies that US firms are more profit orientated. This assumption is strongly evidenced by the outcomes of the US-Japan competition in the auto industry for the last three decades. Our model predicts that when competing with its rivals, Japanese automakers with revenue maximizing strategy should attain a “natural competitive advantage” over its rival firms with profit-maximizing strategy. More specifically, we expect that compared with US automakers, Japanese

use the ratio a/c to approximate the potential size. A larger ratio of a/c means a larger potential market size.

automakers should obtain (1) a larger market share, and (2) a higher profit. And as a result of this competition (Case II), the market price of vehicles will fall.

Table 3 shows changes in shares in the world motor vehicle production by US and Japan. Over the last three decades, US and Japan have almost changed their positions. While Japan is advancing, the US is retreating. These results are more extraordinary when one takes into account the following two events: the introduction of the voluntary export restraint (VER) in 1981, causing the hike of prices of Japanese made cars, and the appreciation of the Yen against the US dollar after the meeting of G5 in 1985, leading to a reduction of Japan's cost advantage in production. These events were supposed to reduce the competitiveness of Japanese automakers. However, it seems that they did not change the basic trend "predetermined" by different strategies.

Table 4 shows profit rates for the Big Three of US and the Top Four of Japan (Toyota, Nissan, Honda and Mazda) from 1970 to 1994.¹⁰ Note that the measured profit rate is the profit-sales ratio, where profit and sales are the summation of net income and net revenue of Big Three and Top Four, respectively. With revenue-maximizing strategy, Japanese automakers could afford to compete at a lower profit rate due to various institutional factors discussed in section 2. Thus, they were able to acquire a higher long-run profit rate against their rivals. Although the average profit-sales ratios in both countries show a downwards trend during the sample period, the ratio for Japanese automakers has been consistently higher than that for the US. This indicates that Case II is a cultural-institutional equilibrium where $a > 2c$ which always leads to $T > S$.

The different strategic behaviors are reflected in the attitude towards the long-run objectives (e.g., long-run growth of the firm) and the short-run objective (e.g., short-run

profit) of the firm. This can be seen in **Figure 4**, and **Table 5** where the average growth of revenue is higher and its coefficient of variation smaller for Japan, indicating that both long-run growth and revenue stability (therefore market-share) have been more important for Japanese automakers. On the other hand, the path of revenue growth for the US has been very fluctuating, implying that revenue is not a target. Of course, other reasons could also be considered. The nature of domestic competition is different. Unlike the US market which is oligopolistic, there exist in Japan eleven automakers, running cut-throat competition among themselves. Consequently, managers of Japanese companies will sacrifice some of their firms' short-run profits for the sake of long-run growth, and they must consider their survival in the first place. The strategic importance of gaining market-share is that cost reduction may be attained by increasing cumulative output if learning is a function of cumulative output. Thus, it is quite natural that such an excess competition drives Japanese automakers to expand their market share even at a lower profit-cost margin in both domestic and foreign markets.¹¹

The success of the revenue-maximizing strategy can be seen from the relationship between the short-run and the long-run profit rates for the US and Japan. When the US firm targets more at profits,¹² it may realize its short-run target. Indeed, the highest profit rate was scored by the US automakers. However, the cost of targeting at the short run profit rate is the larger fluctuations of the long run profit rate, as shown by the large value of the standard deviations of the US profit rate in **Table 4**. The largest negative profit rate was also reported by US automakers. This is basically due to the larger fluctuations in the path of revenue

¹⁰ We excluded Mitsubishi from the data set, since until 1989, Mitsubishi Motors was part of Mitsubishi Heavy Industries, and we could not identify the financial data of the auto division for the period before 1989.

¹¹ This kind of firm's behavior looks like predatory pricing, or dumping to their Western rivals, although to the Japanese, it is simply a normal business practice under severe competition.

growth (see **Table 5**). On the other hand, when Japanese automakers put more emphasis on revenue and have achieved the higher stable growth under the strategy, they also realized a higher long-run profit rate. More significantly, the profit rate differential is changing in favor of Japanese automakers, a fact consistent with the result derived from our model.

The huge trade deficit of US against Japan can be fundamentally explained by the expanding quantity gap between Japan and US. US automakers have been in an unfavorable position in competition with their Japanese counterparts who are revenue-maximizers. Then, why could US automakers not have adopted the revenue-maximizing strategy? Apart from factors such as corporate culture and institutional arrangements, two factors are important. Firstly, currently, $a > 4c$ may be too stringent for them to shift strategy. In fact, they could have chosen to do so in 1960's or early 1970's when the potential market size was close to $a/c > 4$. Secondly, fluctuations and uncertainty of demand in the auto market are another crucial reason. In terms of stability of market demand, **Figure 3** and **Table 6** clearly show that Japan's auto market is more stable, and the coefficient of variation smaller, than that for US. Large variations of growth in newly registered vehicles indicate that the demand shift parameter, a , is larger for US. This seems to have resulted in a more unstable profit path for US automakers, making it more difficult for them to adopt the revenue-maximizing strategy, and hence, expand their domestic plant capacity with an efficient investment plan. On the other hand, Japan's stable growth of market demand is in favor of making a precise investment plan so as to expand its market share in the long-run. Therefore, as we discussed in Section 3, Case II in Table 1 seems to have been a Nash equilibrium in the context of US-Japan bilateral trade for a long time.

¹² GM, for instance, used to follow the target-return pricing strategy, fixing the mark-up rate at 15 to 20 % till the

What will happen if US automakers adopt revenue-maximizing strategy as a variation of “tit-for-tat” strategy when $3 < a/c < 4$? This results in Case III, with an equal market share, $q_1^* = q_2^* = a/3b$, and hence an improvement of trade deficits. Will US automakers change their behavior and become revenue-maximizers? It is difficult for them to do so unless they can convince the stockholders to sacrifice short-run profit, and to seek for long-run growth, and capital gains. At the same time, using a tit-for-tat strategy may lead to mutual loss, given $a/c < 4$, $R < T$, $R < S$. In this sense, US automakers would be punishing themselves by penalizing Japanese automakers.

A more important issue is when potential market size has declined and $a/c < 3$, and Japanese automakers still decide to stay in Case II. This cultural-institutional equilibrium without being a Nash equilibrium will further cause the position of US automakers to deteriorate. In fact, when $a/c < 2$, US firms will be driven out of the market. This implies (1) the trade dispute will be further accelerated, which may damage the foundation of the long-term relationship between the two countries, and (2) the duopoly game will end with Japanese automakers as a monopolist. Therefore, potential market size (a/c) and the willingness of the Japanese and Americans to change their strategies are critical for resolving the trade dispute between the two countries.

In the case of $a < 3c$, going to Case I is a move to Nash equilibrium for Japan and also an effective way of balancing trade [i.e., the market share will be equally divided as $q_1^* = q_2^* = (a - 3c)/3b$], therefore, it should be encouraged and supported by both sides. However, this solution may not be attainable in a short period because of over-investment and over-employment it may result in. This explains why the past trade negotiations between the US and Japan produced meager results. Indeed, it is not easy to break up the cultural-

end of the 1970s (Kawahara, 1995: 103).

institutional equilibrium that has existed for a long time. Persuasion and patience are needed during this process. If one believes that there must be a point in the long run where the industry will turn into the market declining stage, then it is reasonable to believe that Case I may be a long-run solution in terms of both Nash equilibrium and cultural-institutional equilibrium. This means, given time, Japanese automakers may gradually change their behavior when $T < \pi$ under $a/c < 3$ and become more profit-orientated.

Facing the trade deficit and Case II, what the US automakers and US government have done is not very encouraging. For instance, in order to prevent Japan's market share from further expanding, the US government forced Japanese automakers to implement the voluntary export restraint (VER). However, the profit-orientated US automakers in the first half of the 1980s merely used Japanese automakers as a price leader in the Stackelberg sense, and raised their price of automobiles to a level higher than what would have prevailed under tariffs or other related measures (See **Table 7**). Instead of fully utilizing this opportunity to gain more market share, they seem to have been persistently adopting the traditional profit-maximizing strategy. For the sake of stockholders, the Big Three stabilized prices at a higher level than that of Japanese firms. At the same time, instead of being used for reinvestment and increasing plant capacity or setting up new plants abroad to explore foreign markets, a large bonuses were paid to the CEOs.¹³ Similarly, US automakers did not take advantage of the appreciation of the Yen against the US dollar after the G5 meeting in 1985. These allowed Japanese automakers to maintain a competitive advantage over their US rivals, even in a situation that has unfavorable to them.

¹³ Note that in Japan the salary for a top management official is rarely more than as seven or eight times as that of an entry-level junior executive trainee. This means that Japan has no multimillion-dollar brass, and companies give no huge big bonuses, no stock options, no deferred income and no golden parachutes. This also psychologically reduces the gap between employers and employees, and hence, creates mutual respect and a sense that the

In fact, even if US automakers did not adopt revenue-maximizing strategy like their Japanese counterparts, they could have narrowed the trade gap if the following two measures had been taken. Firstly, US automakers could have paid more attention to cost reduction (see Appendix II for competition outcomes if there exists a cost difference). To avoid large fluctuations of a which had put US automakers in a more unfavorable position, they could have also worked on exporting more and producing more abroad. This would have hedged the risk of domestic demand fluctuations. Secondly, the Big Three should not only have reduced prices but also made an effort to improve productivity and quality. Currently, despite the pressure of the further appreciation of the Yen in 1990s, Toyota, Nissan, Honda, and Mitsubishi are yet expected to further expand transplants in US or in other Asian countries, such as Thailand, Malaysia, and Indonesia. For the purpose of maintaining and gaining more market share via lower labor costs, they are ready to sacrifice short-term profits. If the US firms do not concern themselves with gaining market share, then the trade gap can be expected to widen.

There exists another possible solution. If $a/c > 4$, which is highly possible due to the booming of the East Asian economies, then US firms can go for Case III by acting like a revenue-maximizer, and this will help improve and eventually eliminate the trade deficit of US.

5. SUMMARY AND CONCLUSION

In this paper, we first argued that the Japanese firm behaves like a revenue maximizer while the US firm is more profit-orientated. Based on this preliminary judgment, we developed a simple framework of duopolistic competition using a Cournot model. Two important results are immediately derived: (1) according to our revenue-maximizer-

company is the property of employees and not of a few top people. Indeed, this will enhance workers' moral and

dominance hypothesis, a revenue-maximizer seems to have a “natural competitive advantage”; that is, gaining a larger market share and a higher profit than its rival profit-maximizing firm, and hence keeping on winning in duopolistic competition; (2) based on the game analysis of duopolistic competition, the dynamic path of Nash equilibrium is from Case III to Case II and then to Case I, depending on potential market size which indicates the stage of market development. Case II, a case for the cultural-institutional equilibrium conditioned by culture and institutions, is also a Nash equilibrium when $3 < a/c < 4$. We showed that Case II, whether it is a Nash or a cultural-institutional equilibrium, tends to bring about an output gap in favor of the firm that adopts the revenue-maximizing strategy, hence a trade deficit against the country where the firm that has the profit-maximizing strategy. We further showed that in the case of no Nash equilibrium, especially when $a/c < 3$, the cultural-institutional equilibrium of Case II leads to a bitter trade dispute, and in the worst case, a complete take-over of the market by Firm 1.

Our analytical framework is supported by the stylized facts identified from the US-Japan auto trade, and we believe this provides a new explanation for the trade dispute between the two countries. We explored the implications of the model for the trade issue. It is argued that due to the inertia of business culture and institutional arrangements, the trade dispute between US and Japan cannot be solved in a short period. When the market condition becomes tighter, the dispute may be accelerated. To narrow the trade gap, US automakers should be encouraged to adopt a revenue-maximizing strategy, but there is a trade-off between profitability and trade balance when $a/c < 4$. The current boom in East Asia has greatly increased the potential market size, and this provides an opportunity for US

motivation to work harder (Morita, 1987).

to improve both profitability of the auto industry and the trade imbalance. In order not to miss the chance again, US automakers should try to become revenue-maximizers.

The model we developed is not suitable for those industries with many small firms controlled by owner-managers. Rather, it is applicable only to large firms in which managers enjoy considerable autonomy, or firms in technologically progressive industries, such as the automobile and electronics (or semiconductors in particular). A generalization can be made to cover other case studies. If revenue-maximizing strategy, as has been adopted by larger Japanese firms, is a sophisticated way to expand market share, to maintain the stability of revenue growth, and to maximize long-run profits, other Asian companies, such as those in South Korea, Taiwan, Thailand, Malaysia and Singapore are expected to follow the same strategy and hence catch up. Our conclusions are closely related to *a/c*, potential market size. A separate study should, therefore, be carried out to provide empirical evidence on the relationship between potential market size and performances of Firm 1 and Firm 2 in context of duoplistic competition.

Table 3 Shares in World Motor Vehicle Production (1963 - 1994)

Period/ country	Overall Periods 1963 - 1994	1963 - 1972	1973 - 1982	1983 - 1994
Japan	.2116 (.0678)	.1299 (.0456)	.2307 (.0431)	.2638 (.0194)
US	.2880 (.0769)	.3770 (.0609)	.2694 (.0463)	.2292 (.0239)

Sources: *Jidosha Tokei Nenpo*; *Shuyokoku Jidosha Tokei*;
Ward's Automotive Yearbook (various issues)

Note: Numbers shown in () are standard deviation.

Table 4 Profit-Sales Ratio: US Big 3 vs. Japan Top 4 (1970 - 1994)

Period/ Country	Overall Periods 1970 - 1994	1970 - 1982	1983 - 1994
Japan	.0296 (.0119)	.0336 (.0079)	.0252 (.0142)
US	.0224 (.0387)	.0256 (.0277)	.0189 (.0491)

Source: "Global 500 (200)," *Fortune* (various issues).

Note: Numbers shown in () are standard deviation.

Table 5 Growth Rate of Revenues: Japan Top 4 vs. US Big 3 (1970 - 1994)

Period/ Country	Overall Periods 1970 - 1994	1970 - 1982	1983 - 1994
Japan	.1589 (.0841)	.1781 (.0905)	.1381 (.0749)
US	.0891 (.1198)	.0759 (.1430)	.1034 (.0926)

Source: "Global 500 (200)," *Fortune* (various issues).

**Table 6 Growth Rate of Newly Registered Vehicles:
Japan Top Four vs. US Big Three (1970 - 1994)**

Period/ Country	Overall Periods 1970 - 1994	1970 - 1982	1983 - 1994
Japan	.0246 (.0787)	.0292 (.0962)	.0197 (.0581)
US	.0182 (.1138)	-.0003 (.1314)	.0380 (.0926)

Source: *Shuyokoku Jidosha Tokei* (various issues).

Note: Numbers shown in () are standard deviation.

Table 7 Passenger Car Prices (\$) in the US Before and After the VER

Model\Year		1980	1981	1982	1983	% increase in Prices 1980-1983
Nissan	Sunny	4,619	5,219	5,319	5,999	29.9
	Maxima	8,129	9,979	10,549	10,869	40.2
Toyota	Corolla	4,698	5,458	6,138	6,138	30.7
	Crusader	6,429	6,979	8,159	8,599	47.5
GM	Century	5,446	7,094	7,141	9,002	65.3
	Citation	5,153	6,282	6,399	6,934	34.6

Source: *Asahi Newspaper (Asahi Shinbun)*, October 19, 1983

APPENDIX I: Is the Japanese Firm a Revenue-Maximizer?

Proposition I: If a top executive has concerned about maximization of both his/her employees' utility and profits, then the firm will act like a revenue-maximizer, producing more output than a pure profit-maximizer.

Proof:

Following Blinder's model (1993), let $P(Q)$ be the firm's downward-sloping curve. For simplicity, assume that its production function is $Q = f(L)$, where L is labor input. As Aoki (1988: 165) suggested, if the Japanese manager plays a role of mediating between employees and shareholders by maximizing weighted average of profits and employees' utility function $L*U(w)$, assuming that the employees' utility function relies on their wage, w , then the Japanese firm's objective function is to solve the following problem:

$$(A1): \text{Max}_{L, w} [(1 - \beta)\{R(L) - wL\} + \beta U(wL)],$$

where β is the degree of concerning employees' utility, and $0 < \beta < 1$. Note that, unlike the US firm, the Japanese firm determines the employment level, L , and the wage level, w , in the internal labor market rather than in the external labor market.¹⁴ The first order conditions in solving (A1) are:

$$(A2): (1 - \beta)[R'(L) - w] + w\beta U'(wL) = 0;$$

$$(A3): -(1 - \beta)L + \beta L U'(wL) = 0 \Rightarrow (A3'): \beta U'(wL) = 1 - \beta.$$

Substituting (A3') into (A2) yields the following crucial results:

$$(A4): (1 - \beta)R'(L) = 0 \text{ or } R'(L) = 0.$$

This means that the firm will produce up to the revenue-maximizing level of output instead of the profit-maximizing level of output. That is, the firm with concerns for employees' welfare will tend to act like a revenue-maximizer.¹⁵ (Q.E.D.)

¹⁴ The Japanese firm negotiates its employees' wage level within its company labor union under the life-time employment system. Therefore, w is a choice variable for the Japanese firm, in addition to determining the employment level, L .

¹⁵ As Blinder (1993) pointed out, if we change this utility function from $U(wL)$ to $L*U(w)$, we will obtain: $R'(L) = w - [\beta/(1 - \beta)][U(w)/U'(w)] < \text{MFC} = w$. This means that the firm still produces more than the profit-maximizing output level, and employs more than the profit-maximizing level of labor.

APPENDIX II: Cost Differences in Producing A Product

In our simple Cournot model, it was assumed that both Firm 1 and Firm 2 have an identical average cost with constant returns to scale. Now consider the case where Firm i 's cost function is $C(q_i) = c_i q_i$ for $i = 1, 2$. Without losing generality, let $c_1 < c_2$. Each firm initially maximizes its objective function respectively:

$$(A5): \pi_1 = (P - c_1)q_1 = [a - b(q_1 + q_2) - c_1]q_1;$$

$$(A6): \pi_2 = (P - c_2)q_2 = [a - b(q_1 + q_2) - c_2]q_2.$$

What happens in the market if Firm 1 (the revenue-maximizer) has a cost advantage over its rival firm, Firm 2 (the profit-maximizer)? Similar to our discussion on the identical cost case, we summarize results as a pay-off table shown in Table 8.

Table 8 Pay-off Table: A Revenue- vs. a Profit-maximizing Strategy with Different Production Costs

Firm 1 \ Firm 2	Profit-maximizing Strategy	Revenue-maximizing Strategy
Profit-maximizing Strategy	Case I: (π_1, π_2) $q_{1P}^* = (a - 2c_1 + c_2)/3b > q_{2P}^*$ $(a - 2c_2 + c_1)/3b$ $P^* = (a + c_1 + c_2)/3$	Case II': (S_1, T_2) $q_{1P}^* = (a - 2c_1)/3b <$ $q_{2R}^* = (a + c_1)/3b$ $P^* = (a + c_1)/3$
Revenue-maximizing Strategy	Case II: (T_1, S_2) $q_{1R}^* = (a + c_2)/3b >$ $q_{2P}^* = (a - 2c_2)/3b$ $P^* = (a + c_2)/3$	Case III: (R_1, R_2) $q_{1R}^* = q_{2R}^* = a/3b$ $P^* = a/3$

Note: If Firm 1's cost is lower than Firm 2's cost; that is, $c_1 < c_2$, then

$$\begin{aligned} \pi_1 &\equiv (a - 2c_1 + c_2)^2/9b > \pi_2 \equiv (a - 2c_2 + c_1)^2/9b; \\ T_1 &\equiv [(a + c_2)(a + c_2 - 3c_1)]/9b > S_2 \equiv (a - 2c_2)^2/9b; \\ S_1 &\equiv (a - 2c_1)^2/9b < T_2 \equiv [(a + c_1)(a + c_1 - 3c_2)]/9b \\ R_1 &\equiv [a(a - 3c_1)]/9b > R_2 \equiv [a(a - 3c_2)]/9b \end{aligned}$$

This payoff table suggests that Firm 1 is much more dominant over Firm 2 if there is a cost difference. As can be seen in case II, when Firm 1 meets Firm 2 as a cultural-institutional equilibrium, $T_1 \equiv [(a + c_2)(a + c_2 - 3c_1)]/9b > S_2 \equiv (a - 2c_2)^2/9b$. The profit gap in favor of Firm 1 is larger in this case than in the case of an identical average cost.

On the other hand, if Firm 2 adopts a revenue-maximizing strategy, while Firm 1 follows a profit-maximizing strategy (Case II'), then Firm 2 is unable to obtain the same position as Firm 1 in Case II, since $\Delta(T_1 - S_2) > \Delta(T_2 - S_1)$, and $\Delta(q_{1R}^* - q_{2P}^*) > \Delta(q_{2R}^* - q_{1P}^*)$ if $c_1 < c_2$. This is due to the cost difference in favor of Firm 1.

It is worth noting that, if $a/c_2 < 2$, then Firm 1 will be able to drive Firm 2 out of business, since $q_2^* = (a - 2c_2)/3b < 0$ but $q_1^* = (a + c_2)/3b > 0$. Therefore, when a US firm faces a Japanese firm, cost reduction, or *kaizen*, on the side of the US firm, becomes very crucial for survival and profitability.¹⁶

¹⁶ Other exogenous factors, such as rapid appreciation of the Japanese Yen against the US dollar, can damage the cost advantage of the Japanese firm if it produces in Japan.

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