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THE LIFE CYCLE OF A DUOPOLY:
A CASE STUDY FROM THE NORTH AMERICAN
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by

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Abstract

For seventeen years in the early 19th century, the British North American fur trade was a duopoly, in a period of no antitrust law. Due to extensive written records, this duopoly forms an excellent case study against which to examine recent theoretical work on oligopolistic behavior. The study confirms that while firms may wish to maximize joint profits, significant short-run obstacles to that objective can exist. The study highlights in particular the roles of (A) industry age and differences in internal firm structure, (B) information and communication, (C) the state of the environment and (D) barriers to entry.
1. **Introduction**

How firms behave in small-number situations is a central problem of the oligopoly literature. Early formal treatments such as those of Cournot and Stackelberg often stressed certain non-cooperative aspects of behavior. More modern treatments range from the implicit collusion theories of William Fellner (1949) and George Stigler (1964) to the dynamic models of James Friedman (1971a, 1971b). Although this later literature stresses that firms will want to try and coordinate their actions, it also examines factors that could hinder firms from arriving at such an equilibrium.

In spite of the very great amount of theoretical work that has been conducted, there is very little empirical evidence about how firms actually behave in a small-number environment. And much of the empirical evidence that we do have comes from antitrust cases, which imparts a special bias. This paper by contrast, shows how two fur-trading duopolists actually interacted during the period from 1804 to 1821 when there was no antitrust law. The purpose of this case study is to compare the actual interaction of these two firms with various kinds of behavior predicted by the theoretical literature.

The North American fur-trading industry existed for almost two centuries and was served by companies whose Canadian headquarters were located either around Hudson Bay or in Montreal. In spite of this difference in location, the companies operated in the same geographic market area. In 1804 all the Montreal traders merged to conduct this branch of the trade as the North West Company (NWC). The trade from Hudson Bay was carried out by a company commonly known as the Hudson's Bay Company (HBC). Thus for 17 years following 1804, this industry was a duopoly. Then in 1821 the two
companies merged to conduct the trade as a monopoly concern.

These years from 1804 to 1821 are of major economic importance in that they allow us to examine the course of a duopoly interaction from its inception, through a breakdown into highly aggressive, and even predatory, competition, until it died with the merger of the two companies. This is a period of real duopoly. Not only were the HBC and the NWC the sole buyers of furs on the British North American (Canadian) market; they were also the most important sellers of furs on the British market. Two other features of this duopoly are also of importance. The first is that at no time during these years were the actions of either company hindered by the threat or specter of antitrust law. The second aspect of the duopoly studied here is that its operations are documented in detail. There exist previously undisturbed bodies of correspondence between the HBC committee in London and its operations on Hudson Bay, and between the London committee and the NWC. The former group of letters were the main method of communication between England and Hudson Bay. They thus contain the committee's views on how the trade was to be conducted and on the relationship of its men with the rival company. The latter group of letters consists of the direct communications between the two companies and documents not only the various attempts made to reach a more coordinated strategy but also the reasons why the negotiations prior to 1821 failed. Although insufficient quantitative evidence exists for formal econometric work, this correspondence offers us a rare opportunity to document in a fairly precise qualitative fashion the formation and interplay of duopoly strategies.

As stated earlier, the purpose of this paper is to analyze the interfirm behavior of HBC and NWC in light of certain aspects of the current theoretical literature. The first behavioral assertion examined is that duopolists will want to maximize joint profits. This case study shows
that these two companies did indeed want to maximize joint profits. Four sets of negotiations between the two firms tried to achieve just such a solution, over this seventeen year period. However, until 1821, these attempts failed.

The failure of these negotiations points out that, even for a duopoly industry unhindered by the threat of antitrust legislation, achieving a collusive agreement is not a simple matter. With regard to the problems faced by HBC and NWC, the paper examines four factors that for years frustrated a joint-profit maximum. These were (A) industry age and differences in firm structure, (B) the role of communication and information, (C) the state of the environment, and (D) barriers to entry.

Fellner (1949), Williamson (1965), and Spence (1978) emphasize the role of communication or signalling (Spence) in forging and maintaining a collusive agreement. In the HBC/NWC duopoly, the companies communicated freely and often, yet it took 17 years to reach an agreement. Their interaction shows that not only is the ability to communicate important, but that the information transmitted and the receiver's interpretation of that information are of equal importance. In this regard, the case study lends support to the theoretical models of all three authors regarding the relationship between perception and actual communication.

More specifically, three factors seemed to limit the effective exchange of information or signals between the firms despite the frequent communication. First, the fact that the duopoly was new appeared to be important, a consideration discussed by Scherer and Williamson. HBC correspondence indicates that due to its lack of experience with the NWC, the HBC was distrustful and uncertain of the NWC's willingness or ability to enter into a collusive agreement on market sharing. Second, the firms
were very different in internal structure, a factor noted by Scherer. The HBC was a highly centralized firm while the NWC was a highly decentralized, profit-sharing partnership. The implication as discussed below was that the HBC doubted the NWC's ability to prevent entry should the two companies reach an agreement. Third, the two firms had an imperfect ability to distinguish changes in the rival's actions from changes in the environment due to the geographic expansion of the trade, communication lags or disease among the animal population. This is a problem highlighted by Spence, and earlier by Stigler, and implies that a firm cannot directly infer its rival's actions from the information (signals) it receives.

That changes in the environment can directly influence a company's behavior is one of the principal points made by Williamson (1965). Williamson references a large amount of work which supports the notion that a company's willingness to engage in cooperative behavior is inversely related to the state of the environment. The evidence suggests that a deterioration in the environment causes one or more firms to pursue own short-run goals at the expense of collective considerations. The remaining firms tend eventually to react in a reciprocal fashion and industry conduct deteriorates.

This response to environmental deterioration appears in a striking way in this case study. After several years of peaceful coexistence, the Napoleonic Wars led to a sharp decline in demand for HBC furs. That company responded with new policies which were clearly noncooperative. Subsequently, both companies began to suffer from depleted animal stocks. This latter effect coupled with the HBC's new behavior pushed the NWC to reciprocate and industry conduct deteriorated into what can probably be labelled predatory competition.

The period of predatory competition came to an end with the merger of 1821, an event which is also consistent with the theories of the
above-mentioned authors. One significant event was that in 1820 the British
government became involved. This brought with it the threat of government
intervention (Fellner) which in this instance initially involved a government offer to
"confirm" any agreement between the companies. This amounted to a government-
enforced barrier to entry which improved the environment and greatly increased
the returns to cooperation (Williamson).
2. A Model of Interfirm Behavior

Drawing from the models of Williamson and Spence, we can specify a dynamic theory of interfirm behavior in terms of three key variables. These are (A) a profit variable for firm i, denoted $\pi_i$, (B) an "adherence" variable, denoted $a_i$, which measures firm i's degree of cooperative behavior or adherence to industry goals (Williamson) and (C) a communications variable, denoted $s_i$, which gives the signals received by firm i. Exogenous variables include firm i's economic environment ($e_i$), the age of the industry (t), and industry barriers to entry (B). Firm i's profits are specified as follows for our two firm industry.

\[
(1) \quad \pi_i = \pi_i(a_1, a_2, e_i, B); \quad \frac{\partial \pi_i}{\partial a_i} = \pi_{ii} < 0, \quad \frac{\partial \pi_i}{\partial a_j} = \pi_{ij} > 0, \\
\frac{\partial \pi_i}{\partial e_i} = \pi_{ie} > 0, \quad \frac{\partial \pi_i}{\partial B} = \pi_{ib} > 0.
\]

Firm i's profits are ceteris paribus increased by its partner firm's adherence to cooperative behavior and decreased by its own adherence. Firm i's profits improve with the environment and with industry barriers to entry. This last effect attempts to capture the idea that the profitability of cooperative behavior depends on the industry's ability to prevent entry by new firms.

The level of adherence is determined as follows:

\[
(2) \quad a_i = A_i(s_i, \pi_i); \quad \frac{\partial a_i}{\partial s_i} = A_is > 0, \quad \frac{\partial a_i}{\partial \pi_i} = A_{i\pi} \geq 0.
\]

Higher values of $s_i$ are signals to firm i that firm j is behaving in a more cooperative fashion. The behavioral assumption is that firm i reciprocates the type of behavior it perceives that firm j is following and thus an increase
in \( s_i \) produces an increase in \( a_i \). The non-negative effect of \( \pi_i \) on \( a_i \) is an effect discussed at length by Williamson and mentioned briefly in the introduction above. A fall in firm i's profits tends to lead it to pursue own short-run goals and thus lead it to reduce its level of adherence. A strictly positive sign for \( A_{in} \) is not necessary for the results.

The communications or signalling variable is specified as follows:

\[
(3) \quad s_i = S_i(a_j,e_i,t); \quad \frac{\partial s_i}{\partial a_j} = S_{ia}, \quad \frac{\partial s_i}{\partial e_i} = S_{ie}, \quad \frac{\partial s_i}{\partial t} = S_{it} \quad \text{all} > 0.\]

The key to this relationship as discussed by Spence is that firm i has an imperfect ability to distinguish between changes in its environment and changes in firm j's behavior. Firm i is, for example, uncertain as to whether a fall in market price is due to a decrease in demand or an increase in supply by firm j. Thus both \( a_j \) and \( e_i \) appear in the signalling function. Time also appears in the signalling function as a proxy for a learning process (Williamson). The idea is that in a new duopoly (the fur trade in 1804) information is difficult to assess and it is only with experience that a firm learns to properly interpret and efficiently use information.

Substitution of (1) and (3) into (2) gives us an adherence reaction function \( A^* \) for firm i.

\[
(4) \quad a_i = A_i(S_i(a_j,e_i,t),\pi_i(a_1,a_2,e_i,B)) = A^*_i(a_j,e_i,t,B)
\]

For firm i, the partial derivatives are as follows.

\[
(5) \quad \left. \frac{\partial a_i}{\partial a_j} \right|_i = A^*_{ia} = \left( \frac{A_{is}S_{ia} + A_{in}\pi_{ij}}{1 - A_{in}\pi_{ii}} \right) > 0.
\]
(6) \[ \frac{\partial a_i}{\partial e_i} = A^*_{ie} = \frac{(A_{is}S_{ie} + A_{in}\pi_{ie})}{(1 - A_{in}\pi_{ii})} > 0. \]

(7) \[ \frac{\partial a_i}{\partial t} = A^*_{it} = \frac{A_{is}S_{it}}{(1 - A_{in}\pi_{ii})} > 0. \]

(8) \[ \frac{\partial a_i}{\partial B} = \frac{A_{in}\pi_{ib}}{(1 - A_{in}\pi_{ii})} > 0. \]

All partial derivatives of $A^*_i$ are therefore positive. Note especially that either the Williamson assumption (direct dependence of $A_i$ on $\pi_i$ and $e_i$) or the Spence-type signalling function (indirect dependence on $e_i$ via $s_i$) is sufficient for the sign of (5).

These results unfortunately still leave a wide range of possibilities open. We will therefore impose several additional assumptions in order to ensure stability, which requires that (5) lie between zero and one. Subsequent sections suggest that stability is probably an appropriate assumption or alternatively that instability is counterfactual.

Instability (5 greater than one) can arise due to the fact that an increase in $a_j$ has two positive influences on $a_i$: one via the signalling variable ($A_{is}S_{ia}$) and one via the profit variable ($A_{in}\pi_i$) as is shown in (5). Sufficient conditions for stability in (5) are that $A_{is}S_{ia} < 1$ (the response to signals in dampened) and $A_{in}\pi_{ij} < A_{in}\pi_{ii}$. The first assumption seems reasonable but the second is not globally valid. For $a_i$, $a_j$ less than their equilibrium values, we must have $\pi_{ij} > -\pi_{ii} > 0$ if a cooperative adjustment such as $da_1 = da_2 = da > 0$ is to increase each firm's profits ($d\pi_i/da = (\pi_{ii} + \pi_{ij}) > 0$ iff $\pi_{ij} > -\pi_{ii}$). This relationship biases (5) toward being greater than one. With $A_i$ a function of $\pi_i$ as suggested by Williamson, the positive feedback of profits on own behavior may lead to an unstable system in which either $a_i = a_j = 0$ or $a_i$ and $a_j$ take on their joint-profit-maximizing values. It is on the other hand reasonable to
assume that \( \frac{\partial a_i}{\partial a_j} \pi_{ii} = A_{is} S_{ia} < 1 \); that is, at constant profits \( i \)'s cooperative response (\( da_i \)) to an increase in \( a_j \) is less than \( da_j \). This is appealing from a behavioral point of view since \( i \) cannot directly observe \( j \)'s behavior as discussed above. This restriction tends to bias (5) toward being less than one (stability).

Since the first six years of the duopoly period support the stable version of the model (and subsequent years are consistent with it), we will therefore impose a stability assumption. This amounts to assuming that \( \pi_{ij} \) is sufficiently close to \( -\pi_{ii} \) and/or the signalling response \( A_{is} S_{ia} \) is sufficiently less than one such that (5) lies between zero and one. Inverting the equation for \( i = 2 \) in (5), we will then have

\[
0 < \left( \frac{\partial a_1}{\partial a_2} \right)_1 < 1; \quad \left( \frac{\partial a_1}{\partial a_2} \right)_2 > 1
\]

Finally, it is assumed that \( a_i = A_i^*(0, e_i, t, B) > 0 \); that is, even if \( j \) adopts the "worst" possible form of behavior (\( a_j = 0 \)), firm \( i \) will not completely reciprocate. This could be true for two reasons. First, \( i \) does not know the true value of \( a_j \) as discussed above and thus does not know with certainty that such extreme behavior has been adopted. Second, insofar as the "worst" form of behavior for a firm is extremely predatory and implies negative profits, firm \( i \) may not wish to match \( j \) in this type of behavior.

The implications of this last assumption together with (9) are that there exist two reaction functions in \( (a_1, a_2) \) space as shown in Figure 1 with a unique intersection (equilibrium) at \( E \). The learning that occurs with the passage of time shifts each reaction curve out (equation (7)), moves the equilibrium from \( E_0 \) to \( E_1 \) in Figure 2, and thereby increases equilibrium profits. Long-run convergence to a joint-profit-maximizing equilibrium as per the arguments of Fellner and Friedman thus seems assured in this model. Improvements in the environment or in industry barriers to entry cause similar outward
Figure 1

Figure 2
shifts in the reaction functions. Changes in the environment thus have two reinforcing effects on firm profits: (A) the direct effect on profits plus (B) the effect on interfirm cooperation.

Finally, we should specify a dynamic adjustment process when out of equilibrium to take into account adjustment costs, communications time lags, etc. These lags are of considerable importance to the present case study as discussed below. Let this adjustment process be given by the differential equations

\[
\frac{da_i}{dt} = \phi_i(A_i^* - a_i), \quad \phi > 0 \text{ iff } (A_i^* - a_i) > 0.
\]

These equations are represented by the direction field shown in Figure 1. Given the assumptions on $A_1^*$ and $A_2^*$, the system is dynamically stable.

Note for future reference that in the regions to the Northwest and Southeast of $E$, we will observe one firm increasing its adherence or cooperative behavior while the other firm is simultaneously decreasing its adherence.

3. Structure and Development of the HBC and the NWC to 1804

Although HBC and NWC were involved in the business of procuring, transporting and selling furs, the historical development and internal structure of each company was very different. The commercial fur trade which operated from the shores of Hudson Bay was established by Royal Charter in 1670. This charter gave to "the Company of Adventurers operating out of Hudson Bay" rights to all the land within the Bay's drainage basin, an area that extends as far west as the Rocky Mountains. However, the charter did not create automatically a barrier to entry for the HBC. The English parliament had ratified the Charter for a period of seven years
and had never re-ratified it. Thus the legality of the HBC's charter was a question of monarchical prerogative versus parliamentary power. Neither company wanted to test the issue in court.

The company instituted in 1670 was a limited-liability, joint-stock company and over the one hundred and thirty years to 1804, its internal structure remained essentially unchanged. The company organization had three levels. At the top of the pyramid was the HBC committee headed by a Governor and Deputy-Governor. This committee, which resided in London, was composed of shareholders elected at the annual meeting. On the second level were the HBC "Officers" who conducted the trade in North America. Then at the bottom of the pyramid came the general workers or "servants". Both the officers and servants were on wage contracts, although limited scope existed for the officers to earn bonuses.

The control and decision-making authority lay with the committee in London. This group of men made all the decisions relating to the operation of the trade in North America, to the purchase of trade goods, and to the sale of furs in England. In fact the committee allowed its officers in Hudson Bay very little latitude in even the day-to-day conduct of the trade. Perhaps as a result of this rigid control by the London Committee the trade from the Bay area was essentially passive and contrasts sharply with the conduct of the trade from Montreal. Up to the 1770's the HBC had built posts along the edge of Hudson Bay and waited for the Indians to come in to trade with them. Even though the inland penetration after 1770 was limited, it resulted in a market overlap with the firms operating from the St. Lawrence.

The commercial fur trade conducted from the St. Lawrence Basin and Montreal had been under French control until the British conquest of French
Canada in the 1760's. Then control passed into the hands of British—mainly Scottish—merchants. In the years immediately following the British conquest, the trade from Montreal was carried out by many individual merchants who would each hire traders and send them out, along with some trade goods, to trade with the Indians. Individual trading does not appear to have been the most efficient method of pursuing the trade: by the mid 1770's, one year partnerships were being made between groups of merchants and traders. These partnerships came to include more merchants and traders and were entered into for longer periods of time. These series of partnerships became known as the NWC and culminated in the agreement of 1804, which not only included all the Montreal merchants but was to have run until 1822. Thus, although a commercial fur trade from Montreal had a long history the company facing the HBC in 1804 was new.

NWC organization had two distinct levels; partners and labours. On the partner level there were three separate entities. First, there were the Montreal merchants who furnished capital for the enterprise. The second group, known as the "Wintering Partners", went out to trade with the Indians. Wintering partners had no obligation to provide capital or credit to the company; their role was to organize the trade with the Indians. Unlike HBC officers, Wintering partners were shareholders. As such they had an interest in the profitable operation of the company and, in effect, were on profit-sharing rather than wage contracts. The third group were the clerks. They were apprentice partners and could hope to buy shares on the death or retirements of a current partner and after having spent a number of years trading with the Indians. The labourers were on straight wage contracts.

Again in contrast to HBC, NWC was not a limited-liability company. Rather, it was a joint-stock partnership in which each partner was fully
liable for the debts of the operation. The profits or losses from each
year's trade were divided annually among the partners in accordance with
the number of shares held. As a result, no undivided capital was withheld
for the following year's trade.

NWC did not only differ from HBC in terms of its historical development
and internal structure, but also in terms of its attitude towards the conduct of
the trade. Both under the French and then under the NWC partnerships, the
trade from the St. Lawrence Basin can best be described as active, the
policy being to go out to the Indians. As a result of this active policy of
the Montreal traders, the NWC had by 1804 opened up the Rocky Mountains,
Athabasca and Mackenzie Rivers to trade. Thus in 1804, the market in which
furs were purchased could be divided into three separate regions. The current
monopoly regions of the two companies and a central region of overlapping
trading territory.

4. 1804-1810

In the next several sections, I will compare the actual conduct of the
two companies to the model presented in Section 2. Because the evidence is
largely qualitative in nature (involving especially lengthy quotations), careful
and convincing documentation of the facts is extremely space consuming. I will
therefore limit my supporting references and quotations to certain highlights and
refer interested readers to Carlos (1981, 1982) for much more extensive documentation.

In 1804, the British North American Fur Trade was a duopoly concern,
completely unhindered by the threat of anti-trust legislation or of government
interference. It seems plausible that firms in such a duopoly situation will
want to maximize joint profits. Indeed in that year, NWC opened negotiations with
HBC in order to reach a market sharing arrangement. HBC itself realized "that
it would be advantageous for all concerned in the fur trade if some regulation
could be made with the Canadian company or companies". Although the two firms realized that such a market-sharing agreement would be beneficial they failed to reach such an arrangement.

The failure to reach an agreement highlights some of the problems that face firms even when there are only two of them. One problem is evident in the quotation above. HBC talked about the "Canadian company or companies", showing that the committee just did not know what its competition was. This lack of information about the structure of NWC was a result not just of differences in the internal make-up of both firms, but of the recency of the HBC/NWC interaction. HBC's lack of information and uncertainty concerning its competitor became even clearer as negotiations progressed. The committee wrote to the NWC:

We must therefore enquire how far we may be secured from the encroachment of succeeding traders who may disavow the acts of their predecessors and, although enjoying all the benefits resulting from the completion of the present negotiations, we expect that in addition to that satisfactory explanation, you will again offer in such collateral security that will ensure to us those advantages which it is your intention to offer in compensation for those facilities in prosecuting your trade;"7

This quotation points out the suspicion with which the HBC committee viewed its rival. Again this distrust was based directly on a lack of knowledge concerning the structure of the NWC and came out here over the issue of security of collateral. But perhaps of even more interest is the evident concern on the part of the HBC over what it perceived as the NWC's inability to provide a barrier to entry to new firms or to the defection of existing partners.

Although the two companies were unable to reach any form of collusive agreement in the 1804-06 negotiations, the relationship between the firms did not slip into aggressive competition. The most reasonable interpretation of the years from 1804 to 1810, which has been discussed at length in Carlos (1981), is that the two companies peacefully coexisted. That both companies were
interested in preserving this peaceful coexistence can be seen in their letters and journals. HBC continually wrote to its men telling them to "maintain the utmost peace and harmony with your opponents", and that they "were to avoid any discussion or disagreement with those people". Alexander Henry, a NWC partner talks at length in his journal of the good relations that exist between the men of both companies. While Daniel Harmon, a NWC trader who spent sixteen years west of Lake Superior, wrote that "the greater part of the NWC and HBC people live on amicable terms, and when one can with propriety render a service to the other it is done with cheerfulness."

The evidence thus suggests that in the early years following 1804, industry conduct was (A) stable and not highly competitive, but (B) not yet fully cooperative or joint-profit maximizing. In terms of Figure 3, the evidence supports the assumption of a stable model with perhaps an initial position at a point like 'a' leading, through the adjustment process discussed above, toward an equilibrium at $E_a$. It seems reasonable to assume that the initial point is in the region to the southwest of $E_a$ in Figure 3 which implies that both firms are increasing their adherence levels with time. An initial point in the regions to the northwest or southeast of $E_a$ would imply one firm decreasing its adherence level with time, a situation not consistent with the evidence. (The relevance of this will become clear in the next section.)

Both the evidence and the model suggest also that this period of peaceful yet non-collusive coexistence from 1804 can be viewed as a learning period for each company, during which time each side became better informed about its rival. Such learning would mean an outward shift of the reaction functions, $A^*_H$ and $A^*_N$, and a new equilibrium to the northeast of $E_a$. Thus regardless of whether the firms were at an initial position like 'a' in Figure 3 or actually at a
short-run equilibrium like $E_a$, continued stability of the environment following 1804 should have led the firms eventually to a collusive agreement. This is, of course, a counterfactual hypothesis but there is, on the other hand, no evidence to suggest that the relationship was doing anything other than improving from 1804.

However, the environment in which the firms were operating changed significantly. The Napoleonic Wars, more specifically the subsequent European Blockade, dramatically cut the demand for furs and skins sold on the English market by at least 50% of the 1800 level. A full discussion of the effect of this fall in demand can be found in Carlos (1981). For our purposes one feature of this decline in demand is especially significant. There was unequal impact of the fall in demand. For two reasons, the decline hurt HBC more. First, its demand fell by more than that facing NWC because its charter required that it sell on the English market only. Second, HBC faced sticky prices on the input market because of the control exercised by the London Committee, discussed in Section 3. NWC, on the other hand, was able to diversify its output market, selling furs on the American market. It also varied the relative purchase prices of its furs to reflect the new demand conditions, thereby capturing a larger share of the relatively more valuable furs and leaving the HBC with the relatively less valuable furs.11

As a result, by 1809-10 the HBC was faced with a very severe financial crisis, the severity of which is suggested in Table 1. This crisis, in turn, precipitated a major overhaul of the HBC trading pattern from the management in London to the operation in North America. This overhaul became known in the literature as the Retrenchment System and is discussed in the next section. A
worsening of the environment for one or both firms can be analyzed within
the structure of the model. If we assume that NWC was hurt imperceptibly
then $A^*_N$ remains at $A^*_Na$, while $A^*_H$ shifts inward in Figure 3. Thus $E_a$ is no longer the
appropriate equilibrium. Movement toward the new equilibrium $E_c$ will proceed
in a circuitous fashion if the pre-1810 equilibrium is in the region to the
southwest of $E_a$.

5. **1810-1816**

The second phase of HBC/NWC relationship covers the years from 1810 to
1816. This stage can be thought of as a period of transition from the peaceful
coexistence and perhaps improving relations before 1810 to the highly aggressive
competition by both firms evident after 1816. Looking ahead, I will argue that
the behavior of the 1810-1816 period is consistent with the model and can be
roughly summarized by the process illustrated in Figure 3. Briefly, HBC's financial
crisis due to the Napoleonic Wars shifted $A^*_H$ from $A^*_Na$ to $A^*_Hc$ about 1810, as just
noted. The equilibrium moves from $E_a$ to $E_c$ and the behavioral path a to b in
Figure 3 turns southeast toward point d and then southwesterly toward point e
and on toward $E_c$. If the pre-1810 point is between the two reaction curves as
argued above (point b) we will thus see a period in which HBC decrease adherence
which NWC simultaneously increases or at least maintain its adherence. It is
only after some time has passed that both firms begin to behave in an increasingly
non-cooperative fashion.

An all important feature of the 1810-1816 period was the depletion of the
animal stocks (Carlos 1982) which became a major problem for both companies after
1810. This, of course, represents a deterioration in the environment for the
two firms and is illustrated by a shift of $A^*_Na$ to $A^*_Ne$ by 1816. The depleted
animal stocks replaced the Napoleonic Wars as a problem for the HBC and thus I have simply left $A^*_H$ at $A^*_Hc$ for illustrative purposes (which is certainly not to assert that the two affects were equal). Ignoring any shifts due to learning, the equilibrium thus moves from $E_a$ to $E_c$ to $E_e$ in Figure 3 during these years. In summary then, the model predicts an initial period of unilateral change by the HBC followed by a period of bilateral reduction in adherence and deteriorating industry conduct. In order to show how the facts fit with the model, I shall first discuss the behavior changes and then depletion problem, although to some extent they did overlap.

The financial problems faced by HBC, as a result of the Napoleonic Wars, forced that company to undergo a complete restructuring not just of its trading methods but, more important for this discussion, of its view of the company's role in the fur trade. The Retrenchment System had as its basic intent an increase in the HBC's market share and the presumed acceptance of that position by the NWC (Carlos 1981). In this regard, certain facts concerning the nature of the Retrenchment System are important. The plan did not place any great emphasis on the long-run nature of the HBC interrelationship with the NWC or alternatively assumed that the NWC would not respond in a reciprocal fashion. Rather the system suggested that the HBC should deal with its immediate problems in a highly competitive or even aggressive fashion, ignoring the fact that such behavior could in the long run lead to similar conduct by the NWC and to a deterioration in industry profitability.

The change in HBC attitude from its position of peaceful coexistence was very clearly demonstrated in late 1810. In that year the NWC partners again tried to bring about a more collusive agreement between the two companies. They
wrote to the HBC stating that it might be "in the mutual interest of both parties to curtail expense in the competition of a trade for which the circumstances of the times are particularly unpropitious".\textsuperscript{12}

These negotiations also failed. The HBC argued as it had in 1804 that its competitor had neither secure collateral nor could it provide an effective barrier to entry in the face of any competition from Montreal. But the committee also adopted a position more indicative of its changed attitude. If there was to be any division of the trading territory, the HBC wanted sole control over all the land within the bounds of its charter. For the NWC, such a division was unacceptable. Not only would the company have lost that territory but it would have totally disrupted its trading network with its remaining areas and would have seriously damaged its relationship with the Indian tribes. The more aggressive HBC policy is articulated in a letter sent by the committee to the NWC towards the end of the negotiations, in August 1811. It read:

\textit{We are confident the local advantages possessed by the HBC without calculating too highly on the resources already, or those about to be resorted to, will independent of any treaty very soon procure a much larger share of the fur trade than the HBC have possessed for some years.}\textsuperscript{13}

It is clear from this letter that the HBC committee believed that it was capable of restoring the finances of the company by action which ignored possible long-run repercussions.

Thus at a time when NWC was trying to increase the levels of adherence to group goals, the HBC was moving in the opposite direction. Initially the two firms were moving along a trajectory towards $E_a$ in Figure 3. Then the financial problems faced by HBC and its solution, the Retrenchment System, pushed the
trajectory in a southeasterly direction, moving from a point such as b towards one such as d.

Does the southeasterly movement in Figure 3 (b to d), sustained for several years, constitute a rational form of behavior for the NWC? After all, the negotiations of 1810/11 had failed and, by insisting on the validation of its charter, HBC had in fact communicated to the NWC more aggressive intentions. The situation can in part be explained by the fact that there were significant lags in the system which slowed down behavioral changes and subsequent responses. In the first instance there was a long lag between the conception and operation of the Retrenchment policies and then a lag between the implementation of these changes and NWC's perception of those actions as hostile. What was important for inter-firm behavior was perhaps not that HBC informed its competitor that its actions were going to change. Rather it was that HBC actions did eventually change, and as a result of its actual conduct in the field the NWC came to perceive HBC conduct as designed to damage its position in the trade. But such a realization took time.

The lag between conception and implementation was demonstrated clearly in a letter written in 1813 from the committee to its chief factors:

Let them all see that the old system is absolutely destroyed and that the scheme sent out to you is not to be considered so much as idle and visionary policy but that it is that system to which in its gradual progressive improvement we confidently look forward to the re-establishment of the company affairs.\textsuperscript{14}

The main thrust of the Retrenchment System was the strengthening of HBC's position in the commercial fur trade. In operational terms, the committee wanted the output from North America to increase. As discussed in Section 3, the trading territory was composed of three distinct regions, a HBC and a NWC
monopoly area and a jointly-traded area. For the HBC to pursue the Retrenchment policy, it could intensify its operations in any or all regions. However, any intensification of activity in the jointly-traded area or in NWC monopoly area would impose costs on the NWC, in the form of externality effects. Thus the actual operation of the Retrenchment policies which did involve the latter two areas would eventually convince the NWC that its rival was moving towards a less cooperative stance.

NWC perception of its rival's attitude as becoming more aggressive was delayed but eventually heightened by the methods which were used to implement the system. In contrast to the openness of HBC policy prior to 1810, it is reasonable to say that HBC methods now became highly covert. All activities had to be masked. The annual letters from the committee became replete with such statements as "keep this order concerning provisioning secret from neighbours". An example of the more general type of activity is given in the following:

...push some posts southwards towards Lake Superior, Pic and Lac Ste. Anne, an operation by engaging the attention of the Canadians in that quarter will contribute as we hope to weaken the opposition which will be made to Mr. Hillier's establishing himself in Winnipeg River.

There was, as a result, a lag in NWC perception of its rival's action as hostile. It was not until 1814 that one finds evidence of hostility towards the HBC in the minutes of NWC's Annual Meetings at Fort William. In that year the NWC partners decreed that:

...no Hudson's Bay servants should in future be received into any of the company's posts in case of starvation, and on no account [are any] to be engaged in the NWC.

This was a very strong stand, especially when starvation was an ever-present threat to the existence of both trader and Indian.
Thus over the period from 1810, the NWC was slowly coming to perceive its rival's actions as designed to injure NWC's position in the industry. Such a perception of HBC activities was heightened by the changing nature of the environment in which both companies operated. As has been shown in Carlos (1982), not only did depletion of the animal population become a far more serious problem after 1810 but also that both companies viewed the depletion problem as exogenous to their own activities. Thus animal stock depletion constituted an "exogenous" deterioration in the environment for NWC and replaced the Napoleonic Wars as an unfavorable environment factor for HBC. This is represented in Figure 3 by a shift of $A_{Na}^{*}$ to $A_{Ne}^{*}$ and a movement of the equilibrium from $E_c$ to $E_e$ by 1816.

This transitionary period came to an end in late 1815 with HBC's move into the Athabasca region. This movement was a result of the interplay of the Retrenchment policies to increase HBC output and the depletion of the animal population in HBC's traditional trading areas. The Athabasca department had been the monopoly preserve of NWC since its inclusion into the commercial fur trade some twenty years prior. In both the negotiations of 1804 and 1810, this area had been conceded as a NWC monopoly region by the HBC. The move into Athabasca was thus the final convincing evidence for NWC that HBC had adopted a more aggressive, non-cooperative stance and led NWC to behave in a reciprocal fashion.
6. **1816 - 1821**

Although the deterioration in the input market environment was pushing the firms toward a low level equilibrium at $E_e$, the lines of communication between the two companies were not closed. In fact another set of negotiations occurred in 1816. On the surface, these negotiations were yet another attempt to achieve a market-sharing agreement. However, fundamental differences in this set of talks suggest that they were in fact being used by HBC as an attempt to test the NWC's perception of their relative positions in the industry. Unlike the previous two endeavours, the HBC instigated the negotiations. On August 1815, the HBC wrote to Lord Selkirk, who was to be the company's intermediary, stating that the company was

...fully convinced of the importance of some arrangement between the Hudson's Bay Company and the Northwest Company, and of the reciprocal advantages which would result to both from a dereliction of that system of opposition which from a commercial as well as a moral point of view has upon experience been found so hurtful to the interest of each contending party...18

It is clear that the HBC realized the advantages of reaching a collusive agreement with its competitor. Yet in spite of these statements the offer made to NWC was exactly that which that company had rejected in the 1810/11 negotiations. It is interesting that this offer did in fact leave the Athabasca region as a sole NWC area, even though the HBC was already setting up posts and trading in the area.

NWC put forward two counteroffers. The first was a division of territories acceptable to the NWC but automatically unacceptable to the HBC as it was not based on the boundaries of its charter. However, it is the second proposal which is a more interesting test of the hypothesis that these negotiations were in fact a trial of the relative strengths of the companies. The NWC partners
proposed a coalition of the trade for eight years, during which the profits (or losses) would be divided on a 2/3 (NWC) - 1/3 (HBC) basis. Each company would sell half of the skins and the skins could be shipped from Montreal or Hudson Bay, whichever was cheaper. Given the initial sizes of the two companies, an arrangement on these terms was not an unreasonable solution. 19

However, NWC imposed two further conditions. First, the agreement would not imply that that company accepted the validity of HBC's charter. Second, the management and direction of the trade in the interior was to be carried out by the NWC, which would send a partner to Hudson Bay to supervise all activities there. Given the HBC's view of its position in the trade, these two conditions, especially the latter, were totally unacceptable. HBC would become a mere transporter and seller of furs for the NWC. Thus these negotiations also broke down.

Once again direct communications existed between the two companies, yet they failed to come to a resolution. This round of discussion especially suggests that what is important is not communication per se but the signals the firms receive and the background against which those signals are evaluated. In this case, the signals suggest that neither company was ready to compromise in order to promote industry goals.

The signals exchanged in the 1815 negotiations were subsequently strongly reinforced by the actual behavior of the companies from 1816 on. Aggressive and non-cooperative conduct became the dominant form of behavior. That the HBC viewed aggressive competition as the only viable alternative open to it is evident in a latter written concerning its trade in the Athabasca region:
We consider it to be of the most essential importance to the permanent interest of the company that the opposition to the NWC in the Athabasca should be vigourously pursued. By establishing a connection with the Indians of that country we shall either continue to participate in the valuable trade of that district or be enabled to make such arrangements with the NWC for a division of the country as will compensate us for our outlay...

HBC/NWC attitudes towards the conduct of the trade had very definitely changed from the stance of the pre-1810 years. No longer was the London committee writing to its officers stressing the necessity of peaceful coexistence with NWC neighbors. Now the statements were concluded in terms of meeting force with force. However, such conduct did not necessarily represent the predatory competition discussed extensively in the literature.

While the concept of predatory competition is not clearly defined, it does contain "an element of wrongful or specific intent", with firms attempting to increase their market power through the use of action that would not normally be considered profit maximizing. Thus of importance in deciding whether the conduct during these years was just aggressive or in fact predatory are the strategies actually followed by the two companies, discussed at length in Carlos (1982). Robert Bork (1978) suggests that there are three techniques of predation that firms can use in following such a strategy. The first of these is price cutting, the fur trade analog for which is predatory purchase price increases. The second can be classified as disruption of business patterns. The third is misuse of governmental processes. A major problem facing companies using the first technique is that the costs to the predator will be larger than to the rival, which diminishes the predator's chances of success. This is not the case under the latter two techniques, where predation could impose larger costs on the rival firm than on the predator.
There in fact does not appear to have been major predatory increases in the prices paid to the Indians. However, other activities by both companies fit very neatly into Bork's latter two categories. Probably the most famous example of the companies' attempts to upset trading patterns was the hiring of "bully-boys", who were used to disrupt the trade of the rival post. Both companies also tried to disrupt trade by undermining the confidence of the Indian tribes in the rival firm, hoping that the Indians would then transfer their allegiance. A general prescription for this kind of behavior appears in Simpson's instructions to a fellow trader:

You will on all occasions impress on the minds of the Indians, that the [HB] Company are rich, strong, powerful, and strictly honourable, and that our opponents are the reverse.

Such a claim could be thought of as common to all forms of competition whether aggressive or predatory. But this prescription for HBC conduct stands out as a direct attempt to undermine NWC/Indian relations.

Possibly the most damaging strategy followed by both companies in this regard was the policy of trading the other firm's furs. Each autumn, the Indians arrived at the various trading posts where they received not only presents, but trade goods in advance, on the strength of future hunts. The Indians were supposed then to return to these same posts with their hunts and to be paid the balance. However, the system ceased to work that way, for each spring the HBC or NWC actively tried to trade the furs destined for its rival. Again Simpson's instructions explicitly ordered his traders to behave in this manner.

"Every exertion must be used to Trade the Debts of the North West Co., and I trust you will keep your people continually on the alert, both in watching our own Indians and in Trading with those of our Opponents."
Government processes can also be misused by a predator to tie up a rival company for years, in litigation. For the fur companies, misusing government agencies could remove key personnel from the trading structure. In the literature this technique has become known as the "kidnapping business". NWC, especially, made wide use of Bills of Indictment, obtained from Justices of the Peace, to remove a HBC chief trader from the North West, taking him all the way to Montreal before he was released. Similarly by 1819, William Williams, the HBC governor, removed some key NWC partners, conveying them to York Factory and then to England for trial, where they were subsequently released for want of a prosecutor.

The conduct of the companies can be thought of as moving along a trajectory to an equilibrium characterized by very low levels of adherence, $E^*_e$ in Figure 3. Certainly over these years the relationship moves from the realm of aggressive trading for furs to physical assault or rival trader, in the form of the "kidnapping business". The relationships presented in Section Two argues that low levels of adherence will have in turn detrimental effects on the profitability. The evidence for HBC presented in Table 1 shows a deterioration in company profitability. While quantitative evidence for NWC does not exist, the qualitative evidence would seem to argue that that company was in some financial difficulty. In fact the reasons given by NWC partners for a reopening of negotiations between the firms in 1820 were the bad financial state of the competition and the growing violence of the trade.

Fellner (1949) argues that predatory competition carries with it the threat of government regulation. By 1819 the British government was becoming very concerned about the state of affairs in its "Indian countries". And the
government began to question the companies about events in British North America. Thus by 1820, the combination of events (the poor financial state of the companies, the growing violence of the trade, and the possibility of government intervention) increased the likelihood of success in the current round of negotiations. The likelihood of success was greatly enhanced when the government informed both parties that it "might be dispersed to go into and confirm any arrangement the parties might make between themselves."25

The government offer removed many of the problems which had beset the previous discussion. In particular it solved the problem of a barrier to entry to new firms or dissident partners as the government reaffirmed the HBC's charter and granted a commercial monopoly over the remainder of the lands. In terms of the model, this guarantee of a government-enforced monopoly (barrier-to entry) constituted a significant improvement in the environment and could be represented, in Figure 3, by an outward shift in both reaction curves and the movement of the equilibrium to a new higher level of adherence to the Northeast of $E_e$. Similarly it might be argued that the period of aggressive competition resulted in significant learning by each firm about its rival. In particular, each firm likely learned that its rival was equally strong and could not easily be driven from the trade and that aggressive and predatory competition would not prove successful. Again this is represented in the model by an outward shift in both reaction curves and a shift of the equilibrium to a high level of adherence, in Figure 3.

Thus by 1820 we would expect a turnaround in behavior and a gradual improvement in industry conduct. In fact, this improvement occurred with dramatic suddenness with the firms agreeing to merge in 1821, perhaps hastened by the
poor financial state of both companies and the violence of the competition. From 1821, the North American Fur Trade thus became a monopoly as the firms finally achieved a successful joint-profit maximizing strategy.

7. **Conclusions**

As suggested in the introduction, there seems to be some consensus in the theoretical literature that while firms may wish to maximize joint profits, there may exist significant short-run obstacles to this objective. I have shown that the behavior of the two firms during their duopoly period, 1804-1821, was closely consistent with both aspects of this theoretical view of the duopoly problem.

In order to analyze the HBC/NWC rivalry in light of the theoretical literature, Section 2 developed a model of inter-firm behavior based on the work of Williamson (1965) and Spence (1978). It also drew from the ideas of Stigler (1964), Fellner (1949), Scherer (1970) and Friedman (1971a, 1971b). The model is constructed to be consistent with the two aspects of duopoly behavior mentioned above in that (1) the model ensures convergence to a joint-profit maximizing equilibrium, given sufficient time, but (2) predicts or permits significant short-run deviations from fully cooperative behavior due to changes in various exogenous and endogenous factors. In the case of the fur trade, the relevant factors were (A) industry age and differences in internal firm structure, (B) information and communication, (C) the state of the environment, (D) barriers to entry.

The predictions of the model and the facts of the fur trade duopoly seem to fit together nicely. During the initial years when the market environment was favorable, the two firms peacefully coexisted but did not fully cooperate.
The latter fact seemed closely related to the age of the industry and to the internal structure of the NWC. Both factors meant that the HBC was very uncertain as to NWC's willingness and ability to maintain any market sharing agreement. In terms of the model, both firms (but especially the HBC) were receiving imperfect signals that in turn prevented fully cooperative behavior. But, also consistent with the model, it seemed likely on the basis of inter-firm communication that the companies would have eventually reached a joint-profit maximizing outcome.

The Napoleonic Wars brought a far more serious decline in demand for HBC's furs than for those of the NWC. This represented a deterioration in the HBC's market environment and, consistent with the model, led to a deterioration in HBC conduct while the NWC continued for a time to maintain its level of adherence.

As the NWC eventually began to perceive that HBC's conduct had changed, the former company subsequently started to reciprocate with more competitive behavior. This change by NWC was reinforced by (and indeed hard to separate from) the adverse effects on both firms' environment of declining animal stocks. As predicted by the model, the result was a further deterioration in industry conduct as both firms fell into a mode of predatory competition in 1816.

The predatory phase came to an abrupt end in 1821 with the merger of the two companies. In part, this was probably a result of the learning process in which each firm came to understand the strengths and attitudes of its rival. Such learning improves signalling and increases each firm's willingness to cooperate in the model, and thus is consistent with the reversal of industry conduct. But perhaps more importantly, the British government became involved and in 1820 offered to validate any result the firms might arrive at. This amounted to a government enforced barrier to entry for the two companies, and
in terms of the model, meant increased expected profits from cooperative behavior. It is thus consistent with the model that this government offer hastened a joint-profit maximizing outcome. From 1821 the North American Fur Trade was conducted as a monopoly.
### Table 1

**HBC Profit and Loss Accounts**

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</table>


1The Retrenchment System of 1810 brought with it a major overhaul of the company's accounting practices. The new system was put into operation in 1811.
FOOTNOTES

1 Some Russian furs were sold on the British market but Russia was a net importer, being a major purchaser of beaver and otter. E. E. Rich (1959) provides a very detailed discussion of HBC's trade.

2 Suppose, for example, that $a_j$ is linear in $1/Q_i$ where $Q_i$ is output (i.e., cooperation takes the form of mutual reductions in output until a joint-maximum is reached. $a_j = 0$ implies $Q_j \to \infty$ driving output price to zero. The question of whether or not $j$ would ever pursue such a strategy aside, it is not rational for $i$ to match this output, hence $a_i > 0$.

3 The HBC was allowed to be a limited-liability company as part of the charter of 1670. It was not, however, until 1844-1855 that legal changes allowed limited-liability, joint-stock companies in ordinary trade. See H. A. Shannon, "The Coming of General Limited Liability". Essays in Economic History: Volume One, ed., E. M. Carus-Wilson, 1966.

4 The main source material for the NWC comes from W. Stewart Wallace (1934). His introduction contains a skillful reconstruction of the company's history.

5 The NWC trade in the interior was divided into districts known as "Departments" and over each department there was a Wintering partner.

6 Minutes of Transactions Between HBC and the NWC 1804-06, Public Archives of Canada (PAC) HBC MG20AI Reel 18, para. 6.

7 Ibid., Letter 31st January, para. 39.

8 London Correspondence Outward - Official - Albany 1800.

9 Elliot Coues (ed.) (1897).
10 Daniel Harmon (1922), p. 123.

11 Coues (ed.), p. 558. Alexander Henry, a NWC partner noted in 1808, that the Blackfeet "brought in wolves, but I sent them to my neighbours [HBC] as wolves were not in season". By 'in season' Henry meant 'in great demand'.

12 Selkirk Papers, p. 199.


14 London Correspondence Outward, para. 1.

15 London Correspondence Outward, 1812.

16 London Correspondence Outward, para. 5.


18 Selkirk Papers, p. 1631n.

19 At the beginning of the duopoly relationship the NWC was the larger firm, but from 1810 onwards the HBC had been hiring extra personnel.

20 London Correspondence Outward, 1817.

21 Selkirk Papers, p. 480. While the NWC hired French Canadians for this purpose, the HBC hired Irishmen.

22 Rich, ed. (1938), p. 49, emphasis added. George Simpson was the HBC's head of the Northern Department.

23 Ibid., p. 49.

24 Or abuse, given that the majority of the Justices of the Peace for the Northwest were NWC men.

25 Selkirk Papers, p. 6960.
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