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The Dynamics of Duopoly

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THE DYNAMICS OF DUOPOLY

by

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STATEMENT OF THE PROBLEM

A monopolist, knowing the demand curve for his product, can in a given period produce the quantity of this product which will maximize his profit. Any larger or smaller quantity will result in less profit. When another manufacturer starts producing the same or similar product, a duopoly results. The new manufacturer, in order to maximize his profit, according to Cournot (2), will choose a quantity that is derived on the assumption that the original manufacturer's quantity will remain fixed.

Cournot's treatment of competition between two producers, originally published in 1838, was translated into English in 1897. As an abstract example Cournot considers two proprietors who each own springs and who sell springwater to the same market with negligible costs of production. The profits of proprietors 1 and 2 are respectively expressed as $D_1 f(D_1 + D_2)$ and $D_2 f(D_1 + D_2)$ where $D_1 + D_2$ is total production and where price is a function of total production.

Proprietor 1 can have no direct influence on the determination of D_2. But he can adjust his price for the value of D_1 which is best for him according to the condition:

$$\frac{\partial [D_1 f (D_1 + D_2)]}{\partial D_1} = 0$$

and proprietor 2 can determine D_2 in terms of D_1 by the analogous condition:

$$\frac{\partial[D_2 f(D_1 + D_2)]}{\partial D_2} = 0$$

After the new manufacturer enters the market, with a quantity based on the assumption that his competitor's quantity will remain fixed, the original manufacturer must change his quantity of production in order to again maximize his profit since both duopolists share the same linear demand curve. This quantity is derived using the assumption that the new manufacturer won't change his quantity. One sets an output; this induces the first to readjust his, and so on. Each quantity adjustment by a manufacturer is smaller than his previous adjustment and in the opposite direction. Theoretically, an equilibrium will be reached only after an infinite number of adjustments. Practically, an equilibrium is reached with a finite number of adjustments because it is impossible for a manufacturer to produce and market fractions of a unit.

Only with production quantities at the Cournot equilibrium are the conditions on the previous page simultaneously satisfied, and with the conditions simultaneously satisfied neither duopolist has an incentive to change his production quantity. However, at the Cournot equilibrium the total income is less than the income received if either proprietor were a monopolist. With a collusive agreement to share the market and produce the monopoly output, each duopolist would receive greater income than if production were at the Cournot equilibrium. Without a collusive agreement the monopoly output is unstable because either duopolist could fix his production at a higher or lower rate with a temporary benefit. The proprietor who adopts this course of action is soon punished because the other proprietor will then adopt a new scale of production. These successive reactions, instead of bringing both duopolists nearer to the condition of monopoly, separate them farther and farther from it.

Cournot further describes the path to equilibrium and shows mathematically why the monopoly quantity is unstable with two proprietors. This is also done for more than two proprietors and for proprietors that have limitations of productive capacity and varying production costs.

What Cournot explains mathematically is showed graphically by Chamberlin (1). Chamberlin also shows that with a linear demand curve and zero or identical constant costs of production a duopolist maximizes his profit by selecting a production quantity that is one-half the competitive output minus one-half the production quantity of the other duopolist. The competitive output is defined as the aggregate output that yields zero profits to each of the duopolists if the duopolists had no production costs. Therefore, if the current production of duopolist 1 is zero, the monopoly output for duopolist 2 is one-half the competitive output. If the current production of duopolist 2 is one-half the competitive output, duopolist 1 will enter the market with a production of one-quarter the competitive output. The next quantity for duopolist 2 will be three-eighths the competitive output, and the following quantity for duopolist 1 will be five-sixteenths of the competitive output. Both geometric series converge to one-third the competitive output so the aggregate output at the Cournot equilibrium is two-thirds of the competitive output.

In real life it is doubtful that each duopolist readjusts his output with absolutely no expectation of retaliation. Thus Hicks (6) adds the concept of conjectural variation to the Cournot model in an effort to anticipate these expectations. The characteristic feature of the Hicksian model is that when there are only a few proprietors, the fear of retaliation is great. A duopolist, when changing his production quantity to maximize his profits, may attempt to predict the resulting quantity change of his competitor. Under these conditions marginal revenue to duopolist 1 becomes:

$$\frac{\partial\,[D_1 f(D_1+D_2)]}{\partial D_1} = f(D_1+D_2) + D_1 f'(D_1+D_2) + D_1 f'(D_1+D_2)\,\frac{\partial D_2}{\partial D_1}$$

where $\frac{\partial D_2}{\partial D_1}$, hereafter referred to as conjectural variation, is the degree to which duopolist 1 expects duopolist 2 to expand or contract output, if he himself expands output by an increment ΔD_1 .

A reaction curve can be constructed giving the profit maximizing output of duopolist 1 corresponding to each possible output of duopolist 2 when it is assumed that $\frac{\partial D_2}{\partial D_1}$ is invarient over time for each output of duopolist 2. Likewise a reaction curve giving the profit maximizing output of duopolist 2 corresponding to each possible output of duopolist 1 can be constructed. The intersection of these two reaction curves establishes a stable equilibrium. Movement away from this intersection causes the output of one duopolist to rise and that of the other to fall. However, as pointed out by Fellner (3), equilibrium may not be at the intersection of these two reaction curves since the reaction curves may shift before equilibrium is achieved. This shifting occurs whenever original predictions, by both duopolists concerning their rival's behavior, are modified. An equilibrium is stable only as long as nobody realizes his notions are incorrect. It is extremely likely that these notions will be tested--particularly if previous quantity decisions by a duopolist had resulted in less than the maximum possible profit.

According to Stackleberg's duopoly analysis, if equilibrium is to be the outcome, it will not occur at the Cournot equilibrium. Rather the equilibrium will be at quantities near the monopoly output as achieved by a tacit or collusive agreement or else the equilibrium will be at the quantities where one duopolist succumbs to the leadership of the other. A follower adjusts his output level given the quantity decisions of the leader, and the leader knows it. A leader does not observe his own reaction curve. He assumes that the rival acts as a follower, and the leader proceeds to maximize his profit. Conjectural variation of the leader is the slope of the follower's reaction curve. This reaction function gives the profit maximizing output of the leader corresponding to each possible output of the follower. In this case the leader's conjectural variation is not necessarily zero, since the leader knows what the follower will do. It is possible that the follower will not react in attempting to stop the leader short of complete leadership. A Cournot time path to equilibrium occurs when both duopolists act as followers. This equilibrium occurs at the intersection of the two reaction curves.

A Stackleberg profit-indifference map shows the combination of outputs by one proprietor on one axis and outputs by the other proprietor on the other axis which results in identical profits to the proprietor in question. The reaction function of the proprietor is then defined as the locus of tangency points of the family of curves to lines perpendicular to his rival's axis. The leadership equilibrium point of the proprietor is that point of the rival's (follower's) reaction curve where it becomes tangent to a profit-indifference curve of the leader. The followership point of a proprietor is the same as his rival's leadership point.

Microeconomic theory (5) shows with numerical examples profits to each duopolist at the Cournot equilibrium and profits to each duopolist when one has succumbed to the leadership of the other. Clearly the duopolist who becomes a leader receives the most profit. For this reason Stackleberg predicts both duopolists will strive to become leaders and that disequilibrium will be the outcome since both reaction curves will be constantly shifting.

Conjectural variation is the degree to which one duopolist expects the other to expand or contract output in retaliation for a quantity change; so if both duopolists exhibit a Cournot dynamic time path to equilibrium, the conjectural variation associated with each quantity change is zero. A dynamic time path, that differs from the Cournot time path, to the Cournot equilibrium causes conjectural variations that originally are non-zero to approach zero. Stackleberg disequilibrium causes conjectural variations to vary randomly without a tendency to approach any fixed values. A leader-follower relationship causes conjectural variation of the follower to approach zero and the conjectural variations of the leader to approach a fixed negative value. Collusive agreements cause the conjectural variations of both duopolists to approach fixed positive values.

Duopoly bargaining situations are simulated in the laboratory to determine under what conditions one of the above outcomes is to be expected. Students are given actual cash payments according to production quantities selected. Following each selection the conjectural variation exhibited by the student in selecting that quantity is calculated. The empirical data from these simulations is used in developing models to predict conjectural variation for future time periods. Once these models are obtained and if Stackleberg disequilibrium is not the outcome, the complete equations for both reaction curves can be derived. Students play these games having either identical, similar, or dissimilar cost curves. Fixed and variable costs are such that with identical cost curves the Cournot equilibrium for both duopolists is 63 units of production. With similar cost curves the Cournot equilibrium is 66 and 56 respectively for duopolists 1 and 2. With dissimilar cost curves the

Cournot equilibrium is 72 and 42. On some games the players know the profit level of their opponent in addition to their own.

Empirical data obtained in the same manner by Lawrence E. Fouraker and Sidney Siegel (4) support the following conclusions:

1. Bargainers under incomplete information (knowing only their own profit levels but not the profit levels of their opponents) tend to negotiate transactions at the Cournot equilibrium.
2. Increasing the amount of relevant information available to bargainers decreases the tendency to the Cournot point.
3. Bargaining groups under complete information (knowing the profit level of their opponents in addition to their own), show no strong tendency or typical solution in their negotiated transactions, but rather show a multi-modal distribution of results. Under complete information some oligopolies show a tendency to the Paretian optima (outputs that result in the largest aggregate profit), some to the competitive point, and some to mixed solutions.

However, in the study by Fouraker and Siegel when students exhibited a tendency to negotiate to equilibriums, conjectural variation was not measured and no attempt was made to derive equations of the reaction cruves. Only payoff matrices were used that had the same Cournot equilibrium quantity for both duopolists, and zero cost curves were assumed.

METHODS OF ANALYSIS

Theoretical Derivation of Dynamic Reaction Curves

Equation (1) is the demand function for the combined output of two duopolists; equations (2) and (3) are cost functions for duopolists 1 and 2 respectively.

$$p(t) = a - b\,[q_1(t) + q_2(t)] \quad . \; . \; . \; . \; . \; . \; . \; . \; . \quad (1)$$

$$T_1[q_1(t)] = k_1 + c_1 q_1(t) + d_1 q_1^2(t) \quad . \; . \; . \; . \; . \; . \; . \quad (2)$$

$$T_2[q_2(t)] = k_2 + c_2 q_2(t) + d_2 q_2^2(t) \quad . \; . \; . \; . \; . \; . \; . \quad (3)$$

Given that each duopolist has a two period planning horizon, the profit to duopolist 1 is :

$$\pi_1 = [a-bq_1(t) - bq_2(t)]\, q_1(t) - [k_1 + c_1 q_1(t) + d_1 q_1^2(t)]$$
$$+ [a-bq_1(t+1) - bq_2(t+1)\, q_1(t+1)] - [k_1 + c_1 q_1(t+1)$$
$$+ d_1 q_1^2(t+1)]$$

The profit to duopolist 1 can then be maximized with respect to $q_1(t)$ as follows :

$$\frac{\partial\pi_1}{\partial q_1(t)} = [a-bq_1(t) - bq_2(t)] + q_1(t)\ [\ - b - b\frac{\partial q_2(t)}{\partial q_1(t)}\ ] - c_1$$

$$- 2d_1 q_1(t) + [a-bq_1(t+1) - bq_2(t+1)]\ \frac{\partial q_1(t+1)}{\partial q_1(t)}$$

$$+ q_1(t+1)\ [- b\frac{\partial q_1(t+1)}{1\ q_1(t)} - b\frac{\partial q_2(t+1)}{\partial q_1(t)} - c_1\ \frac{\partial q_1(t+1)}{\partial q_1(t)}\ ]$$

$$- 2d_1 q_1(t+1)\ \frac{\partial q_1(t+1)}{\partial q_1(t)} = 0 \quad . \ . \ . \ . \ . \ . \ . \ . \quad (5)$$

Since duopolist 1 does not expect duopolist 2 to react instantaneously to changes in $q_1(t)$, $\frac{\partial q_2(t)}{\partial q_1(t)} = 0$. However, $\frac{\partial q_2(t+1)}{\partial q_1(t)}$ is not necessarily zero;

$$\frac{\partial q_2(t+1)}{\partial q_1(t)} \ ,$$

the conjectural variation of duopolist 1 and designated by $\ell_1(t)$, is the degree to which duopolist 1 expects duopolist 2 to expand or contract output, if he himself changes output by an increment Δq_1 . Duopolist 1 will not alter output in the next period solely as a result of changes in output occurring during the present period; therefore

$$\frac{\partial q_1(t+1)}{\partial q_1(t)} = 0 \ ,$$

and equation (5) becomes :

$$\frac{\partial \pi_1}{\partial q_1(t)} = a - bq_1(t) - bq_2(t) - bq_1(t) - c_1 - 2d_1 q_1(t)$$

$$- bq_1(t+1)\ \ell_1(t) = 0 \quad . \ . \ . \ . \ . \ . \ . \ . \quad (6)$$

The profit to duopolist 1 can then be maximized with respect to $q_1(t+1)$.

$$\frac{\partial \pi_1}{\partial q_1(t+1)} = [a-bq_1(t) - bq_2(t)]\ \frac{\partial q_1(t)}{\partial q_1(t+1)} + q_1(t) \left[-b\frac{\partial q_1(t)}{\partial q_1(t+1)}\right.$$

$$\left. - b\frac{\partial q_2(t)}{\partial q_1(t+1)}\right] - c\ \frac{\partial q_1(t)}{\partial q_1(t+1)} - 2d_1 q_1(t)\ \frac{\partial q_1(t)}{\partial q_1(t+1)}$$

$$+ [a-ba_1(t+1) - bq_2(t+1)] + q_1(t+1) \left[-b - b\frac{\partial q_2(t+1)}{\partial q_1(t+1)}\right]$$

$$- 2d_1 q_1(t+1) = 0 . \quad . \ . \ . \ . \ . \ . \ . \ . \quad (7)$$

Since duopolists 1 and 2 do not anticipate any reaction occurring in the present time period as a result of action in subsequent time periods, $\frac{\partial q_1(t)}{\partial q_1(t+1)}$ and $\frac{\partial q_2(t)}{\partial q_1(t+1)} = 0$. Since instantaneous reaction by either duopolist is not anticipated $\frac{\partial q_2(t+1)}{\partial q_1(t+1)} = 0$. Now equation (7) becomes:

$$\frac{\partial \pi_1}{\partial q_1(t+1)} = a - bq_1(t+1) - bq_2(t+1) - bq_1(t+1) - c_1 - 2d_1 q_1(t+1) = 0$$

$$. \ . \ . \ . \ . \ . \ . \ . \quad (8)$$

Solving for $q_1(t+1)$:

$$q_1(t+1) = \frac{a - c_1 - b\, q'_2(t+1)}{2(b + d_1)}$$

The anticipated output by duopolist 1 of duopolist 2 in period t+1 is $q'_2(t+1)$. (A primed quantity indicates the quantity is an anticipated output by the other duopolist rather than the actual output. This distinction is necessary in the following computations.)

By definition of conjectural variation $q_1(t+1)$ can be arrived at as follows:

$$q'_2(t) = q_2(t-1) + [q_1(t-1) - q_1(t-2)] \frac{\partial q_2(t)}{\partial q_1(t-1)} \quad . \quad . \quad (10)$$

$$q'_2(t+1) = q_2(t) + [q_1(t) - q_1(t-1)] \frac{\partial q_2(t+1)}{\partial q_1(t)} \quad . \quad . \quad (11)$$

where $\frac{\partial q_2(t)}{\partial q_1(t-1)}$ and $\frac{\partial q_2(t+1)}{\partial q_1(t)}$ are conjectural variations for two successive period. Thus $q_1(t+1)$ becomes:

$$q_1(t+1) = \frac{a - c_1 - b[q'_2(t) + \{q_1(t) - q_1(t-1)\}\ \ell_1(t)]}{2(b + d_1)} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (12)$$

where $\ell_1(t) = \frac{\partial q_2(t+1)}{\partial q_1(t)}$. Substituting equation (12) into (4) :

$$\frac{\partial \pi_1}{\partial q_1(t)} = a - bq_1(t) - bq'_2(t) - bq_1(t) - c_1 - 2d_1 q_1(t)$$

$$- \frac{b}{2(b+d_1)} \Big(a - c_1 - b\,[q'_2(t) + \{q_1(t) - q_1(t-1)\}\,]$$

$$\ell_1(t) \Big) \ell_1(t) = 0 \qquad \dots\dots\dots\dots \qquad (13)$$

Solving for $q_1(t)$:

$$q_1(t) = \frac{2[b+d_1][a-c_1-bq'_2(t)] - b[a-c_1-bq'_2(t)+bq_1(t-1)\ell_1(t)]\ell_1(t)}{b^2[4-\ell_1^2(t)] + 4d_1(2b+d_1)} \qquad \dots\dots\dots\dots \qquad (14)$$

By differentiating equations (1) and (2) with respect to $q_1(t)$ after multiplying equation (1) by $q_1(t)$, marginal revenue and marginal costs are obtained. Equating marginal revenue to marginal cost and solving for $q_1(t)$ yields:

$$q_1(t) = \frac{a - c_1 - bq_2(t)}{2(b+d_1)} \qquad \dots\dots\dots\dots \qquad (15)$$

Equation (15) shows $q_1(t)$ that maximizes profit to duopolist 1 for any value $q_2(t)$ selected by duopolist 2 .

Let conjectural variation be defined as follows:

$$\ell_1(t) = \alpha_1 + \beta_1 \left(\frac{a - c_1 - bq_2(t-1)}{2(b+d_1)} - q_1(t-1) \right) + \gamma_1 \ell_1(t-1) \quad \ldots\ldots\ldots (16)$$

The expression in parenthesis in equation (16) is the quantity by which duopolist 1 missed his profit-maximizing quantity on the last production decision; the expression satisfies the following conditions: (a) If duopolist 2 is not in the market and duopolist 1 is producing a profit maximizing quantity, the conjectural variation is zero; this is expected in real life because duopolist 1 does not expect any reaction from duopolist 2 until duopolist 2 is known to be in the market. (b) When both duopolists are at their respective Cournot equilibriums, conjectural variation defined as $\ell_1(t)$ is zero; this is so because duopolist 1 expects duopolist 2 to eventually produce a quantity specified by the Cournot equilibrium and maintain that quantity.

The constant β exists only when both duopolists fail to reach the Cournot equilibrium. If both duopolists reach the Cournot equilibrium α will be zero. If duopolist 2 becomes a follower, α_2 will be zero and α_1 for duopolist 1 will be negative; the degree of leadership by duopolist 1 is indicated by how negative α_1 is. With Stackleberg disequilibrium, both α_1 and α_2 are negative. If duopolist 1 is attempting to reach a tacit agreement or has obtained one α_1 is positive.

The constant γ exists only when a duopolist considers previous conjectural variations in making current decisions of production quantities.

Using identical procedures, the reaction curve for duopolist 2 is obtained.

$$q_2(t) = \frac{2[b+d_2][a-c_2-bq'_1(t)]-b[a-c_2-bq'_1(t)+bq_2(t-1)\ell_2(t)]\ell_2(t)}{b^2[4-\ell_2^2(t)]+4d_2(2b+d_2)} \quad (17)$$

$$q'_1(t) = q_1(t-1)+[q_2(t-1)-q_2(t-2)]\ell_2(t-1)\ell_2(t-1) \quad (18)$$

$$\ell_2(t) = d_2+\beta_2\left(\frac{a-c_2-bq_1(t-1)}{2(b+d_2)} - q_2(t-1)\right)+\gamma_2\ell_2(t-1) \quad (19)$$

Measurement of Conjectural Variation

Solving equation (14) for $\ell_1(t)$:

$$\ell_1(t) = \frac{-b\{a-c_1-bq'_2(t)\}\pm\sqrt{b^2[a-c_1-bq'_2(t)]^2-4b^2\{q_1(t-1)-q_1(t)\}\{q_1(t)[4b^2+8d_1b+4d_1^2]-2[b+d_1][a-c_1-bq'_2(t)]\}}}{2b^2[q_1(t-1)-q_1(t)]} \quad (20)$$

where

$$q'_2(t) = q_2(t-1)+\{q_1(t-1)-q_1(t-2)\}\ell_1(t-1)$$

To show that the desired root exists only when the square root in the above equation is (+), it is necessary to evaluate limit $\ell_1(t)$ as $q_1(t) \rightarrow q_1(t-1)$ using a (+) sign. Multiplying both numerator and denomenator of equation (20) by

$$\frac{-b\{a-c_1-bq'_2(t)\} - \sqrt{b^2[a-c_1-bq'_2(t)]^2 - 4b^2\{q_1(t-1)-q_1(t)\}}}{\{q_1(t)\left(4b^2+8d_1b+4d_1^2 - 2[b+d][a-c_1 - bq'_2(t)]\right)\}}$$

and letting $q_1(t) \rightarrow q_1(t-1)$:

$$\lim_{q_1(t)\rightarrow q_1(t-1)} \ell_1(t) = \frac{-[4b^2+8d_1b+4d^2]q_1(t) + 2[b+d_1][a-c_1-bq'_2(t)]}{b[a-c_1 - bq'_2(t)]} \qquad \text{. . . . . (21)}$$

Using a (-) sign, $\lim_{q_1(t)\rightarrow q_1(t-1)} \ell_1(t) = \infty$

Equation (21) provides a method of evaluating conjectural variation when the production quantity of a producer remains constant from one period to the next. Of course equation (20) can only be used to evaluate conjectural variation when the production quantity changes.

Using identical calculations, the equations for measuring conjectural variation of duopolist 2 are obtained:

$$\ell_2(t) = \frac{-b\,\{a-c_2-bq_1'(t)\} + \sqrt{b^2[a-c_2-bq_1'(t)]^2 - 4b^2\{q_2(t-1)}}{2b^2\,[q_2(t-1) - q_2(t)\,]}$$

$$\overline{q_2(t)\}\ \{q_2(t)\ [4b^2+8d_1b+4d_1^2] -2[b+d_1][a-c_1-bq_1'(t)]\}}$$

$$\ldots \ldots \quad (22)$$

where

$$q_1'(t) = q_1(t-1) + \{q_2(t-1) - q_2(t-2)\}\ \ell_2(t-1)$$

$$\lim_{q_2(t)\to q_2(t-1)} \ell_2(t) = \frac{-[4b^2+8d_2b+4d_2^2]\,q_2(t) + 2[b+d_2][a-c_2-bq_1'(t)]}{b[a-c_2-bq_1(t)]} \quad \ldots \ldots \quad (23)$$

The conjectural variation for each decision of every game was computed with the aid of an IBM 1620 computer using equations (20) through (23) .

Description of Games

Five empirical games were played; and in each game there were 10 to 21 players representing duopolist 1 and 10 to 21 players representing duopolist 2 for a total of approximately 160 players. The players were undergraduate students at Utah State University who volunteered and had completed Freshman Economics. As each student volunteered he was arbitrarily assigned a future game time that was not in conflict with a previously scheduled game or the student's class schedule.

Physical arrangements were such that a player did not know the identity of his opponent until after the game. It was felt that asking each player not to discuss the experiment with anyone would cause more discussion than if they were not asked. Also discussion probably could not bias the results since a player and any preceeding player had only one chance in eight of being assigned matricies with the same payoff levels.

When a bargaining pair first met with the administrator, each player was furnished with an instruction sheet (see Appendix I), a copy of one of various compatible payoff matricies (see Appendixes II through XI) and the starting production quantity of both duopolists. The starting point on all matricies was the quantity that results in maximum profit to a duopolist if his opponent is not in business. In other words the conjectural variation is zero for both duopolists when they first start production; theoretically, neither duopolist knows the other exists, and neither duopolist expects retaliation until he is aware of the competition.

Next each duopolist examined his payoff matrix and secretly marked the quantity of production on a slip of paper. The administrator examined both slips of paper, recorded $q_1(1)$ and $q_2(1)$ along with the payoff, and advised each player of his payoff and opponents move by returning the paper. After 9 more such moves the payoffs were totaled and paid. No conversation was permitted between participants during the session.

Calculation of Payoff Matricies

All payoff matricies contain 962 cells. (See Appendixes II through XI) In each cell the lower number is the payoff to duopolist 1 and the upper number is the payoff to duopolist 2 . A cell is selected by duopolist 1 choosing a q_1 on the abscissa and duopolist 2 simultaneously choosing a q_2 on the ordinate. If duopolist 1 holds his q_1 constant, duopolist 2 can select 31 cells by varying his q_2 and visa versa. If a game is classified as limited information, as contrasted to full information, each player knows only his own payoff so there is just one payoff number in each cell.

Payoffs to duopolists 1 and 2 with identical cost curves (Cournot equilibrium of 63 for both duopolists) are calculated from the following equation:

$$\pi_1 = \pi_2 = \{117 - 0.5\,[q_1(t)+q_2(t)]\}\, q_1(t) - 810 - 9.0\, q_1(t) - 0.1 q_1^2(t) \qquad . \; . \; . \; . \; . \; . \; . \; . \; . \; (24)$$

Payoffs to duopolist 1 with similar cost curves (Cournot equilibrium of 66) are calculated from the following equation:

$$\pi_1 = \{117 - 0.5\,[q_1(t)+q_2(t)]\}\, q_1(t) - 1260 - 9.0\, q_1(t) - 0.1\, q_1^2(t) \qquad . \; . \; . \; . \; . \; . \; . \; . \; . \; (25)$$

Payoffs to duopolist 2 with similar cost curves (Cournot equilibrium of 56) are calculated from the following equation:

$$\pi_2 = \{117 - 0.5\,[q_2(t)+q_1(t)]\}\, q_2(t) - 880 - 5.0\, q_2(t) - 0.2\, q_2^2(t) \qquad \ldots\ldots\ (26)$$

Payoffs to duopolist 1 with dissimilar cost curves (Cournot equilibrium of 72) are calculated from the following equation :

$$\pi_1 = \{117 - 0.5\,[q_1(t)+q_2(t)]\}\, q_1(t) - 1890 - 9.0\, q_1(t) - 0.1\, q_1^2(t) \qquad \ldots\ldots\ (27)$$

Payoffs to duopolist 2 with dissimilar cost curves (Cournot equilibrium of 42) are calculated from the following equation :

$$\pi_2 = \{117 - 0.5\,[q_2(t)+q_1(t)]\}\, q_2(t) - 297 - 18.0\, q_2(t) - 0.25\, q_2^2(t) \qquad \ldots\ldots\ (28)$$

<u>Outcomes of Games</u>

Table 1 lists $q_1(1) \ldots q_1(10)$ for all players representing duopolist 2 with identical cost curves and limited information; below each quantity is listed the conjectural variation exhibited by the player in selecting that quantity. Table 2 contains the same information for all players with identical cost curves and complete information. Table 3 contains the same information for all players with similar cost curves and limited information. Table 4 contains the same information for all players with dissimilar cost curves and limited information. Table 5 contains the same information for all players with dissimilar cost curves and complete information.

Table 1A. Conjectural variations for duopolists 1 with identical cost curves, limited information.

62.	64.	62.	62.	64.	62.	60.	60.	62.	66.
-.4870	-.2633	.1470	.0239	-.0576	-.0111	-.1419	-.1465	-.1148	-.1987
54.	60.	70.	68.	66.	62.	62.	68.	64.	62.
-.0700	.1191	-.0993	-.3801	-.0489	-.0477	.0476	-.2094	-.4138	.0558
64.	44.	48.	66.	70.	70.	60.	50.	56.	64.
-.6000	.5957	.8445	-.2572	-.1735	-.1407	.0954	.5461	.5285	.1370
60.	54.	52.	54.	68.	62.	56.	66.	60.	62.
-.3766	.2479	.4708	.4456	-.0311	.1729	.2335	-.1432	.0869	-.0045
58.	68.	80.	68.	48.	70.	80.	58.	66.	64.
-.2699	.0314	-.5375	-.2068	.4213	-.3366	-.2537	.2038	-.4165	-.1368
64.	72.	60.	66.	74.	68.	64.	68.	66.	66.
-.6000	-.3866	.1694	-.1331	-.3819	-.1945	-.0120	-.2109	-.0552	-.0078
58.	54.	58.	60.	64.	62.	58.	56.	64.	70.
-.2699	.4433	.3884	.3249	.1713	.2391	.2898	.4209	.0497	-.1257
70.	56.	48.	70.	70.	56.	68.	64.	42.	72.
-.9404	-.3181	.6252	.0143	-.0335	-.0438	-.0881	-.0733	.7100	-.0732
58.	64.	62.	50.	58.	62.	62.	62.	64.	66.
-.2699	-.2427	.0105	.3878	.1843	-.0708	-.0084	.0192	-.0253	-.1001
64.	90.	66.	68.	64.	64.	64.	40.	70.	62.
-.6000	-1.1490	.2980	.0568	.0045	.0372	-.0253	.6957	-.1371	-.1136
60.	60.	70.	80.	62.	64.	58.	60.	66.	64.
-.3766	-.0563	-.1505	-.5800	-.0497	-.1402	.2325	.1174	-.0097	.0071
50.	64.	54.	60.	70.	82.	52.	56.	62.	64.
.1104	-.0186	.3993	.0649	-.2552	-.9335	.4551	.4816	.1123	-.0043
64.	60.	62.	58.	58.	60.	62.	66.	62.	62.
-.6000	-.4296	-.1098	-.0893	.0076	.0649	.0485	-.1024	.0568	.0845
46.	42.	56.	52.	70.	70.	62.	60.	66.	62.
.2714	.6346	.3222	.0867	-.5593	.1100	-.0130	-.0017	-.1007	.0287

Table 1A. Continued

78.	66.	58.	58.	56.	58.	80.	58.	58.	58.
-1.3356	-.2079	.1034	.0933	.1902	.1488	-.6557	.3048	.3960	.1427
66.	56.	54.	60.	70.	64.	60.	64.	66.	70.
-.7143	.0081	.3794	.0770	-.2907	-.0109	.1249	-.1160	-.1951	-.3883
66.	58.	70.	72.	76.	68.	72.	66.	66.	70.
-.7143	-.2371	.0015	-.1288	-.8862	.0339	.0997	-.0752	-.1085	-.0000
66.	66.	68.	60.	64.	64.	52.	52.	52.	64.
-.7143	-.3378	-.0789	.1278	-.0091	.0068	.4158	.4921	.4551	-.0252
52.	64.	58.	66.	56.	64.	64.	54.	64.	66.
.0227	.1379	.3128	-.3501	.2837	-.0439	-.0197	.2926	-.0106	-.1324
60.	60.	64.	60.	60.	60.	56.	54.	54.	58.
-.3766	.0116	.1801	.0211	.1276	.1558	.2480	.3385	.3079	.1121
68.	64.	66.	64.	66.	64.	62.	64.	66.	62.
-.8284	-.2779	-.0864	-.0225	-.0068	-.0251	.0802	.0087	-.1012	.0536

Table 1B. Conjectural variations for duopolists 2 with identical cost curves, limited information.

64.	58.	66.	66.	68.	80.	80.	74.	70.	66.
-.6000	-.0139	-.1019	-.0556	-.1431	-.5977	-.4590	-.3367	-.2198	-.0829
62.	54.	76.	60.	70.	64.	66.	86.	62.	60.
-.4870	.2987	-.3471	.1482	-.2763	-.0132	-.0698	-.7422	.2010	.1958
56.	52.	70.	64.	58.	66.	60.	50.	50.	68.
-.1676	.3494	.0753	.1866	.1879	-.1821	.0561	.5392	.7196	-.0477
60.	62.	58.	54.	56.	68.	68.	68.	68.	68.
-.3766	-.0679	.3367	.5125	.4361	-.2568	-.0935	-.0480	-.2112	-.1108
42.	60.	72.	72.	78.	50.	66.	86.	74.	78.
.4145	.4807	-.5501	-.5083	-.6201	.6533	.0868	-1.1001	.0320	-.5787
52.	64.	68.	64.	68.	62.	66.	62.	58.	62.
.0227	-.0116	-.3146	.0558	-.2062	-.1008	-.1783	.0614	.1459	.0284
48.	52.	48.	50.	50.	58.	54.	60.	56.	54.
.1933	.6058	.6566	.6117	.5393	.2043	.3553	.2342	.3628	.3712
78.	54.	52.	50.	84.	58.	68.	66.	64.	72.
-1.3356	.0069	.5265	.6908	-.7523	.4255	.1110	-.1885	-.0313	.0157
68.	68.	72.	70.	70.	68.	66.	64.	64.	62.
-.8284	-.4022	-.3256	-.1967	-.0347	-.0791	-.0712	.0040	.0064	.0505
64.	64.	56.	62.	60.	64.	74.	74.	78.	74.
-.6000	-.3026	-.1617	-.0015	.0650	-.0232	-.3924	-.3336	-.1522	-.5145
64.	58.	64.	76.	70.	62.	66.	58.	62.	64.
-.6000	.0205	.0388	-.5759	-.4291	.0415	-.0954	.2865	.1444	-.0670
68.	60.	72.	64.	80.	70.	62.	58.	62.	64.
-.8284	.0611	-.3120	.1744	-.5020	-.2208	-.3158	.3284	.1870	-.0054
78.	72.	82.	76.	68.	64.	64.	64.	62.	64.
-1.3356	-.6698	-.6775	-.3268	-.1108	.0536	.0402	.0062	.0192	.0068
90.	64.	82.	82.	50.	68.	72.	64.	66.	74.
-1.7143	.2239	-.2217	-.4802	.5786	.0192	-.4419	.0333	-.0327	-.4305

Table 1B. Continued.

54.	68.	72.	70.	68.	68.	70.	56.	68.	66.
-.0700	-.4684	-.2474	-.1363	-.0834	-.0506	-.1516	.0334	-.0713	.0069
64.	62.	68.	66.	66.	64.	70.	70.	72.	76.
-.6000	-.2581	-.0558	.0581	-.0351	-.1251	-.1596	-.1596	-.3270	-.4991
72.	46.	52.	84.	54.	36.	62.	64.	48.	52.
-1.0485	.3545	.6227	-.8417	.5309	.2498	-.2798	-.2798	.5334	.5175
60.	58.	64.	62.	64.	64.	64.	62.	64.	64.
-.3766	-.0086	-.0577	-.0850	.1106	-.0217	-.0246	.2218	.1586	.1478
54.	54.	80.	66.	68.	64.	68.	66.	66.	64.
-.0700	.4738	-.5750	.1987	-.1633	.1004	-.1693	-.0901	.0507	-.0253
60.	50.	70.	64.	62.	66.	66.	68.	70.	72.
-.3766	.3987	-.1185	.0119	.1117	-.0334	-.0348	-.0480	-.0873	-.1569
60.	62.	64.	58.	64.	62.	62.	64.	64.	62.
-.3766	-.2118	-.0185	.1722	-.0089	.0200	.0511	.0062	-.0255	.0192

Table 2A. Conjectural variations for duopolists 1 with identical cost curves, complete information.

58.	58.	62.	68.	86.	64.	60.	62.	64.	62.
-.2699	-.1825	-.0460	-.2063	-.9839	.0017	-.0680	-.1924	-.1529	-.3424
78.	62.	64.	60.	64.	82.	70.	66.	62.	76.
-1.3356	-.3640	-.2291	.3213	.1429	-.8481	-.2713	-.2652	-.0640	-.3966
70.	80.	74.	82.	76.	86.	84.	84.	40.	50.
-.9404	-1.1236	-.2458	-1.2364	-.6162	-1.2298	-.7850	-1.1464	.8553	1.0543
50.	68.	82.	86.	78.	74.	76.	80.	84.	60.
.1104	-.2664	-6169	-.6001	-.5648	-.5801	-.4830	-.5285	-.6494	.2140
54.	70.	66.	78.	78.	78.	70.	70.	70.	78.
-.0700	-.1578	.0317	-.7974	-.6445	-.6773	-.1864	-.1762	.2323	-.8170
30.	66.	70.	66.	68.	62.	66.	64.	80.	74.
.7562	.5473	-.5080	-.5323	-.1786	.0248	-.2357	.0511	-.7374	-.1719
88.	52.	54.	64.	60.	62.	60.	60.	62.	62.
-1.6670	.0350	.6091	-.1447	-.0092	-.0806	.0027	.0330	-.0130	.0196
50.	80.	86.	88.	76.	70.	64.	56.	80.	88.
.1104	-.4066	-.6035	-.8892	-.5906	-.3115	-.0556	.2694	-.4788	-.6086
58.	74.	54.	60.	80.	74.	76.	58.	58.	86.
-.2699	-.9405	.2472	.0156	-.8393	-.3960	-.9132	-.0240	-.1392	-1.1337
74.	78.	70.	82.	72.	86.	80.	76.	72.	70.
-1.1511	-.8448	-.2673	-.9899	-.2302	-1.3407	-.4746	-.7159	-.5045	-.2191
60.	60.	58.	62.	58.	60.	60.	60.	50.	60.
-.3766	-.0218	.2576	-.0046	.2570	.0495	.0313	.0960	.6404	-.0269
80.	86.	86.	86.	86.	88.	88.	78.	80.	72.
-1.4164	-1.4922	-.5671	-.7352	-1.1383	-1.4660	-1.4713	-1.2278	-.9810	-.2281
78.	78.	78.	78.	78.	78.	78.	78.	78.	78.
-1.3356	-1.0567	-.6773	-.5174	-.4800	-.3065	-.4435	-.4435	-.4435	-.5174

Table 2B. Conjectural variations for duopolist 2 with identical cost curves, complete information.

78.	70.	66.	76.	80.	76.	78.	72.	86.	76.
-1.3356	-.4515	-.0625	-.4349	-.6147	-.9311	-.6248	-.2395	-.7897	-.2899
70.	70.	50.	54	74.	80.	70.	70.	60.	60.
-.9404	-.9828	.4977	.4853	-.3508	-.4888	-.5681	-.4734	.0954	.1697
70.	66.	88.	80.	80.	76.	78.	46.	48.	90.
-.9404	-.6002	-1.1690	-.3534	-1.1129	-.7426	-1.1172	.3899	.4896	-.5016
74.	66.	60.	66.	68.	62.	60.	60.	60.	60.
-1.1511	-.1776	.0422	-.4237	-.5506	-.1686	-.0513	-.0704	-.1412	-.2182
56.	58.	78.	78.	70.	60.	58.	30.	78.	62.
-.1676	.2635	-.6333	-.3620	-.5386	-.1877	-.0543	1.0170	-.1673	.0808
62.	58.	88.	62.	66.	72.	60.	72.	62.	60.
-.4870	.4569	-.8092	.2899	-.0132	-.3948	.1872	-.3161	.1070	-.1215
86.	44.	70.	74.	72.	72.	70.	68.	66.	68.
-1.6141	.2865	.1113	-.2770	-.3099	-.2691	-.2188	-.1180	-.0406	-.1444
58.	64.	66.	70.	60.	64.	64.	60.	60.	60.
-.2699	.0575	-.4000	-.6689	-.2495	-.2787	-.1058	.1259	.2468	-.1412
84.	86.	76.	78.	80.	82.	80.	84.	86.	90.
-1.5552	-.9206	-.6750	-.4908	-.5318	-1.0305	-.8077	-1.0636	-.6478	-.8367
60.	68.	78.	70.	88.	74.	72.	70.	60.	50.
-.3766	-.5764	-.7146	-.2357	-1.2304	-.1678	-.8605	-.6082	-.0908	.3774
62.	60.	68.	60.	70.	70.	66.	50.	80.	70.
-.4870	-.0276	-.1110	.2224	-.1861	-.1222	-.0370	.5239	-.3772	.1252
78.	58.	58.	76.	86.	88.	88.	68.	60.	56.
-1.3356	-.4131	-.3442	-.8640	-.9423	-1.2144	-1.4863	-.7472	-.4200	-.0319
70.	70.	62.	60.	50.	58.	58.	58.	62.	60.
-.9404	-.9828	-.1899	-.1325	.3024	.0311	-.0252	-.0209	-.1868	-.0910

Table 3A. Conjectural variations for duopolists 1 with similar cost curves, limited information.

60.	70.	68.	48.	66.	72.	72.	70.	74.	60.
-.1459	-.2214	-.0757	.6595	.2615	-.2345	-.2016	-.0289	-.1990	.1925
60.	64.	56.	70.	80.	60.	68.	64.	64.	66.
-.1459	.0908	.2959	-.1131	-.4735	.1631	-.3652	-.3356	-.0148	-.0369
70.	60.	62.	58.	58.	54.	66.	62.	58.	66.
-.6215	.1189	.0380	.2825	.2739	.4020	-.1730	.1403	.3168	-.1797
64.	64.	66.	64.	66.	66.	58.	64.	66.	66.
-.3316	-.1013	.0240	.0362	.2415	-.0135	.1416	.0837	.0461	-.0384
60.	62.	64.	60.	58	52.	80.	64.	66.	68.
-.1459	-.0864	-.1566	-.0285	.1098	.5204	-.4281	.1761	.0361	-.1118
62.	60.	54	54.	70.	58	52.	68.	56	66.
-.2375	.1164	.5407	.3703	-.3483	.3245	.5610	-.0574	.4528	.0452
80.	80.	62.	70.	66.	66.	66.	68.	68.	66.
-1.0729	-.5677	.2173	-.0013	-.0059	.0236	.0240	-.0178	-.0475	-.0369
52.	52.	56.	56.	60.	66.	66.	60.	68.	68.
.1878	.6700	.4620	.3075	.1565	.2342	-.0277	.3145	.0672	-.0258
60.	64.	56	50.	64.	62.	64.	60.	58.	64.
-.1459	-.0313	.1906	.5598	.0874	.1505	.2102	.1778	.1227	.0407
58.	62	60.	58.	80.	62.	64.	70.	68.	70.
-.0572	.1427	.4054	.2132	-.3829	.4246	.2276	-.0065	.0964	.0854
64.	54.	56.	62.	64.	68.	68.	74.	64.	64.
-.3316	.4820	.2622	.0109	.0052	-.0790	-.0131	-.2944	.0631	.1051
70.	66.	68.	68.	66.	68.	68.	68.	68.	68.
-.6215	-.4523	-.0759	-.0766	.0240	-.0472	-.0466	-.0480	-.0480	-.0480
62.	40.	62.	62.	66.	66.	64.	62.	64.	66.
-.2375	.7857	.3557	-.0770	-.0369	.0555	.0959	.1134	.0702	-.0082

Table 3B. Conjectural variations for duopolists 2 with similar cost curves, limited information

58.	60.	52.	52	54.	58.	50.	52.	60.	52.
-.6663	-.3482	.1633	.2084	.3963	-.0923	.2246	.1495	-.2570	.1182
52.	62.	58	58	66.	78.	84.	62.	60.	64.
-.2561	-.2939	.0093	.0939	-.5446	-1.2046	-.8652	-.2223	-.2334	-.3422
52.	66.	58.	60.	60.	70.	60.	56.	70.	68.
-.2561	-.6800	.1780	-.0783	-.0311	-.4915	.1100	.0404	-.5574	-.2682
60.	56.	60.	40.	58.	68.	58.	54.	60.	62.
-.8079	-.2540	-.1582	.7518	.2065	-.6298	.0323	.2530	-.1210	-.2615
68.	72.	74.	70.	56.	58.	62.	58.	60.	54.
-1.3391	-.9894	-.6901	-.6099	.0819	.0796	-.0286	-.3588	-.1663	.1255
58.	48.	66.	70.	60.	56.	60	50.	60.	56.
-.6663	.2419	-.2995	-.3266	.0539	-.0410	-.0365	.5079	-.1194	.2041
50.	52.	52.	58.	56.	56.	54.	56.	60.	54.
-.1291	-.1092	-.0268	-.0069	-.0502	.0195	.1203	.0255	-.2152	.1007
50.	50.	60.	62.	40.	58.	50.	50.	54.	56.
-.1291	.4684	.0654	-.1045	.8428	.3190	.2228	.3467	.2197	-.0303
60.	70.	60.	60.	56.	48.	60.	70.	60.	60.
-.8079	-.8618	.0103	..0017	.2750	.4538	-.0399	-.5974	.0325	-.0282
56.	42.	64.	52.	42.	54.	48.	46.	42.	42.
-.5260	.6182	-.1377	.3504	.8254	.0194	.4657	.5805	.6664	.7247
44.	70.	66.	62.	58.	54.	58.	60.	56.	60.
.2134	-.4425	-.0509	-.0.971	-.0137	.1525	-.1032	-.2069	-.1193	-.1482
70.	56.	58.	56.	56.	56.	56.	56.	56.	56.
-1.4531	-.3610	-.1727	-.0081	-.0147	.0213	-.0144	-.0144	-.0144	-.0144
58.	60.	64.	60.	54.	56.	60.	58.	58.	58.
-.6663	-.3905	.0847	-.1101	.1784	.0400	-.1779	.0294	-.0079	-.0420

Table 4A. Conjectural variations for duopolists 1 with dissimilar cost curves, limited information.

60.	66.	62.	64.	68.	66.	70.	68.	66.	72.
.0942	.1757	.2843	.2717	.0611	.1064	.0030	.0957	.1660	-.0636
62.	68.	74	68	82.	68.	70.	72.	74.	64.
.0191	-.0704	-.1007	-.0388	-.2809	-.0492	.0736	-.0132	-.3656	.1336
60.	68.	64.	66.	66.	68.	68.	70.	70.	70.
.0942	.1345	.0802	.1943	.1045	-.0480	-.0465	..0558	.0543	.0828
60.	66.	62	40.	80.	90.	70.	74.	76.	78.
.0942	.0654	.3403	.6950	-.0596	-.6873	.1912	.0814	-.1497	-.1773
76.	64.	64.	68.	70.	64.	62.	68.	78.	72.
-.5462	.1816	.1270	.0405	.0260	-.0586	.0136	.0409	-.2132	.0453
64.	74.	76.	78.	66.	66.	70.	66.	78.	78.
-.0582	-.0151	.0228	-.1531	.0285	.0291	-.0000	-.0061	-.0158	-.0130
60.	62.	62.	64.	64.	66.	66.	68	70.	70.
.0942	.1799	.1906	.2575	.2249	.1902	.1849	.1492	.0788	.0537
66.	64.	74.	68.	68.	68	68.	74.	68.	70.
-.1374	-.0141	.1087	.0533	.0450	.1745	-.0178	.1088	.0594	.1647
68.	74.	70.	76.	78.	74.	72.	78.	68.	62.
-.2182	-.3419	-.3263	-.2556	-.2808	-.1291	-.0184	-.1525	-.1980	.4527
64.	78.	66.	54.	60.	54.	64.	70.	74.	68.
-.0582	-.4867	.0648	.4036	.2537	.3809	.0714	.0461	-.0535	.0986
72.	74,	76.	68.	54.	58.	58.	52.	50.	50.
-.3823	-.0621	.-225	.1215	.4723	.5572	.4993	.5834	.7148	.6591
58.	64.	58.	66.	62.	60.	70.	62.	70.	64.
.1669	.2759	.4095	.0009	.2724	.4462	-.0159	.1688	-.2604	.1250
66.	62.	66.	68.	70.	70.	68.	72.	72.	72,
-.1374	-.0344	.0802	.0070	-.0002	.0282	.0685	.0184	.0155	.0166
70.	72.	60.	62.	62.	64.	66.	66.	66.	64.
-.3000	-.2576	.1326	.0749	.1935	.0369	.0523	.1084	.0533	-.0576

Table 4A. Continued

54.	40.	80.	72.	70.	68.	68.	70.	68.	70.
.3042	1.0162	-.0991	-.1301	.0136	.0408	.1756	.0282	.1219	.0861
64.	66.	60.	66.	64.	68.	70.	70.	78.	82.
-.0582	.0604	.1816	.0692	.1462	.0447	-.0315	.0009	-.2100	-.2867
50.	58.	80.	78.	62.	70.	78.	84.	84.	88.
.4306	.4102	-.7435	-.2379	.0430	.0923	-.3138	-.4311	-1.1950	-.6435
74.	68.	68.	70.	78.	78.	68.	68.	74.	70.
-.4646	-.1684	-.0636	-.1198	-.3960	-.3535	-.0481	-.0554	-.0218	.0575
58.	66.	66.	58.	50.	70.	80.	64.	74.	66.
.1669	.0728	.1293	.2279	.7193	.1337	-.2849	.1345	.0074	.2836
38.	74.	66.	74.	74.	50.	64.	90.	70.	60.
.7472	.3847	-.0038	-.2290	-.2338	.5133	.4357	-.7505	.2434	.2984

Table 4B. Conjectural variations for duopolists 2 with dissimilar cost curves, limited information.

48.	46.	44.	48.	50.	48.	46.	46.	48.	44.
-1.2679	-.6007	-.0276	-.1768	-.3389	-.3073	-.1514	-.2420	-.3215	.0145
58.	46.	56.	40.	60.	42.	44.	62.	54.	54.
-2.1879	-.5213	-.9932	.3012	-.8883	.1703	.0240	-1.1688	-.3105	-.9995
46.	56.	44.	50.	56.	56.	44.	44.	42.	42.
-1.0297	-1.1752	.2029	-.2945	-.7430	-.6934	-.0464	-.0592	.0468	.0490
56.	42.	76.	44.	52.	40.	36.	44.	42.	40.
-2.0593	-.2257	-1.6180	.8154	.4673	-.1531	-.0520	-.0982	-.0290	.0477
42.	56.	50.	46.	66.	66.	50.	44.	42.	50.
-.5729	-1.3018	.0706	-.0800	-1.3142	-.8501	-.3750	-.0463	.0860	-.7110
38.	32.	40.	56.	56.	48.	58.	30.	30.	46.
-.1746	.7437	.2001	-1.0418	-.6877	-.2774	-.9523	.8793	1.2761	-.4258
58.	54.	44.	46.	44.	44.	42.	42.	44.	42.
-2.1879	-1.0714	-.0065	-.0455	.0468	.0468	.1361	.1423	-.0461	.0490
60.	30.	48.	50.	40.	54.	30.	48.	36.	44.
-2.2918	.6194	..1722	-.7137	.2559	-.6250	.9106	.1581	.3158	.0402
56.	70.	50.	50.	48.	44.	40.	66.	30.	30.
-2.0593	-2.1608	.0818	-.4712	-.5459	-.3341	.0650	-1.3367	1.0154	1.3789
60.	60.	60.	60.	60.	60.	44.	42.	46.	48.
-2.2918	-1.4907	-1.5000	-1.0909	-.7500	-.9130	.2434	.2578	-.2199	-.4560
36.	32.	44.	54.	42.	38.	50.	48.	52.	56.
-.0000	.6988	-.1217	-.8745	.2693	.6651	-.1524	-.0460	-.2063	-.3826
48.	46.	60.	48.	40.	50.	56.	66.	56.	46.
-1.2679	-.5381	-.9645	.1831	.3116	-.2449	-.5744	-1.3751	-.3750	-.3414
66.	52.	52.	48.	46.	48.	42.	42.	42.	42.
-2.5000	-.5813	-.6602	-.2750	-.2125	-.3839	.0643	..1009	0.0000	0.0000
54.	64.	64.	54.	60.	54.	50.	54.	66.	44.
-1.9019	-2.0693	-.9266	-.5431	-1.0820	-.4181	-.4278	-.7145	-1.2627	.2958

Table 4B. Continued

50.	46.	56.	46.	50.	40.	46.	44.	42.	50.
-1.5000	-.4570	-.2240	-.4608	-.6912	.2425	-.1256	-.0286	.0455	-.4468
52.	60.	54.	52.	50.	50.	48.	44.	42.	40.
-1.7143	-1.6991	-.3429	-.4456	-.4352	-.3802	-.3247	-.1099	.0367	.0018
66.	70.	62.	64.	42.	50.	48.	84.	50.	46.
-2.5000	-1.2167	-.8962	-2.1163	-.0430	-.3257	-.3091	-2.0569	.5519	-.1187
56.	56.	56.	56.	56.	56.	56.	40.	44.	40.
-2.0593	-1.8740	-.8769	-.8769	-.9375	-1.2000	-1.2000	.2246	.0358	.0931
58.	48.	62.	44.	44.	42.	56.	40.	36.	44.
-2.1879	-.5515	-1.2411	.3354	.2884	.4433	-.8347	.2182	.6319	-.1287
46.	44.	54.	56.	60.	42.	50.	48.	56.	44.
-1.0297	.1590	-.8511	-.5821	-1.2633	.0703	-.0148	-.2218	-.5152	.1714

Table 5A Conjectural variations for duopolists 1 with dissimilar cost curves, complete information.

62.	72.	78.	82.	86.	72.	70.	70.	72.	74.
.0191	-.1502	-.3111	-.3143	-.3911	.0377	.0629	.0300	-.0112	-.0493
58.	62.	52.	66.	62.	64.	66.	66.	70.	64.
.1669	.3181	.6229	.1141	.0869	.1843	.0185	.0234	.1352	.0287
70.	60.	64.	64.	64.	66.	64.	64.	64.	64.
-.3000	.3822	.3294	.2652	.2567	.1902	.2759	.2636	.2814	.2567
44.	60.	60.	68.	66.	70.	82.	70.	70.	74.
.6000	.5655	.1105	-.1752	-0783	-0312	-4298	.0974	-.2674	-.1070
74.	78.	90.	72.	90.	90.	90.	70.	74.	74.
-.4646	-.5373	-.7549	.1328	-.5122	.4294	-.5793	-.1219	-.0005	.0320
80.	80.	84.	80.	78.	90.	78.	80.	84.	84.
-.7051	-.1750	-.4746	-.6867	-.1349	-.9845	.0575	-.9106	-.4445	-.3216
80.	56.	70.	80.	66.	66.	68.	60.	66.	70.
-.7051	.4606	-.1026	-.5812	.0788	.0692	-.0178	.2277	.1634	-.0433
64.	78.	80.	62.	58.	90.	70.	70.	68.	72.
-.0582	-.3864	-.1399	.0236	.1782	-.7522	.2495	.0141	.0117	-.1907
76.	74.	80.	76.	88.	86.	90.	80.	88.	90.
-.5462	-.2260	-.4450	-.43520	-.9464	-.5637	-1.0524	-.6125	-1.0605	-.8616
72.	90.	86.	90.	80.	80.	68.	90.	78.	70.
-.3823	-1.0385	-.1447	-.6852	-.4436	-.5621	.1475	-.9334	.0170	.1112

Table 5B. Conjectural variations for duopolists 2 with dissimilar cost curves, complete information.

54.	52.	44.	40.	42.	44.	46.	44.	42.	44.
-1.9019	-1.1589	-.2045	-.0415	-.2621	-.5145	-.2580	-.0814	.0431	-.1404
50.	44.	56.	60.	50.	56.	56.	38.	60.	46.
-1.5000	-.4231	-.7286	-.4836	-.3701	-.7818	-.6340	.3885	-.7870	.1489
38.	42.	42.	44.	44.	42.	44.	42.	44.	42.
-.1746	-.0702	.2664	.0448	.0428	.1786	.0081	.1783	.0527	.1764
58.	56.	64.	64.	50.	50.	46.	66.	46.	32.
-2.1879	-.6996	-1.1405	-.9151	-.4871	-.5948	-.2361	-1.6750	.4152	.8183
56.	56.	42.	42.	42.	42.	56.	36.	36.	36.
-2.0593	-1.8740	-.1527	-.5707	0.0000	-.5000	-1.4092	.4339	.6295	.3871
30.	48.	68.	36.	66.	36.	78.	48.	40.	64.
.4365		1.5970	.6789	-1.0255	.7415	-1.5824	.6211	.3577	-1.4794
40.	66.	64.	58.	54.	54.	56.	48.	50.	48.
-.3655	-1.7451	-.0742	-1.1443	-1.4486	-.8509	-.8083	-.2873	-.3146	-.2582
54.	40.	66.	66.	58.	52.	52.	52.	56.	54.
-1.9019	-.2457	-1.5560	-.7487	-.8842	-.5336	-1.4657	-.6563	-9115	-.6427
46.	54.	64.	66.	60.	66.	66.	66.	66.	66.
-1.0297	-1.5925	-1.1205	-1.5597	-1.4114	-2.4854	-1.6804	-2.5000	-2.0339	-2.4000
64.	40.	48.	56.	56.	42.	68.	48.	40.	32.
-2.4439	.0274	-9143	-1.1374	-1.3040	-.2086	-1.6802	.4856	-.0586	.5689

RESULTS AND DISCUSSION

Regression techniques were used to fit the conjectural variation models described by equations (16) and (19) to the measured conjectural variations of each game. The constants β and γ were evaluated and, when significant at the 1% level or better, included in the model for conjectural variation. The constant α can be considered the value of conjectural variation approached as the number of time periods become large. For each game α_1 was substituted for $\ell_1(t)$ in equation (14) and α_2 was substituted for $\ell_2(t)$ in equation (17), and the equations were solved by iterations to determine $\lim_{t \to \infty} q_1(t)$ and $\lim_{t \to \infty} q_2(t)$. The models for conjectural variation can be used to predict the dynamic time path of subsequent games with the same demand curve, cost curve, and knowledge about the rival's profit.

Identical Cost Curves, Limited Information

$\alpha_1 = 0.0082$

$\beta_1 = 0.0122$ at a significance level of 0.1%

$\gamma_1 = -0.0149$ with no significance

Therefore, the model for conjectural variation becomes :

$$\ell_1(t) = 0.0082 + 0.0122\left(\frac{117 - 9 - 0.5\, q_2(t-1)}{2(0.5 + 0.1)} - q_1(t-1)\right) \quad \text{(29)}$$

at a significance level of 0.1% .

$\alpha_2 = -0.0163$

$\beta_2 = 0.0155$ at a significance level of 0.1%

$\gamma_2 = -0.1134$ at a significance level of 25%

Therefore, the model for conjectural variation becomes:

$$\ell_2(t) = -0.0163 + 0.0155 \left(\frac{117 - 9 - 0.5\,q_1(t-1)}{2(0.5 + 0.1)} - q_2(t-1) \right) \quad \ldots\ldots\ldots (30)$$

at a significance level of 0.1%

$$\lim_{t \to \infty} q_1(t) = \lim_{t \to \infty} q_2(t) = 63$$

which is the Cournot equilibrium of both duopolists.

Identical Cost Curves, Complete Information

$\alpha_1 = -0.1558$

$\beta_1 = 0.01594$ at a significance level of 0.1%

$\gamma_1 = 0.1991$ with no significance

Therefore the model for conjectural variation becomes :

$$\ell_1(t) = -0.1558 + 0.01594 \left(\frac{117 - 9 - 0.5\,q_2(t-1)}{2(0.5 + 0.1)} - q_1(t-1) \right) \quad \ldots\ldots\ldots (31)$$

at a significance level of 0.1%

$\alpha_2 = -0.1685$

$\beta_2 = 0.0195$ at a significance level of 0.1%

$\gamma_2 = -0.0670$ with no significance

Therefore, the model for conjectural variation becomes:

$$\ell_2(t) = -0.1685 + 0.0195 \left(\frac{117 - 9 - 0.5\, q_1(t-1)}{2(0.5 + 0.1)} - q_2(t-1) \right) \quad \ldots \ldots \ldots (32)$$

at a significance level of 0.1%

$$\lim_{t \to \infty} q_1(t) = \lim_{t \to \infty} q_2(t) = 67$$

as compared with the Cournot equilibrium of 63. Since quantities of production of 67 are unstable, Stackleberg disequilibriums are centered about 67. With production at 67 both duopolists could fix their production at a lower rate with temporary benefits to both.

<u>Similar Cost Curves, Limited Information</u>

$\alpha_1 = 0.0467$

$\beta_1 = 0.01112$ at a significance level of 0.1%

$\gamma_1 = -0.0308$ with no significance

Therefore, the model for conjectural variation becomes :

$$\ell_1(t) = 0.0467 + 0.01112\left(\frac{117 - 9 - 0.5\, q_2(t-1)}{2(0.5 + 0.1)} - q_1(t-1)\right) \quad \ldots\ldots\ldots (33)$$

at a significance level of 0.1%

α_2 = -0.01665

β_2 = 0.01701 at a significance level of 0.1%

γ_2 = 0.08512 with no significance

Therefore, the model for conjectural variation becomes :

$$\ell_2(t) = -0.01665 + 0.0171\left(\frac{117 - 5 - 0.5\, q_1(t-1)}{2(0.5 + 0.2)} - q_2(t-1)\right) \quad \ldots\ldots\ldots (34)$$

at a significance level of 0.1%

$$\lim_{t \to \infty} q_1(t) = 66\ , \quad \lim_{t \to \infty} q_2(t) = 56$$

which is the Cournot equilibrium.

<u>Dissimilar Cost Curves, Limited Information</u>

α_1 = 0.03016

β_1 = 0.00472 at a significance level of 1%

γ_1 = 0.2687 at a significance level of 1%

Therefore, the model for conjectural variation becomes :

$$\ell_1(t) = 0.03016 + 0.00472\left(\frac{117 - 9 - 0.5q_2(t-1)}{2(0.5 + 0.1)} - q_1(t-1)\right)$$

$$+ 0.2687\,\ell_1(t-1) \qquad . \ . \ . \ . \ . \ . \ . \ . \ . \ (35)$$

at a significance level of 0.1%

$\alpha_2 = -0.1983$

$\beta_2 = 0.0309$ at a significance level of 0.1%

$\gamma_2 = 0.00000642$ with no significance

Therefore, the model for conjectural variation becomes :

$$\ell_2(t) = -0.1983 + 0.0309\left(\frac{117 - 18 - 0.5\,q_1(t-1)}{2(0.5 + 0.25)} - q_2(t-1)\right)$$

$$. \ . \ . \ . \ . \ . \ . \ . \ . \ (36)$$

at a significance level of 0.1%

$\lim_{t \to \infty} q_1(t) = 71$, $\lim_{t \to \infty} q_2(t) = 46$ as compared with the Cournot equilibrium of 72 and 42. Since quantities of 71 and 46 are stable, duopolist 2 has become a price leader. With production at 71 and 46 duopolist 1 can not fix his production at a higher or lower rate with a temporary benefit.

Dissimilar Cost Curves, Complete Information

$\alpha_1 = -0.0534$

$\beta_1 = 0.01445$ at a significance level of 0.1%

$\gamma_1 = -0.00834$ with no significance

Therefore, the model for conjectural variation becomes :

$$\ell_1(t) = -0.0534 + 0.01445\left(\frac{117 - 9 - 0.5q_2(t-1)}{2(0.5 + 0.1)} - q_1(t-1)\right) \quad \ldots\ldots\ldots \quad (37)$$

at a significance level of 0.1%

$\alpha_2 = -0.391$

$\beta_2 = 0.0221$ at a significance level of 1%

$\gamma_2 = 0.0863$ with no significance

Therefore, the model for conjectural variation becomes :

$$\ell_2(t) = -0.391 + 0.0221\left(\frac{117 - 18 - 0.5q_1(t-1)}{2(0.5 + 0.25)} - q_2(t-1)\right) \quad \ldots\ldots\ldots \quad (38)$$

at a significance level of 5%.

$\lim_{t \to \infty} q_1(t) = 70$, $\lim_{t \to \infty} q_2(t) = 50$ as compared with the Cournot equilibrium of 72 and 42. Since quantities of 70 and 50 are stable, duopolist 2 has become a price leader.

Discussion

With the dissimilar cost curves used in this study, the Cournot equilibrium is 72 and 42 for duopolists 1 and 2 respectively. Limited information games resulted in equilibrium of 71 and 46. Complete information games resulted in equilibrium of 70 and 50. Studies of Fouraker and Siegel (4) also showed that increasing the amount of relevant information available to bargainers decreases their tendency to the Cournot equilibrium. With the identical cost curves used in this study, the Cournot equilibrium is 63 for both duopolists. Limited information games resulted in equilibrium of 63. Complete information games resulted in disequilibrium centered about 67.

Although a few bargaining pairs achieved a tacit agreement, more bargaining pairs were competitive. As a group only duopolists 1 with dissimilar cost cur ve, limited information considered previous conjectural variations in making current decisions of production as indicated by the only significant γ .

At the beginning of most games it appears the theoretical reaction curves did not coincide with the actual reaction curves because the participants used about three moves trying to maneuver or trick their opponents. After the next four moves most games that eventually ended at equilibrium were at equilibrium. A few players used moves 8 and 9 in an attempt to "set their opponent up for a kill" on move 10. Therefore, the theoretical data fits the empirical data best during the middle moves of the game.

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APPENDIXES

Appendix I

Instruction Sheets

Instructions to Duopolist 1

The Ford Foundation has provided funds for research by the Utah State University Department of Economics regarding economic decisions. If you follow instructions carefully and make appropriate decisions, you may earn an appreciable amount of money. You may keep all the money that you earn. You cannot lose your own money but poor choices will result in small profit for you.

You will be paired at random with one other person hereafter called duopolist 2. You will not see this person or speak with him at any time. You will never know the identity of your competitor nor will he be aware of yours.

Imagine that you and duopolist 2 are the sole producers of some standardized commodity. You and duopolist 2 will engage in a series of transactions by written bids, the bids on each transaction representing the quantity of the commodity produced for that transaction. You must bid on each transaction.

You will be furnished with a payoff matrix which shows in red the various levels of profit or loss you can attain. You may or may not be given the level of profit of your competitor (duopolist 2). If you are given his profit levels, they will appear in green directly above your profit levels. The quantities you may produce from 30 to 90 are listed in red down the left hand margin; the quantities duopolist 2 may produce from

30 to 90 are listed in green across the top of the matrix. For any transaction, your profit, and maybe the profit of duopolist 2, is at the intersection of the row selected by you, and column selected by duopolist 2. The actual cash payoff is scaled at 1 cent per 50[1] points, so the objective of the game is to win for yourself the maximum number of points.

On your payoff matrix is encircled the profit resulting from your first quantity of production and the first quantity of production by duopolist 2. The process is continued by each player selecting and recording a quantity on a sheet provided for that purpose. You will select any quantity listed down the left hand margin, record it, and then give the sheet to the administrator. When the administrator returns your sheet, it will show for that transaction your quantity bid, your profit or loss from that transaction, and duopolist 2's quantity bid.

The process is repeated 10 times. You may select the same quantity each time; however you do not have to do so. Decisions will ordinarily be made every few minutes, but extra time will be granted when necessary.

For each production quantity of duopolist 2, you have one and only one corresponding quantity that maximizes your profit.

At the end of the session we will add up your profit and loss column and give you the resulting amount of money.

Are there any questions?

---

[1] With dissimilar cost curves, the actual cash payoff was scaled at 1 cent per 33-1/3 points.

Instructions to Duopolist 2

The Ford Foundation has provided funds for research by the Utah State University Department of Economics regarding economic decisions. If you follow instructions carefully and make appropriate decisions, you may earn an appreciable amount of money. You may keep all the money that you earn. You cannot lose your own money, but poor choices will result in small profit to you.

You will be paired at random with one other person hereafter called duopolist 1. You will not see this person or speak with him at any time. You will never know the identity of your competitor nor will he be aware of yours.

Imagine that you and duopolist 1 are the sole producers of some standardized commodity. You and duopolist 1 will engage in a series of transactions by means of written bids, the bids on each transaction representing the quantity of the commodity produced for that transaction. You must bid on each transaction.

You will be furnished with a payoff matrix which shows in green the various levels of profit or loss you can attain. You may or may not be given the level of profit of your competitor (duopolist 1). If you are given his profit levels, they will appear in red directly below your profit levels. The quantities you may produce from 30 to 90 are listed in green across the top; the quantities duopolist 1 may produce from 30 to 90 are listed in red down the left hand margin of the matrix. For any transaction, your profit and maybe the profit of duopolist 1, is at the intersection of the column selected by you and the row selected by duopolist 1. The actual cash payoff is scaled at 1 cent per 50[2] points, so the objective of the game is to win for yourself the maximum number of points.

On your payoff matrix is encircled the profit resulting from your first quantity of production and the first quantity of production by duopolist 1. The process is continued by each player selecting and recording a quantity on a sheet provided for that purpose. You will select any quantity listed across the top, record it, and then give the sheet to the administrator. When the administrator returns your sheet it will show for that transaction your quantity bid, your profit or loss from that transaction, and duopolist 1's quantity bid.

The process is repeated 10 times. You may select the same quantity each time; however you do not have to do so. Decissions will ordinarily be made every few minutes, but extra time will be granted when necessary.

For each quantity of production by duopolist 1, you have one and only one corresponding quantity that maximizes your profit.

At the end of the session, we will add up your profit and loss column and give you the resulting amount of money.

Are there any questions?

---

[2]With dissimilar cost curves games, the actual cash payoff was scaled at 1 cent per 33-1/3 points.

Appendix II

Payoff Matrix for Duopolist 1

Identical Cost Curves

Limited Information

DUOPOLIST 1

	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90
30	1440	1410	1380	1350	1320	1290	1260	1230	1200	1170	1140	1110	1080	1050	1020	990	960	930	900	870	840	810	780	750	720	690	660	630	600	570	540
32	1552	1520	1488	1456	1424	1392	1360	1328	1296	1264	1232	1200	1168	1136	1104	1072	1040	1008	976	944	912	880	848	816	784	752	720	688	656	624	592
34	1658	1624	1590	1556	1522	1488	1454	1420	1386	1352	1318	1284	1250	1216	1182	1148	1114	1080	1046	1012	978	944	910	876	842	808	774	740	706	672	638
36	1760	1724	1688	1652	1616	1580	1544	1508	1472	1436	1400	1364	1328	1292	1256	1220	1184	1148	1112	1076	1040	1004	968	932	896	860	824	788	752	716	680
38	1858	1820	1782	1744	1706	1668	1630	1592	1554	1516	1478	1440	1402	1364	1326	1288	1250	1212	1174	1136	1098	1060	1022	984	946	908	870	832	794	756	718
40	1950	1910	1870	1830	1790	1750	1710	1670	1630	1590	1550	1510	1470	1430	1390	1350	1310	1270	1230	1190	1150	1110	1070	1030	990	950	910	870	830	790	750
42	2038	1996	1954	1912	1870	1828	1786	1744	1702	1660	1618	1576	1534	1492	1450	1408	1366	1324	1282	1240	1198	1156	1114	1072	1030	988	946	904	862	820	778
44	2120	2076	2032	1988	1944	1900	1856	1812	1768	1724	1680	1636	1592	1548	1504	1460	1416	1372	1328	1284	1240	1196	1152	1108	1064	1020	976	932	888	844	800
46	2198	2152	2106	2060	2014	1968	1922	1876	1830	1784	1738	1692	1646	1600	1554	2508	1462	1416	1370	1324	1278	1232	1186	1140	1094	1048	1002	956	910	864	818
48	2272	2224	2176	2128	2080	2032	1984	1936	1888	1840	1792	1744	1696	1648	1600	1552	1504	1456	1408	1360	1312	1264	1216	1168	1120	1072	1024	976	928	880	832
50	2340	2290	2240	2190	2140	2090	2040	1990	1940	1890	1840	1790	1740	1690	1640	1590	1540	1490	1440	1390	1340	1290	1240	1190	1140	1090	1040	990	940	890	840
52	2404	2352	2300	2248	2196	2144	2092	2040	1988	1936	1884	1832	1780	1728	1676	1624	1572	1520	1468	1416	1364	1312	1260	1208	1156	1104	1052	1000	948	896	844
54	2462	2408	2354	2300	2246	2192	2138	2084	2030	1976	1922	1868	1814	1760	1706	1652	1598	1544	1490	1436	1382	1328	1274	1220	1166	1112	1058	1004	950	896	842
56	2516	2460	2404	2348	2292	2236	2180	2124	2068	2012	1956	1900	1844	1788	1732	1676	1620	1564	1508	1452	1396	1340	1284	1228	1172	1116	1060	1004	948	892	836
58	2566	2508	2450	2392	2334	2276	2218	2160	2102	2044	1986	1928	1870	1812	1754	1696	1638	1580	1522	1464	1406	1348	1290	1232	1174	1116	1058	1000	942	884	826
60	2610	2550	2490	2430	2370	2310	2250	2190	2130	2070	2010	1950	1890	1830	1770	1710	1650	1590	1530	1470	1410	1350	1290	1230	1170	1110	1050	990	930	870	810
62	2650	2588	2526	2464	2402	2340	2278	2216	2154	2092	2030	1968	1906	1844	1782	1720	1658	1596	1534	1472	1410	1348	1286	1224	1162	1100	1038	976	914	852	790
64	2684	2620	2556	2492	2428	2364	2300	2236	2172	2108	2044	1980	1916	1852	1788	1724	1660	1596	1532	1468	1404	1340	1276	1212	1148	1084	1020	956	892	828	764
66	2714	2648	2582	2516	2450	2384	2318	2252	2186	2120	2054	1988	1922	1856	1790	1724	1658	1592	1526	1460	1394	1328	1262	1196	1130	1064	998	932	866	800	734
68	2740	2672	2604	2536	2468	2400	2332	2264	2196	2128	2060	1992	1924	1856	1788	1720	1652	1584	1516	1448	1380	1312	1244	1176	1108	1040	972	904	836	768	700
70	2760	2690	2620	2550	2480	2410	2340	2270	2200	2130	2060	1990	1920	1850	1780	1710	1640	1570	1500	1430	1360	1290	1220	1150	1080	1010	940	870	800	730	660
72	2775	2703	2631	2559	2487	2415	2343	2271	2199	2127	2055	1983	1911	1839	1767	1695	1623	1551	1479	1407	1335	1263	1191	1119	1047	975	903	831	759	687	615
74	2786	2712	2638	2564	2490	2416	2342	2268	2194	2120	2046	1972	1898	1824	1750	1676	1602	1528	1454	1380	1306	1232	1158	1084	1010	936	862	788	714	640	566
76	2792	2716	2640	2564	2488	2412	2336	2260	2184	2108	2032	1956	1880	1804	1728	1652	1576	1500	1424	1348	1272	1196	1120	1044	968	892	816	740	664	588	512
78	2793	2715	2637	2559	2481	2403	2325	2247	2169	2091	2013	1935	1857	1779	1701	1623	1545	1467	1389	1311	1233	1155	1077	999	921	843	765	687	609	531	453
80	2790	2710	2630	2550	2470	2390	2310	2230	2150	2070	1990	1910	1830	1750	1670	1590	1510	1430	1350	1270	1190	1110	1030	950	870	790	710	630	550	470	390
82	2781	2699	2617	2535	2453	2371	2289	2207	2125	2043	1961	1879	1797	1715	1633	1557	1469	1387	1305	1223	1141	1059	977	895	813	731	649	567	485	403	321
84	2768	2684	2600	2516	2432	2348	2264	2180	2096	2012	1928	1844	1760	1676	1592	1508	1424	1340	1256	1172	1088	1004	920	836	752	668	584	500	416	332	248
86	2750	2664	2578	2492	2406	2320	2234	2148	2062	1976	1890	1804	1718	1632	1546	1460	1374	1288	1202	1116	1030	944	858	772	686	600	514	428	342	256	170
88	2728	2640	2552	2464	2376	2288	2200	2112	2024	1936	1848	1760	1672	1584	1496	1408	1320	1232	1144	1056	968	880	792	704	616	528	440	352	264	176	88
90	2700	2610	2520	2430	2340	2250	2160	2070	1980	1890	1800	1710	1620	1530	1440	1350	1260	1170	1080	990	900	810	720	630	540	450	360	270	180	90	0

Appendix III

Payoff Matrix for Duopolist 2

Identical Cost Curves

Limited Information

DUOPOLIST 2

	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90
30	1440	1532	1658	1760	1858	1950	2038	2120	2198	2272	2340	2404	2462	2516	2566	2610	2650	2684	2714	2740	2760	2775	2786	2792	2793	2790	2781	2768	2750	2728	2700
32	1410	1520	1624	1724	1820	1910	1996	2076	2152	2224	2290	2352	2408	2460	2508	2550	2588	2620	2648	2672	2690	2703	2712	2716	2715	2710	2699	2684	2664	2640	2610
34	1380	1488	1590	1688	1782	1870	1954	2032	2106	2176	2240	2300	2354	2404	2450	2490	2526	2556	2582	2604	2620	2631	2638	2640	2637	2630	2617	2600	2578	2552	2520
36	1350	1456	1556	1652	1744	1830	1912	1988	2060	2128	2190	2248	2300	2348	2392	2430	2464	2492	2516	2536	2550	2559	2564	2564	2559	2550	2535	2516	2492	2464	2430
38	1320	1424	1522	1616	1706	1790	1870	1944	2014	2080	2140	2196	2246	2292	2334	2370	2402	2428	2450	2468	2480	2487	2490	2488	2481	2470	2453	2432	2406	2376	2340
40	1290	1392	1488	1580	1668	1750	1828	1900	1968	2032	2090	2144	2192	2236	2276	2310	2340	2364	2384	2400	2410	2415	2416	2412	2403	2390	2371	2348	2320	2288	2250
42	1260	1360	1454	1544	1630	1710	1786	1856	1922	1984	2040	2092	2138	2180	2218	2250	2278	2300	2318	2332	2340	2343	2342	2336	2325	2310	2289	2264	2234	2200	2160
44	1230	1328	1420	1508	1592	1670	1744	1812	1876	1936	1990	2040	2084	2124	2160	2190	2216	2236	2252	2264	2270	2271	2268	2260	2247	2230	2207	2180	2148	2112	2070
46	1200	1296	1386	1472	1534	1630	1702	1768	1830	1888	1940	1988	2030	2068	2102	2130	2154	2172	2186	2196	2200	2199	2194	2184	2169	2150	2125	2096	2062	2024	1980
48	1170	1264	1352	1436	1516	1590	1660	1724	1784	1840	1890	1936	1976	2012	2044	2070	2092	2108	2120	2128	2130	2127	2120	2108	2091	2070	2043	2012	1976	1936	1890
50	1140	1232	1318	1400	1478	1550	1618	1680	1738	1792	1840	1884	1922	1956	1986	2010	2030	2044	2054	2060	2060	2055	2046	2032	2013	1990	1961	1928	1890	1848	1800
52	1110	1200	1284	1364	1440	1510	1576	1636	1692	1744	1790	1832	1868	1900	1928	1950	1968	1980	1988	1992	1990	1983	1972	1956	1935	1910	1879	1844	1804	1760	1710
54	1080	1168	1250	1328	1402	1470	1534	1592	1646	1696	1740	1780	1814	1844	1870	1890	1906	1916	1922	1924	1920	1911	1898	1880	1857	1830	1797	1760	1718	1672	1620
56	1050	1136	1216	1292	1364	1430	1492	1548	1600	1648	1690	1728	1760	1788	1812	1830	1844	1852	1856	1856	1850	1839	1824	1804	1779	1750	1715	1676	1632	1584	1530
58	1020	1104	1182	1256	1326	1390	1450	1504	1554	1600	1640	1676	1706	1732	1754	1770	1782	1788	1790	1788	1780	1767	1750	1728	1701	1670	1633	1592	1546	1496	1440
60	990	1072	1148	1220	1288	1350	1408	1460	1508	1552	1590	1624	1652	1676	1696	1710	1720	1724	1724	1720	1710	1695	1676	1652	1623	1590	1551	1508	1460	1408	1350
62	960	1040	1114	1184	1250	1310	1366	1416	1462	1504	1540	1572	1598	1620	1638	1650	1658	1660	1658	1652	1640	1623	1602	1576	1545	1510	1469	1424	1374	1320	1260
64	930	1008	1080	1148	1212	1270	1324	1372	1416	1456	1490	1520	1544	1564	1580	1590	1596	1596	1592	1584	1570	1551	1528	1500	1467	1430	1387	1340	1288	1232	1170
66	900	976	1046	1112	1174	1230	1282	1328	1370	1408	1440	1468	1490	1505	1522	1530	1534	1532	1526	1516	1500	1479	1454	1424	1389	1350	1305	1256	1202	1144	1080
68	870	944	1012	1076	1136	1190	1240	1284	1324	1360	1390	1416	1436	1452	1464	1470	1472	1468	1460	1448	1430	1407	1380	1348	1311	1270	1223	1172	1116	1056	990
70	840	912	978	1040	1098	1150	1198	1240	1278	1312	1340	1364	1382	1396	1406	1410	1410	1404	1394	1380	1360	1335	1306	1272	1233	1190	1141	1088	1030	968	900
72	810	880	944	1004	1060	1110	1156	1196	1232	1264	1290	1312	1328	1340	1348	1350	1348	1340	1328	1312	1290	1263	1232	1196	1155	1110	1059	1004	944	880	810
74	780	848	910	968	1022	1070	1114	1152	1186	1216	1240	1260	1274	1284	1290	1290	1286	1276	1262	1244	1220	1191	1158	1120	1077	1030	977	920	858	792	720
76	750	816	876	932	984	1030	1072	1108	1140	1168	1190	1208	1220	1228	1232	1230	1224	1212	1196	1176	1150	1119	1084	1044	999	950	895	836	772	704	630
78	720	784	842	896	946	990	1030	1064	1094	1120	1140	1156	1166	1172	1174	1170	1162	1148	1130	1108	1080	1047	1010	968	921	870	813	752	686	616	540
80	690	752	808	860	908	950	988	1020	1048	1072	1090	1104	1112	1116	1116	1110	1100	1084	1064	1040	1010	975	936	892	843	790	731	668	600	528	450
82	660	720	774	824	870	910	946	976	1002	1024	1040	1052	1058	1060	1058	1050	1038	1020	998	972	940	903	862	816	765	710	649	584	514	440	360
84	630	688	740	788	832	870	904	932	956	976	990	1000	1004	1004	1000	990	976	956	932	904	870	831	788	740	687	630	567	500	428	352	270
86	600	656	706	752	794	830	862	888	910	928	940	948	950	948	942	930	914	892	866	836	800	759	714	664	609	550	485	416	342	264	180
88	570	624	672	716	756	790	820	844	864	880	890	896	896	892	884	870	852	828	800	768	730	687	640	588	531	470	403	332	256	176	90
90	540	592	638	680	718	750	778	800	818	832	840	844	842	836	826	810	790	764	734	700	660	615	566	512	453	390	321	248	170	88	0

Appendix IV

Payoff Matrix for Duopolist 1

Identical Cost Curves

Complete Information

DUOPOLIST 2

DUOPOLIST 1

D1 \ D2	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60
30	1440 1440	1552 1410	1658 1380	1760 1350	1858 1320	1950 1290	2038 1260	2120 1230	2198 1200	2272 1170	2340 1140	2404 1110	2462 1080	2516 1050	2566 1020	2610 990
32	1410 1552	1520 1520	1624 1488	1724 1456	1820 1424	1910 1392	1996 1360	2076 1328	2152 1296	2224 1264	2290 1232	2352 1200	2408 1168	2460 1136	2508 1104	2550 1072
34	1380 1658	1488 1624	1590 1590	1688 1556	1782 1522	1870 1488	1954 1454	2032 1420	2106 1386	2176 1352	2240 1318	2300 1284	2354 1250	2404 1216	2450 1182	2490 1148
36	1350 1760	1456 1724	1556 1688	1652 1652	1744 1616	1830 1580	1912 1544	1988 1508	2060 1472	2128 1436	2190 1400	2248 1364	2300 1328	2348 1292	2392 1256	2430 1220
38	1320 1858	1424 1820	1522 1782	1616 1744	1706 1706	1790 1668	1870 1630	1944 1592	2014 1554	2080 1516	2140 1478	2196 1440	2246 1402	2292 1364	2334 1326	2370 1288
40	1290 1950	1392 1910	1488 1870	1580 1830	1668 1790	1750 1750	1828 1710	1900 1670	1968 1630	2032 1590	2090 1550	2144 1510	2192 1470	2236 1430	2276 1390	2310 1350
42	1260 2038	1360 1996	1454 1954	1544 1912	1630 1870	1710 1828	1786 1786	1856 1744	1922 1702	1984 1660	2040 1618	2092 1576	2138 1534	2180 1492	2218 1450	2250 1408
44	1230 2120	1328 2076	1420 2032	1508 1988	1592 1944	1670 1900	1744 1856	1812 1812	1876 1768	1936 1724	1990 1680	2040 1636	2084 1592	2124 1548	2160 1504	2190 1460
46	1200 2198	1296 2152	1386 2106	1472 2060	1554 2014	1630 1968	1702 1922	1768 1876	1830 1830	1888 1784	1940 1738	1988 1692	2030 1646	2068 1600	2102 1554	2130 1508
48	1170 2272	1264 2224	1352 2176	1436 2128	1516 2080	1590 2032	1660 1984	1724 1936	1784 1888	1840 1840	1890 1792	1936 1744	1976 1696	2012 1648	2044 1600	2070 1552
50	1140 2340	1232 2290	1318 2240	1400 2190	1478 2140	1550 2090	1618 2040	1680 1990	1738 1940	1792 1890	1840 1840	1884 1790	1922 1740	1956 1690	1986 1640	2010 1590
52	1110 2404	1200 2352	1284 2300	1364 2248	1440 2196	1510 2144	1576 2092	1636 2040	1692 1988	1744 1936	1790 1884	1832 1832	1868 1780	1900 1728	1928 1676	1950 1624
54	1080 2462	1168 2408	1250 2354	1328 2300	1402 2246	1470 2192	1534 2138	1592 2084	1646 2030	1696 1976	1740 1922	1780 1868	1814 1814	1844 1760	1870 1706	1890 1652
56	1050 2516	1136 2460	1216 2404	1292 2348	1364 2292	1430 2236	1492 2180	1548 2124	1600 2068	1648 2012	1690 1956	1728 1900	1760 1844	1788 1788	1812 1732	1830 1676
58	1020 2566	1104 2508	1182 2450	1256 2392	1326 2334	1390 2276	1450 2218	1504 2160	1554 2102	1600 2044	1640 1986	1676 1928	1706 1870	1732 1812	1754 1754	1770 1696
60	990 2610	1072 2550	1148 2490	1220 2430	1288 2370	1350 2310	1408 2250	1460 2190	1508 2130	1552 2070	1590 2010	1624 1950	1652 1890	1676 1830	1696 1770	1710 1710
62	960 2650	1040 2588	1114 2526	1184 2464	1250 2402	1310 2340	1366 2278	1416 2216	1462 2154	1504 2092	1540 2030	1572 1968	1598 1906	1620 1844	1638 1782	1650 1720
64	930 2684	1008 2620	1080 2556	1148 2492	1212 2428	1270 2364	1324 2300	1372 2236	1416 2172	1452 2108	1490 2044	1520 1980	1544 1916	1564 1852	1580 1788	1590 1724
66	900 2714	976 2648	1046 2582	1112 2516	1174 2450	1230 2384	1282 2318	1328 2252	1370 2186	1408 2120	1440 2054	1468 1988	1490 1922	1508 1856	1522 1790	1530 1724
68	870 2740	944 2672	1012 2604	1076 2536	1136 2468	1190 2400	1240 2332	1284 2264	1324 2196	1360 2128	1390 2060	1416 1992	1436 1924	1452 1856	1464 1788	1470 1720
70	840 2760	912 2690	978 2620	1040 2550	1098 2480	1150 2410	1198 2340	1240 2270	1278 2200	1312 2130	1340 2060	1364 1990	1382 1920	1396 1850	1406 1780	1410 1710
72	810 2775	880 2703	944 2631	1004 2559	1060 2487	1110 2415	1156 2343	1196 2271	1232 2199	1264 2127	1290 2055	1312 1983	1328 1911	1340 1839	1348 1767	1350 1695
74	780 2786	848 2712	910 2638	968 2564	1022 2490	1070 2416	1114 2342	1152 2268	1186 2194	1216 2120	1240 2046	1260 1972	1274 1898	1284 1824	1290 1750	1290 1676
76	750 2792	816 2716	876 2640	932 2564	984 2488	1030 2412	1072 2336	1108 2260	1140 2184	1168 2108	1190 2032	1208 1956	1220 1880	1228 1804	1232 1728	1230 1652
78	720 2793	784 2715	842 2637	896 2559	946 2481	990 2403	1030 2325	1064 2247	1094 2169	1120 2091	1140 2013	1156 1935	1166 1857	1172 1779	1174 1701	1170 1623
80	690 2790	752 2710	808 2630	860 2550	908 2470	950 2390	988 2310	1020 2230	1048 2150	1072 2070	1090 1990	1104 1910	1112 1830	1116 1750	1116 1670	1110 1590
82	660 2781	720 2699	774 2617	824 2535	870 2453	910 2371	946 2289	976 2207	1002 2125	1024 2043	1040 1961	1052 1878	1058 1797	1060 1715	1058 1633	1050 1551
84	630 2768	688 2684	740 2600	788 2516	832 2432	870 2348	904 2264	932 2180	956 2096	976 2012	990 1928	1000 1844	1004 1760	1004 1676	1000 1592	990 1508
86	600 2750	656 2664	706 2578	752 2492	794 2406	830 2320	862 2234	888 2148	910 2062	928 1976	940 1890	948 1804	950 1718	948 1632	942 1546	930 1460
88	570 2728	624 2640	672 2552	716 2464	756 2376	790 2288	820 2200	844 2112	864 2024	880 1936	890 1848	896 1760	896 1672	892 1584	884 1496	870 1408
90	540 2700	592 2610	638 2520	680 2430	718 2340	750 2250	778 2160	800 2070	818 1980	832 1890	840 1800	844 1710	842 1620	836 1530	826 1440	810 1350

D1 \ D2	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90
30	2650 960	2684 930	2714 900	2740 870	2760 840	2775 810	2786 780	2792 750	2793 720	2790 690	2781 660	2768 630	2750 600	2728 570	2700 540
32	2588 1040	2620 1008	2648 976	2672 944	2690 912	2703 880	2712 848	2716 816	2715 784	2710 752	2699 720	2684 688	2664 656	2640 624	2610 592
34	2526 1114	2556 1080	2582 1046	2604 1012	2620 978	2631 944	2638 910	2640 876	2637 842	2630 808	2617 774	2600 740	2578 706	2552 672	2520 638
36	2464 1184	2492 1148	2516 1112	2536 1076	2550 1040	2559 1004	2564 968	2564 932	2559 896	2550 860	2535 824	2516 788	2492 752	2464 716	2430 680
38	2402 1250	2428 1212	2450 1174	2468 1136	2480 1098	2487 1060	2490 1022	2488 984	2481 946	2470 908	2453 870	2432 832	2406 794	2376 756	2340 718
40	2340 1310	2364 1270	2384 1230	2400 1190	2410 1150	2415 1110	2416 1070	2412 1030	2403 990	2390 950	2371 910	2348 870	2320 830	2288 790	2250 750
42	2278 1366	2300 1324	2318 1282	2332 1240	2340 1198	2343 1156	2342 1114	2336 1072	2325 1030	2310 988	2289 946	2264 904	2234 862	2200 820	2160 778
44	2216 1416	2236 1372	2252 1328	2264 1284	2270 1240	2271 1196	2268 1152	2260 1108	2247 1064	2230 1020	2207 976	2180 932	2148 888	2112 844	2070 800
46	2154 1462	2172 1416	2186 1370	2196 1324	2200 1278	2199 1232	2194 1186	2184 1140	2169 1094	2150 1048	2125 1002	2096 956	2062 910	2024 864	1980 818
48	2092 1504	2108 1456	2120 1408	2128 1360	2130 1312	2127 1264	2120 1216	2108 1168	2091 1120	2070 1072	2043 1024	2012 976	1976 928	1936 880	1890 832
50	2030 1540	2044 1490	2054 1440	2060 1390	2060 1340	2055 1290	2046 1240	2032 1190	2013 1140	1990 1090	1961 1040	1928 990	1890 940	1848 890	1800 840
52	1968 1572	1980 1520	1988 1468	1992 1416	1990 1364	1983 1312	1972 1260	1956 1208	1935 1156	1910 1104	1879 1052	1844 1000	1804 948	1760 896	1710 844
54	1906 1598	1916 1544	1922 1490	1924 1436	1920 1382	1911 1328	1898 1274	1880 1220	1857 1166	1830 1112	1797 1058	1760 1004	1718 950	1672 896	1620 842
56	1844 1620	1852 1564	1856 1508	1856 1452	1850 1396	1839 1340	1824 1284	1804 1228	1779 1172	1750 1116	1715 1060	1676 1004	1632 948	1584 892	1530 836
58	1782 1638	1788 1580	1790 1522	1788 1464	1780 1406	1767 1348	1750 1290	1728 1232	1701 1174	1670 1116	1633 1058	1592 1000	1546 942	1496 884	1440 826
60	1720 1650	1724 1590	1724 1530	1720 1470	1710 1410	1695 1350	1676 1290	1652 1230	1623 1170	1590 1110	1551 1050	1508 990	1460 930	1408 870	1350 810
62	1658 1658	1660 1596	1658 1534	1652 1472	1640 1410	1623 1348	1602 1286	1576 1224	1545 1162	1510 1100	1469 1038	1424 976	1374 914	1320 852	1260 790
64	1596 1660	1596 1596	1592 1532	1584 1468	1570 1404	1551 1340	1528 1276	1500 1212	1467 1148	1430 1084	1387 1020	1340 956	1288 892	1232 828	1170 764
66	1534 1658	1532 1592	1526 1526	1516 1460	1500 1394	1479 1328	1454 1262	1424 1196	1389 1120	1350 1064	1305 998	1256 932	1202 866	1144 800	1080 734
68	1472 1652	1468 1584	1460 1516	1448 1448	1430 1380	1407 1312	1380 1244	1348 1176	1311 1108	1270 1040	1223 972	1172 904	1116 836	1056 768	990 700
70	1410 1640	1404 1570	1394 1500	1380 1430	1360 1360	1335 1290	1306 1220	1272 1150	1233 1080	1190 1010	1141 940	1088 870	1030 800	968 730	900 660
72	1348 1623	1340 1551	1328 1479	1312 1407	1290 1335	1263 1263	1232 1191	1196 1119	1155 1047	1110 975	1059 903	1004 831	944 759	880 687	810 615
74	1286 1602	1276 1528	1262 1454	1244 1380	1220 1306	1191 1232	1158 1158	1120 1084	1077 1010	1030 936	977 862	920 788	858 714	792 640	720 566
76	1224 1576	1212 1500	1196 1424	1176 1348	1150 1272	1119 1196	1084 1120	1044 1044	999 968	950 892	895 816	836 740	772 664	704 588	630 512
78	1162 1545	1148 1467	1130 1389	1108 1311	1080 1233	1047 1155	1010 1077	968 999	921 921	870 843	813 765	752 687	686 609	616 531	540 453
80	1100 1510	1084 1430	1064 1350	1040 1270	1010 1190	975 1110	936 1030	892 950	843 870	790 790	731 710	668 630	600 550	528 470	450 390
82	1038 1469	1020 1387	998 1305	972 1223	940 1141	903 1059	862 977	816 895	765 813	710 731	649 649	584 567	514 485	440 403	360 321
84	976 1424	956 1340	932 1256	904 1172	870 1088	831 1004	788 920	740 836	687 752	630 668	567 584	500 500	428 416	352 332	270 248
86	914 1374	892 1288	866 1202	836 1116	800 1030	759 944	714 858	664 772	609 686	550 600	485 514	416 428	342 342	264 256	180 170
88	852 1320	828 1232	800 1144	768 1056	730 968	687 880	640 792	588 704	531 616	470 528	403 440	332 352	256 264	176 176	90 88
90	790 1260	764 1170	734 1080	700 990	660 900	615 810	566 720	512 630	453 540	390 450	321 360	248 270	170 180	87 90	0 0

Appendix V

Payoff Matrix for Duopolist 2

Identical Cost Curves

Complete Information

DUOPOLIST 2

DUOPOLIST 1

	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90
30	1440	1552	1658	1760	1858	1950	2038	2120	2198	2272	2340	2404	2462	2516	2566	2610	2650	2684	2714	2740	2760	2775	2786	2792	2793	2790	2781	2768	2750	2728	2700
	1440	1410	1380	1350	1320	1290	1260	1230	1200	1170	1140	1110	1080	1050	1020	990	960	930	900	870	840	810	780	750	720	690	660	630	600	570	540
32	1410	1520	1624	1724	1820	1910	1996	2076	2152	2224	2290	2352	2408	2460	2508	2550	2588	2620	2648	2672	2690	2703	2712	2716	2715	2710	2699	2684	2664	2640	2610
	1552	1520	1488	1456	1424	1392	1360	1328	1296	1264	1232	1200	1168	1136	1104	1072	1040	1008	976	944	912	880	848	816	784	752	720	688	656	624	592
34	1380	1488	1590	1688	1782	1870	1954	2032	2106	2176	2240	2300	2354	2404	2450	2490	2526	2556	2582	2604	2620	2631	2638	2640	2637	2630	2617	2600	2578	2552	2520
	1658	1624	1590	1556	1522	1488	1454	1420	1386	1352	1318	1284	1250	1216	1182	1148	1114	1080	1046	1012	978	944	910	876	842	808	774	740	706	672	638
36	1350	1456	1556	1652	1744	1830	1912	1988	2060	2128	2190	2248	2300	2348	2392	2430	2464	2492	2516	2536	2550	2559	2564	2564	2559	2550	2535	2516	2492	2464	2430
	1760	1724	1688	1652	1616	1580	1544	1508	1472	1436	1400	1364	1328	1292	1256	1220	1184	1148	1112	1076	1040	1004	968	932	896	860	824	788	752	716	680
38	1320	1424	1522	1616	1706	1790	1870	1944	2014	2080	2140	2196	2246	2292	2334	2370	2402	2428	2450	2468	2480	2487	2490	2488	2481	2470	2453	2432	2406	2376	2340
	1858	1820	1782	1744	1706	1668	1630	1592	1554	1516	1478	1440	1402	1364	1326	1288	1250	1212	1174	1136	1098	1060	1022	984	946	908	870	832	794	756	718
40	1290	1392	1488	1580	1668	1750	1828	1900	1968	2032	2090	2144	2192	2236	2276	2310	2340	2364	2384	2400	2410	2415	2416	2412	2403	2390	2371	2348	2320	2288	2250
	1950	1910	1870	1830	1790	1750	1710	1670	1630	1590	1550	1510	1470	1430	1390	1350	1310	1270	1230	1190	1150	1110	1070	1030	990	950	910	870	830	790	750
42	1260	1360	1454	1544	1630	1710	1786	1856	1922	1984	2040	2092	2138	2180	2218	2250	2278	2300	2318	2332	2340	2343	2342	2336	2325	2310	2289	2264	2234	2200	2160
	2039	1996	1954	1912	1870	1828	1786	1744	1702	1660	1618	1576	1534	1492	1450	1408	1366	1324	1282	1240	1198	1156	1114	1072	1030	988	946	904	862	820	778
44	1230	1328	1420	1508	1592	1670	1744	1812	1876	1936	1990	2040	2084	2124	2160	2190	2216	2236	2252	2264	2270	2271	2268	2260	2247	2230	2207	2180	2148	2112	2070
	2120	2076	2032	1988	1944	1900	1856	1812	1768	1724	1680	1636	1592	1548	1504	1460	1416	1372	1328	1284	1240	1196	1152	1108	1064	1020	976	932	888	844	800
46	1200	1296	1386	1472	1554	1630	1702	1768	1830	1888	1940	1988	2030	2068	2102	2130	2154	2172	2186	2196	2200	2199	2194	2184	2169	2150	2125	2096	2062	2024	1980
	2198	2152	2106	2060	2014	1968	1922	1876	1830	1784	1738	1692	1646	1600	1554	1508	1462	1416	1370	1324	1278	1232	1186	1140	1094	1048	1002	956	910	864	818
48	1170	1264	1352	1436	1516	1590	1660	1724	1784	1840	1890	1936	1976	2012	2044	2070	2092	2108	2120	2128	2130	2127	2120	2108	2091	2070	2043	2010	1976	1936	1890
	2272	2224	2176	2128	2080	2032	1984	1936	1888	1840	1792	1744	1696	1648	1600	1552	1504	1456	1408	1360	1312	1264	1216	1168	1120	1072	1024	976	928	880	832
50	1140	1232	1318	1400	1478	1550	1618	1680	1738	1792	1840	1884	1922	1956	1986	2010	2030	2044	2054	2060	2060	2055	2046	2032	2013	1990	1961	1928	1890	1848	1800
	2340	2290	2240	2190	2140	2090	2040	1990	1940	1890	1840	1790	1740	1690	1640	1590	1540	1490	1440	1390	1340	1290	1240	1190	1140	1090	1040	990	940	890	840
52	1110	1200	1284	1364	1440	1510	1576	1636	1692	1744	1790	1832	1868	1900	1928	1950	1968	1980	1988	1992	1990	1983	1972	1956	1935	1910	1879	1844	1804	1760	1710
	2404	2352	2300	2248	2196	2144	2092	2040	1988	1936	1884	1832	1780	1728	1676	1624	1572	1520	1468	1416	1364	1312	1260	1208	1156	1104	1052	1000	948	896	844
54	1080	1168	1250	1328	1402	1470	1534	1592	1646	1696	1740	1780	1814	1844	1870	1890	1906	1916	1922	1924	1920	1911	1898	1880	1857	1830	1799	1760	1718	1672	1620
	2462	2408	2354	2300	2246	2192	2138	2084	2030	1976	1922	1868	1814	1760	1706	1652	1598	1544	1490	1436	1382	1328	1274	1220	1166	1112	1058	1004	950	896	842
56	1050	1136	1216	1292	1364	1430	1492	1548	1600	1648	1690	1728	1760	1788	1812	1830	1844	1852	1856	1856	1850	1839	1824	1804	1779	1750	1715	1676	1632	1584	1530
	2516	2460	2404	2348	2292	2236	2180	2124	2068	2012	1956	1900	1844	1788	1732	1676	1620	1564	1508	1452	1396	1340	1284	1228	1172	1116	1060	1004	948	892	836
58	1020	1104	1182	1256	1326	1390	1450	1504	1554	1600	1640	1676	1706	1732	1754	1770	1782	1788	1790	1788	1780	1767	1750	1728	1701	1670	1633	1592	1546	1496	1440
	2566	2508	2450	2392	2334	2276	2218	2160	2102	2044	1986	1928	1870	1812	1754	1696	1638	1580	1522	1464	1406	1348	1290	1232	1174	1116	1058	1000	942	884	826
60	990	1072	1148	1220	1288	1350	1408	1460	1508	1552	1590	1624	1652	1676	1696	1710	1720	1724	1724	1720	1710	1695	1676	1652	1623	1590	1551	1508	1460	1408	1350
	2610	2550	2490	2430	2370	2310	2250	2190	2130	2070	2010	1950	1890	1830	1770	1710	1650	1590	1530	1470	1410	1350	1290	1230	1170	1110	1050	990	930	870	810
62	960	1040	1114	1184	1250	1310	1366	1416	1462	1504	1540	1572	1598	1620	1638	1650	1658	1660	1658	1652	1640	1623	1602	1576	1545	1510	1469	1424	1374	1320	1260
	2650	2588	2526	2464	2402	2340	2278	2216	2154	2092	2030	1968	1906	1844	1782	1720	1658	1596	1534	1472	1410	1348	1286	1224	1162	1100	1038	976	914	852	790
64	930	1008	1080	1148	1212	1270	1324	1372	1416	1456	1490	1520	1544	1564	1580	1590	1596	1596	1592	1584	1570	1551	1528	1500	1467	1430	1387	1340	1288	1232	1170
	2684	2620	2556	2492	2428	2364	2300	2236	2172	2108	2044	1980	1916	1852	1788	1724	1660	1596	1532	1468	1404	1340	1276	1212	1148	1084	1020	956	892	828	764
66	900	976	1046	1112	1174	1230	1282	1328	1370	1408	1440	1468	1490	1508	1522	1530	1534	1532	1526	1516	1500	1479	1454	1424	1389	1350	1305	1256	1202	1144	1080
	2714	2648	2582	2516	2450	2384	2318	2252	2186	2120	2054	1988	1922	1856	1790	1724	1658	1592	1526	1460	1394	1328	1262	1196	1130	1064	998	932	866	800	734
68	870	944	1012	1076	1136	1190	1240	1284	1324	1360	1390	1416	1436	1452	1464	1470	1472	1468	1460	1448	1430	1407	1380	1349	1311	1270	1223	1172	1116	1056	990
	2740	2672	2604	2536	2468	2400	2332	2264	2196	2128	2060	1992	1924	1856	1788	1720	1652	1584	1516	1448	1380	1312	1244	1176	1108	1040	972	904	836	768	700
70	840	912	978	1040	1098	1150	1198	1240	1278	1312	1340	1364	1382	1396	1406	1410	1410	1404	1394	1380	1360	1335	1306	1272	1233	1190	1141	1088	1030	968	900
	2760	2690	2620	2550	2480	2410	2340	2270	2200	2130	2060	1990	1920	1850	1780	1710	1640	1570	1500	1430	1360	1290	1220	1150	1080	1010	940	870	800	730	660
72	810	880	944	1004	1060	1110	1156	1196	1232	1264	1290	1312	1328	1340	1348	1350	1348	1340	1328	1312	1290	1263	1232	1196	1155	1110	1059	1004	944	880	810
	2775	2703	2631	2559	2487	2415	2343	2271	2199	2127	2055	1983	1911	1839	1767	1695	1623	1551	1479	1407	1335	1263	1191	1119	1047	975	903	831	759	687	615
74	780	848	910	968	1022	1070	1114	1152	1186	1216	1240	1260	1274	1284	1290	1290	1286	1276	1262	1244	1220	1191	1158	1120	1077	1030	977	920	858	792	720
	2786	2712	2638	2564	2490	2416	2342	2268	2194	2120	2046	1972	1898	1824	1750	1676	1602	1528	1454	1380	1306	1232	1158	1084	1010	936	862	788	714	640	566
76	750	816	876	932	984	1030	1072	1108	1140	1168	1190	1208	1220	1228	1232	1230	1224	1212	1196	1176	1150	1119	1084	1044	999	950	895	836	772	704	630
	2792	2716	2640	2564	2488	2412	2336	2260	2184	2108	2032	1956	1880	1804	1728	1652	1576	1500	1424	1348	1272	1196	1120	1044	968	892	816	740	664	588	512
78	720	784	842	896	946	990	1030	1064	1094	1120	1140	1156	1166	1172	1174	1170	1162	1148	1130	1108	1080	1047	1010	968	921	870	813	752	686	616	540
	2793	2715	2637	2559	2481	2403	2325	2247	2169	2091	2013	1935	1857	1779	1701	1623	1545	1467	1389	1311	1233	1155	1077	999	921	843	765	687	609	531	453
80	690	752	808	860	908	950	988	1020	1048	1072	1090	1104	1112	1116	1116	1110	1100	1084	1064	1040	1010	975	936	892	843	790	731	668	600	528	450
	2790	2710	2630	2550	2470	2390	2310	2230	2150	2070	1990	1910	1830	1750	1670	1590	1510	1430	1350	1270	1190	1110	1030	950	870	790	710	630	550	470	390
82	660	720	774	824	870	910	946	976	1002	1024	1040	1052	1058	1060	1058	1050	1038	1020	998	972	940	903	862	816	765	710	649	584	514	440	360
	2781	2699	2617	2535	2453	2371	2289	2207	2125	2043	1961	1879	1797	1715	1633	1551	1469	1387	1305	1223	1141	1059	977	895	813	731	649	567	485	403	321
84	630	688	740	788	832	870	904	932	956	976	990	1000	1004	1004	1000	990	976	956	932	904	870	831	788	740	687	630	567	500	428	352	270
	2768	2684	2600	2516	2432	2348	2264	2180	2096	2012	1928	1844	1760	1676	1592	1508	1424	1340	1256	1172	1088	1004	920	836	752	668	584	500	416	332	248
86	600	656	706	752	794	830	862	888	910	928	940	948	950	948	942	930	914	892	866	836	800	759	714	664	609	550	485	416	340	264	180
	2750	2664	2578	2492	2406	2320	2234	2148	2062	1976	1890	1804	1718	1632	1546	1460	1374	1288	1202	1116	1030	944	858	772	686	600	514	428	342	256	170
88	570	624	672	716	756	790	820	844	864	880	890	896	896	892	884	870	852	828	800	768	730	687	640	588	531	470	408	332	256	176	90
	2728	2640	2552	2464	2376	2288	2200	2112	2024	1936	1848	1760	1672	1584	1496	1408	1320	1232	1144	1056	968	880	792	704	616	528	440	352	264	176	88
90	540	592	638	680	718	750	778	800	818	832	840	844	842	836	826	810	790	764	734	700	660	615	566	512	453	390	321	248	170	88	0
	2700	2610	2520	2430	2340	2250	2160	2070	1980	1890	1800	1710	1620	1530	1440	1350	1260	1170	1080	990	900	810	720	630	540	450	360	270	180	90	0

Appendix VI

Payoff Matrix for Duopolist 1

Similar Cost Curves

Limited Information

DUOPOLIST 1'

	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90
30	990	960	930	900	870	840	810	780	750	720	690	660	630	600	570	540	510	480	450	420	390	360	330	300	270	240	210	180	150	120	90
32	1102	1070	1038	1006	974	942	910	878	846	814	782	750	718	686	654	622	590	558	526	494	462	430	398	366	334	302	270	238	206	174	142
34	1208	1174	1140	1106	1072	1038	1004	970	936	902	868	834	800	766	732	698	664	630	596	562	528	494	460	426	392	358	324	290	256	222	188
36	1310	1274	1238	1202	1166	1130	1094	1058	1022	986	950	914	878	842	806	770	734	698	662	626	590	554	518	482	446	410	374	338	302	266	230
38	1408	1370	1332	1294	1256	1218	1180	1142	1104	1066	1028	990	952	914	876	838	800	762	724	686	648	610	572	534	496	458	420	382	344	306	268
40	1500	1460	1420	1380	1340	1300	1260	1220	1180	1140	1100	1060	1020	980	940	900	860	820	780	740	700	660	620	580	540	500	460	420	380	340	300
42	1588	1546	1504	1462	1420	1378	1336	1294	1252	1210	1168	1126	1084	1042	1000	958	916	874	832	790	748	706	664	622	580	538	496	454	412	370	328
44	1670	1626	1582	1538	1494	1450	1406	1362	1318	1274	1230	1186	1142	1098	1054	1010	966	922	878	834	790	746	702	658	614	570	526	482	438	394	350
46	1748	1702	1656	1610	1564	1518	1472	1426	1380	1334	1288	1242	1196	1150	1104	1058	1012	966	920	874	828	782	736	690	644	598	552	506	460	414	368
48	1822	1774	1726	1678	1630	1582	1534	1486	1438	1390	1342	1294	1246	1198	1150	1102	1054	1006	958	910	862	814	766	718	670	622	574	526	478	430	382
50	1890	1840	1790	1740	1690	1640	1590	1540	1490	1440	1390	1340	1290	1240	1190	1140	1090	1040	990	940	890	840	790	740	690	640	590	540	490	440	390
52	1954	1902	1850	1798	1746	1694	1642	1590	1538	1486	1434	1382	1330	1278	1226	1174	1122	1070	1018	966	914	862	810	758	706	654	602	550	498	446	394
54	2012	1958	1904	1850	1796	1742	1688	1634	1580	1526	1472	1418	1364	1310	1256	1202	1148	1094	1040	986	932	878	824	770	716	662	608	554	500	446	392
56	2066	2010	1954	1898	1842	1786	1730	1674	1618	1562	1506	1450	1394	1338	1282	1226	1170	1114	1058	1002	946	890	834	778	722	666	610	554	498	442	386
58	2116	2058	2000	1942	1884	1826	1768	1710	1652	1594	1536	1478	1420	1362	1304	1246	1188	1130	1072	1014	956	898	840	782	724	666	608	550	492	434	376
60	2160	2100	2040	1980	1920	1860	1800	1740	1680	1620	1560	1500	1440	1380	1320	1260	1200	1140	1080	1020	960	900	840	780	720	660	600	540	480	420	360
62	2200	2138	2076	2014	1952	1890	1828	1766	1704	1642	1580	1518	1456	1394	1332	1270	1208	1146	1084	1022	960	898	836	774	712	650	588	526	464	402	340
64	2234	2170	2106	2042	1978	1914	1850	1786	1722	1658	1594	1530	1466	1402	1338	1274	1210	1146	1082	1018	954	890	826	762	698	634	570	506	442	378	314
66	2264	2198	2132	2066	2000	1934	1868	1802	1736	1670	1604	1538	1472	1406	1340	1274	1208	1142	1076	1010	944	878	812	746	680	614	548	482	416	350	284
68	2290	2222	2154	2086	2018	1950	1882	1814	1746	1678	1610	1542	1474	1406	1338	1270	1202	1134	1066	998	930	862	794	726	658	590	522	454	386	318	250
70	2310	2240	2170	2100	2030	1960	1890	1820	1750	1680	1610	1540	1470	1400	1330	1260	1190	1120	1050	980	910	840	770	700	630	560	490	420	350	280	210
72	2325	2253	2181	2109	2037	1965	1893	1821	1749	1677	1605	1533	1461	1389	1317	1245	1173	1101	1029	957	885	813	741	669	597	525	453	381	309	237	165
74	2336	2262	2188	2114	2040	1966	1892	1818	1744	1670	1596	1522	1448	1374	1300	1226	1152	1078	1004	930	856	782	708	634	560	486	412	338	264	190	116
76	2342	2266	2190	2114	2038	1962	1886	1810	1734	1658	1582	1506	1430	1354	1278	1202	1126	1050	974	898	822	746	670	594	518	442	366	290	214	138	62
78	2343	2265	2187	2109	2031	1953	1875	1797	1719	1641	1563	1485	1407	1329	1251	1173	1095	1017	939	861	783	705	627	549	471	393	315	237	159	81	3
80	2340	2260	2180	2100	2020	1940	1860	1780	1700	1620	1540	1460	1380	1300	1220	1140	1060	980	900	820	740	660	580	500	420	340	260	180	100	20	-60
82	2332	2250	2168	2086	2004	1922	1840	1758	1676	1594	1512	1430	1348	1266	1184	1102	1020	938	856	774	692	610	528	446	364	282	200	118	36	-46	-128
84	2318	2234	2150	2066	1982	1898	1814	1730	1646	1562	1478	1394	1310	1226	1142	1058	974	890	806	722	638	554	470	386	302	218	134	50	-34	-118	-202
86	2300	2214	2128	2042	1956	1870	1784	1698	1612	1526	1440	1354	1268	1182	1096	1010	924	838	752	666	580	494	408	322	236	150	64	-22	-108	-194	-280
88	2278	2190	2102	2014	1926	1838	1750	1662	1574	1486	1398	1310	1222	1134	1046	958	870	782	694	606	518	430	342	254	166	78	-10	-98	-186	-274	-362
90	2250	2160	2070	1980	1890	1800	1710	1620	1530	1440	1350	1260	1170	1080	990	900	810	720	630	540	450	360	270	180	90	0	-90	-180	-270	-360	-450

Appendix VII

Payoff Matrix for Duopolist 2

Similar Cost Curves

Limited Information

DUOPOLIST 2'

	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90
30	1400	1507	1609	1705	1795	1880	1959	2033	2101	2163	2220	2271	2317	2357	2391	2420	2443	2461	2473	2479	2480	2475	2465	2449	2426	2400	2364	2329	2285	2236	2180
32	1370	1475	1575	1669	1757	1840	1917	1989	2055	2115	2170	2219	2263	2301	2333	2360	2381	2397	2407	2411	2410	2403	2391	2373	2348	2320	2284	2245	2199	2148	2090
34	1340	1443	1541	1633	1719	1800	1875	1945	2009	2067	2120	2167	2209	2245	2275	2300	2319	2333	2341	2343	2340	2331	2317	2297	2270	2240	2202	2161	2113	2060	2000
36	1310	1411	1507	1597	1681	1760	1833	1901	1963	2019	2070	2115	2155	2189	2217	2240	2257	2269	2275	2275	2270	2259	2243	2221	2192	2160	2120	2077	2027	1972	1910
38	1280	1379	1473	1561	1643	1720	1791	1857	1917	1971	2020	2063	2101	2133	2159	2180	2195	2205	2209	2207	2200	2187	2169	2145	2114	2080	2038	1993	1941	1884	1820
40	1250	1347	1439	1525	1605	1680	1749	1813	1871	1923	1970	2011	2047	2077	2101	2120	2133	2141	2143	2139	2130	2115	2095	2069	2036	2000	1956	1909	1855	1796	1730
42	1220	1315	1405	1489	1567	1640	1707	1769	1825	1875	1920	1959	1993	2021	2043	2060	2071	2077	2077	2071	2060	2043	2021	1993	1958	1920	1874	1825	1769	1708	1640
44	1190	1283	1371	1453	1529	1600	1665	1725	1779	1827	1870	1907	1939	1965	1985	2000	2009	2013	2011	2003	1990	1971	1947	1917	1880	1840	1792	1741	1683	1620	1550
46	1160	1251	1337	1417	1491	1560	1623	1681	1733	1779	1820	1855	1885	1909	1927	1840	1947	1949	1945	1935	1920	1899	1873	1841	1802	1760	1710	1657	1597	1532	1460
48	1130	1219	1303	1381	1453	1520	1581	1637	1687	1731	1770	1803	1831	1853	1869	1880	1885	1885	1879	1867	1850	1827	1799	1765	1724	1680	1628	1573	1511	1444	1370
50	1100	1187	1269	1345	1415	1480	1539	1593	1641	1683	1720	1751	1777	1797	1811	1820	1823	1821	1813	1799	1780	1755	1725	1689	1646	1600	1546	1489	1425	1356	1280
52	1070	1155	1235	1309	1377	1440	1497	1549	1595	1635	1670	1699	1723	1741	1753	1760	1761	1757	1747	1731	1710	1683	1651	1613	1568	1520	1464	1405	1339	1268	1190
54	1040	1123	1201	1273	1339	1400	1455	1505	1549	1587	1620	1647	1669	1685	1695	1700	1699	1693	1681	1663	1640	1611	1577	1537	1490	1440	1382	1321	1253	1180	1100
56	1010	1091	1167	1237	1301	1360	1413	1461	1503	1539	1570	1595	1615	1629	1637	1640	1637	1629	1615	1595	1570	1539	1503	1461	1412	1360	1300	1237	1167	1092	1010
58	980	1059	1133	1201	1263	1320	1371	1417	1457	1491	1520	1543	1561	1573	1579	1580	1575	1565	1549	1527	1500	1467	1429	1385	1334	1280	1218	1153	1081	1004	920
60	950	1027	1099	1165	1225	1280	1329	1373	1411	1443	1470	1491	1507	1517	1521	1520	1513	1501	1483	1459	1430	1395	1355	1309	1256	1200	1136	1069	995	916	830
62	920	995	1065	1129	1187	1240	1287	1329	1365	1395	1420	1439	1453	1461	1463	1460	1451	1437	1417	1391	1360	1323	1281	1233	1178	1120	1054	985	909	828	740
64	890	963	1031	1093	1149	1200	1245	1285	1319	1347	1370	1387	1399	1405	1405	1400	1389	1373	1351	1323	1290	1251	1207	1157	1100	1040	972	901	823	740	650
66	860	931	997	1057	1111	1160	1203	1241	1273	1299	1320	1335	1345	1349	1347	1340	1327	1309	1285	1255	1220	1179	1133	1081	1022	960	890	817	737	652	560
68	830	899	963	1021	1073	1120	1161	1197	1227	1251	1270	1283	1291	1293	1289	1280	1265	1245	1219	1187	1150	1107	1059	1005	944	880	808	733	651	564	470
70	800	867	929	985	1035	1080	1119	1153	1181	1203	1220	1231	1237	1237	1231	1220	1203	1181	1153	1119	1080	1035	985	929	866	800	726	649	565	476	380
72	770	835	895	949	997	1040	1077	1109	1135	1155	1170	1179	1183	1181	1173	1160	1141	1117	1087	1051	1010	963	911	853	788	720	644	565	479	388	290
74	740	803	861	913	959	1000	1035	1065	1089	1107	1120	1127	1129	1125	1115	1100	1079	1053	1021	989	940	891	837	777	710	640	562	481	393	300	200
76	710	771	827	877	921	960	993	1021	1043	1059	1070	1075	1075	1069	1057	1040	1017	989	955	915	870	819	763	701	632	560	480	397	307	212	110
78	680	739	793	841	883	920	951	977	997	1011	1020	1023	1021	1013	999	980	955	925	889	847	800	747	689	625	554	480	398	313	221	124	20
80	650	707	759	805	845	880	909	933	957	963	970	971	967	957	941	920	893	861	823	779	730	675	615	549	476	400	316	229	135	36	-70
82	620	675	725	769	807	840	867	889	905	915	920	919	913	901	883	860	831	797	757	711	660	603	541	473	398	320	234	145	49	-52	-160
84	590	643	691	733	769	800	825	845	859	867	870	867	859	845	825	800	769	733	691	643	590	531	467	397	320	240	152	61	-37	-140	-250
86	560	611	657	697	731	760	783	801	813	819	820	815	805	789	767	740	707	669	625	575	520	459	393	321	242	160	70	-23	-123	-228	-340
88	530	579	623	661	693	720	741	757	767	771	770	763	751	733	709	680	645	605	559	507	450	387	319	245	164	80	-12	-107	-209	-316	-430
90	500	547	589	625	655	680	699	713	721	723	720	711	697	677	651	620	583	541	493	439	380	315	245	169	86	**0**	-94	-191	-295	-404	-520

Appendix VIII

Payoff Matrix for Duopolist 1

Dissimilar Cost Curves

Limited Information

DUOPOLIST 1"

	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90
30	360	330	300	270	240	210	180	150	120	90	60	30	0	-30	-60	-90	-120	-150	-180	-210	-240	-270	-300	-330	-360	-390	-420	-450	-480	-510	-540
32	472	440	408	376	344	312	280	248	216	184	152	120	88	56	24	-8	-40	-72	-104	-136	-168	-200	-232	-264	-296	-328	-360	-392	-424	-456	-488
34	578	544	510	476	442	408	374	340	306	272	238	204	170	136	102	68	34	0	-34	-68	-102	-136	-170	-204	-238	-272	-306	-340	-374	-408	-442
36	680	644	608	572	536	500	464	428	392	356	320	284	248	212	176	140	104	68	32	-4	-40	-76	-112	-148	-184	-220	-256	-292	-328	-364	-400
38	778	740	702	664	626	588	550	512	474	436	398	360	322	284	246	208	170	132	94	56	18	-20	-58	-96	-134	-172	-210	-248	-286	-324	-362
40	870	830	790	750	710	670	630	590	550	510	470	430	390	350	310	270	230	190	150	110	70	30	-10	-50	-90	-130	-170	-210	-250	-290	-330
42	958	916	874	832	790	748	706	664	622	580	538	496	454	412	370	328	286	244	202	160	118	76	34	-8	-50	-92	-134	-176	-218	-260	-302
44	1040	996	952	908	864	820	776	732	688	644	600	556	512	468	424	380	336	292	248	204	160	116	72	28	-16	-60	-104	-148	-192	-236	-280
46	1118	1072	1026	980	934	888	842	796	750	704	658	612	566	520	474	428	382	336	290	244	198	152	106	60	14	-32	-78	-124	-170	-216	-262
48	1192	1144	1096	1048	1000	952	904	856	808	760	712	664	616	568	520	472	424	376	328	280	232	184	136	88	40	-8	-56	-104	-152	-200	-248
50	1260	1210	1160	1110	1060	1010	960	910	860	810	760	710	660	610	560	510	460	410	360	310	260	210	160	110	60	10	-40	-90	-140	-190	-240
52	1324	1272	1220	1168	1116	1064	1012	960	908	856	804	752	700	648	596	544	492	440	388	336	284	232	180	128	76	24	-28	-80	-132	-184	-236
54	1382	1328	1274	1220	1166	1112	1058	1004	950	896	842	788	734	680	626	572	518	464	410	356	302	248	194	140	86	32	-22	-76	-130	-184	-238
56	1436	1380	1324	1268	1212	1156	1100	1044	988	932	876	820	764	708	652	596	540	484	428	372	316	260	204	148	92	36	-20	-76	-132	-188	-244
58	1486	1428	1370	1312	1254	1196	1138	1080	1022	964	906	848	790	732	674	616	558	500	442	384	326	268	210	152	94	36	-22	-80	-138	-196	-254
60	1530	1470	1410	1350	1290	1230	1170	1110	1050	990	930	870	810	750	690	630	570	510	450	390	330	270	210	150	90	30	-30	-90	-150	-210	-270
62	1570	1508	1446	1384	1322	1260	1198	1136	1074	1012	950	888	826	764	702	640	578	576	454	392	330	268	206	144	82	20	-42	-104	-166	-228	-290
64	1604	1540	1476	1412	1348	1284	1220	1156	1092	1028	964	900	836	772	708	644	580	516	452	388	324	260	196	132	68	4	-60	-124	-188	-252	-316
66	1634	1568	1502	1436	1370	1304	1238	1172	1106	1040	974	908	842	776	710	644	578	512	446	380	314	248	182	116	50	-16	-82	-148	-214	-280	-346
68	1660	1592	1524	1456	1388	1320	1252	1184	1116	1048	980	912	844	776	708	640	572	504	436	368	300	232	164	96	28	-40	-108	-176	-244	-312	-380
70	1680	1610	1540	1470	1400	1330	1260	1190	1120	1050	980	910	840	770	700	630	560	490	420	350	280	210	140	70	0	-70	-140	-210	-280	-350	-420
72	1695	1623	1551	1479	1407	1335	1263	1191	1119	1047	975	903	831	759	687	615	543	471	399	327	255	183	111	39	-33	-105	-177	-249	-321	-393	-465
74	1706	1632	1558	1484	1410	1336	1262	1188	1114	1040	966	892	818	744	670	596	522	448	374	300	226	152	78	4	-70	-144	-218	-292	-366	-440	-514
76	1712	1636	1560	1484	1408	1332	1256	1180	1104	1028	952	876	800	724	648	572	496	420	344	268	192	116	40	-36	-112	-188	-264	-340	-416	-492	-568
78	1713	1635	1557	1479	1401	1323	1245	1167	1089	1011	933	855	777	699	621	543	465	387	309	231	153	75	-3	-81	-159	-237	-315	-393	-471	-549	-627
80	1710	1630	1550	1470	1390	1310	1230	1150	1070	990	910	830	750	670	590	510	430	350	270	190	110	30	-50	-130	-210	-290	-370	-450	-530	-610	-690
82	1702	1620	1538	1456	1374	1292	1210	1128	1046	964	882	800	718	636	554	472	390	308	226	144	62	-20	-102	-184	-266	-348	-430	-512	-594	-676	-758
84	1688	1604	1520	1436	1352	1268	1184	1100	1016	932	848	764	680	596	512	428	344	260	176	92	8	-76	-160	-244	-328	-412	-496	-580	-664	-748	-832
86	1670	1584	1498	1412	1326	1240	1154	1068	982	896	810	724	638	552	466	380	294	208	122	36	-50	-136	-222	-308	-394	-480	-556	-652	-738	-824	-910
88	1648	1560	1472	1384	1296	1208	1120	1032	944	856	768	680	592	504	416	328	240	152	64	-24	-112	-200	-288	-376	-464	-552	-640	-728	-816	-904	-992
90	1620	1530	1440	1350	1260	1170	1080	990	900	810	720	630	540	450	360	270	180	90	0	-90	-180	-270	-360	-450	-540	-630	-720	-810	-900	-990	-1080

Appendix IX

Payoff Matrix for Duopolist 2

Dissimilar Cost Curves

Limited Information

DUOPOLIST 2"

	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90
30	1550	1623	1692	1735	1812	1863	1908	1947	1980	2007	2030	2043	2052	2055	2052	2043	2028	2007	1980	1947	1911	1863	1812	1755	1692	1623	1548	1467	1320	1287	1190
32	1520	1591	1658	1719	1774	1823	1866	1903	1934	1959	1980	1991	1998	1999	1994	1983	1966	1943	1914	1879	1841	1791	1738	1679	1614	1543	1466	1383	1234	1199	1100
34	1490	1559	1624	1683	1736	1783	1824	1859	1888	1911	1930	1939	1944	1943	1936	1923	1904	1879	1848	1811	1771	1719	1664	1603	1536	1463	1384	1299	1148	1111	1010
36	1460	1527	1590	1647	1698	1743	1782	1815	1842	1863	1880	1887	1890	1887	1878	1863	1842	1815	1782	1743	1701	1647	1590	1527	1458	1383	1302	1215	1062	1023	920
38	1430	1495	1556	1611	1660	1703	1740	1771	1796	1815	1830	1835	1836	1831	1820	1803	1780	1751	1716	1675	1631	1575	1516	1451	1380	1303	1220	1131	976	935	830
40	1400	1463	1522	1575	1622	1663	1698	1727	1750	1767	1780	1783	1782	1775	1762	1743	1718	1687	1650	1607	1561	1503	1442	1375	1302	1223	1138	1047	890	847	740
42	1370	1431	1488	1539	1584	1623	1656	1683	1704	1719	1730	1731	1728	1719	1704	1683	1656	1623	1584	1539	1491	1431	1368	1299	1224	1143	1056	963	804	759	650
44	1340	1399	1454	1503	1546	1583	1614	1639	1658	1671	1680	1679	1674	1663	1646	1623	1594	1559	1518	1471	1421	1359	1294	1223	1146	1063	974	879	718	671	560
46	1310	1367	1420	1467	1508	1543	1572	1595	1612	1623	1630	1627	1620	1607	1588	1563	1532	1495	1452	1403	1351	1287	1220	1147	1068	983	892	795	632	583	470
48	1280	1335	1386	1431	1470	1503	1530	1551	1566	1575	1580	1575	1566	1551	1530	1503	1470	1431	1386	1335	1281	1215	1146	1071	990	903	810	711	546	495	380
50	1250	1303	1352	1395	1432	1463	1488	1507	1520	1527	1530	1523	1512	1495	1472	1443	1408	1367	1320	1267	1211	1143	1072	995	912	823	728	627	460	407	290
52	1220	1271	1318	1359	1394	1423	1446	1463	1474	1479	1480	1471	1458	1439	1414	1383	1346	1303	1254	1199	1141	1071	998	914	834	743	646	543	374	319	200
54	1190	1239	1284	1323	1356	1383	1404	1419	1428	1431	1430	1419	1404	1383	1356	1323	1284	1239	1188	1131	1071	999	924	843	756	663	564	459	288	231	110
56	1160	1207	1250	1287	1318	1343	1362	1375	1382	1383	1380	1367	1350	1327	1298	1263	1222	1175	1122	1063	1001	927	850	767	678	583	482	375	202	143	20
58	1130	1175	1216	1251	1280	1303	1320	1331	1336	1335	1330	1315	1296	1271	1240	1203	1160	1111	1056	995	931	855	776	691	600	503	400	291	116	55	-70
60	1100	1143	1182	1215	1242	1263	1278	1287	1290	1287	1280	1263	1242	1215	1182	1143	1098	1047	990	927	861	783	702	615	522	423	318	207	30	-33	-160
62	1070	1111	1148	1179	1204	1223	1236	1243	1244	1239	1230	1211	1188	1159	1124	1083	1036	983	924	859	791	711	628	539	444	343	236	123	-56	-121	-250
64	1040	1079	1114	1143	1166	1183	1194	1199	1198	1191	1180	1159	1134	1103	1066	1023	974	919	858	791	721	639	554	463	366	263	154	39	-142	-209	-340
66	1010	1047	1080	1107	1128	1143	1152	1155	1152	1143	1130	1107	1080	1047	1008	963	912	855	792	723	651	567	480	387	288	183	72	-45	-228	-297	-430
68	980	1015	1046	1071	1090	1103	1110	1111	1106	1095	1080	1055	1026	991	950	903	850	791	726	655	581	495	406	311	210	103	-10	-129	-314	-385	-520
70	950	983	1012	1035	1052	1063	1068	1067	1060	1047	1030	1003	972	935	892	843	788	727	660	587	511	423	332	235	132	23	-92	-213	-400	-473	-610
72	920	951	978	999	1014	1023	1026	1023	1014	999	980	951	918	879	834	783	726	663	594	519	441	351	258	157	54	-57	-174	-297	-486	-561	-700
74	890	919	944	963	976	983	984	979	968	951	930	899	864	823	776	723	664	599	528	451	371	279	184	83	-24	-137	-256	-381	-572	-649	-790
76	860	887	910	927	938	943	942	935	922	903	880	847	810	767	718	663	602	535	462	383	301	207	110	7	-102	-217	-338	-465	-658	-737	-880
78	830	855	876	891	900	903	900	891	876	855	830	795	756	711	660	603	540	471	396	315	231	135	36	-69	-180	-297	-420	-549	-744	-825	-970
80	800	823	842	855	862	863	858	847	830	807	780	743	702	655	602	543	478	407	330	247	161	63	-38	-145	-258	-377	-502	-633	-830	-913	-1060
82	770	791	808	819	824	823	816	803	784	759	730	691	648	599	544	483	416	343	264	179	91	-9	-112	-221	-336	-457	-584	-717	-916	-1001	-1150
84	740	759	774	783	786	783	774	759	738	711	680	639	594	543	486	423	354	279	198	111	21	-81	-186	-297	-414	-537	-666	-801	-1002	-1089	-1240
86	710	725	740	747	748	743	732	715	692	663	630	587	540	487	428	363	292	215	132	43	-49	-153	-260	-373	-492	-617	-748	-885	-1088	-1177	-1330
88	680	695	706	711	710	703	690	671	646	615	580	535	486	431	370	303	230	157	66	-25	-119	-225	-334	-449	-570	-677	-830	-969	-1174	-1265	-1420
90	650	663	672	675	672	663	648	627	600	567	530	483	432	375	312	243	168	87	0	-93	-189	-297	-408	-525	-648	-777	-912	-1053	-1260	-1353	-1510

Appendix X

Payoff Matrix for Duopolist 1

Dissimilar Cost Curves

Complete Information

DUOPOLIST 2"

DUOPOLIST 1"

	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90
30	1550 / 360	1623 / 330	1692 / 300	1755 / 270	1812 / 240	1863 / 210	1908 / 180	1947 / 150	1980 / 120	2007 / 90	2030 / 60	2045 / 30	2052 / 0	2055 / -30	2052 / -60	2043 / -90	2028 / -120	2007 / -150	1980 / -180	1947 / -210	1911 / -240	1863 / -270	1812 / -300	1755 / -330	1692 / -360	1623 / -390	1548 / -420	1467 / -450	1320 / -480	1287 / -510	1190 / -540
32	1520 / 472	1591 / 440	1658 / 408	1719 / 376	1774 / 344	1823 / 312	1866 / 280	1903 / 248	1934 / 216	1959 / 184	1980 / 152	1991 / 120	1998 / 88	1999 / 56	1994 / 24	1983 / -8	1966 / -40	1943 / -72	1914 / -104	1879 / -136	1841 / -168	1791 / -200	1738 / -232	1679 / -264	1614 / -296	1543 / -328	1466 / -360	1383 / -340	1234 / -374	1199 / -408	1100 / -442
34	1490 / 578	1559 / 544	1624 / 510	1683 / 476	1736 / 442	1783 / 408	1824 / 374	1859 / 340	1888 / 306	1911 / 272	1930 / 238	1939 / 204	1944 / 170	1943 / 136	1936 / 102	1923 / 68	1904 / 34	1879 / 0	1848 / -34	1811 / -68	1771 / -102	1719 / -136	1664 / -170	1603 / -204	1536 / -238	1463 / -272	1384 / -306	1299 / -340	1148 / -374	1111 / -408	1010 / -442
36	1460 / 680	1527 / 644	1590 / 608	1647 / 572	1698 / 536	1743 / 500	1782 / 464	1815 / 428	1842 / 392	1863 / 356	1880 / 320	1887 / 284	1890 / 248	1887 / 212	1878 / 176	1863 / 140	1842 / 104	1815 / 68	1782 / 32	1743 / -4	1701 / -40	1647 / -76	1590 / -112	1527 / -148	1458 / -184	1383 / -220	1302 / -256	1215 / -292	1062 / -328	1023 / -364	920 / -400
38	1430 / 778	1495 / 740	1556 / 702	1611 / 664	1660 / 626	1703 / 588	1740 / 550	1771 / 512	1796 / 474	1815 / 436	1830 / 398	1835 / 360	1836 / 322	1831 / 284	1820 / 246	1803 / 208	1780 / 170	1751 / 132	1716 / 94	1675 / 56	1631 / 18	1575 / -20	1516 / -58	1451 / -96	1380 / -134	1303 / -172	1220 / -210	1131 / -248	976 / -286	935 / -324	830 / -362
40	1400 / 870	1463 / 830	1522 / 790	1575 / 750	1622 / 710	1663 / 670	1698 / 630	1727 / 590	1750 / 550	1767 / 510	1780 / 470	1783 / 430	1782 / 390	1775 / 350	1762 / 310	1743 / 270	1718 / 230	1687 / 190	1650 / 150	1607 / 110	1561 / 70	1503 / 30	1442 / -10	1375 / -50	1302 / -90	1223 / -130	1138 / -170	1047 / -210	890 / -250	847 / -290	740 / -330
42	1370 / 958	1431 / 916	1488 / 874	1539 / 832	1584 / 790	1623 / 748	1656 / 706	1683 / 664	1704 / 622	1719 / 580	1730 / 538	1731 / 496	1728 / 454	1719 / 412	1704 / 370	1683 / 328	1656 / 286	1623 / 244	1584 / 202	1539 / 160	1491 / 118	1431 / 76	1368 / 34	1299 / -8	1224 / -50	1143 / -92	1056 / -134	963 / -176	804 / -218	759 / -260	650 / -320
44	1340 / 1040	1399 / 996	1454 / 952	1503 / 908	1546 / 864	1583 / 820	1614 / 776	1639 / 732	1658 / 688	1671 / 644	1680 / 600	1679 / 556	1674 / 512	1663 / 468	1646 / 424	1623 / 380	1594 / 336	1559 / 292	1518 / 248	1471 / 204	1421 / 160	1359 / 116	1294 / 72	1223 / 28	1146 / -16	1063 / -60	974 / -104	879 / -148	718 / -192	671 / -236	560 / -280
46	1310 / 1118	1367 / 1072	1420 / 1026	1467 / 980	1508 / 934	1543 / 888	1572 / 842	1595 / 796	1612 / 750	1623 / 704	1630 / 658	1627 / 612	1620 / 566	1607 / 520	1588 / 474	1563 / 428	1532 / 382	1495 / 336	1452 / 290	1403 / 244	1351 / 198	1287 / 152	1220 / 106	1147 / 60	1068 / 14	983 / -32	890 / -78	795 / -124	632 / -170	583 / -216	470 / -262
48	1280 / 1192	1335 / 1144	1386 / 1096	1431 / 1048	1470 / 1000	1503 / 952	1530 / 904	1551 / 856	1566 / 808	1575 / 760	1580 / 712	1575 / 664	1566 / 616	1551 / 568	1530 / 520	1503 / 472	1470 / 424	1431 / 376	1386 / 328	1335 / 280	1281 / 232	1215 / 184	1146 / 136	1071 / 88	990 / 40	903 / -8	810 / -56	711 / -104	546 / -152	495 / -200	380 / -248
50	1250 / 1260	1303 / 1210	1352 / 1160	1395 / 1110	1432 / 1060	1463 / 1010	1488 / 960	1507 / 910	1520 / 860	1527 / 810	1530 / 760	1523 / 710	1512 / 660	1495 / 610	1472 / 560	1443 / 510	1408 / 460	1367 / 410	1320 / 360	1267 / 310	1211 / 260	1143 / 210	1072 / 160	995 / 110	912 / 60	823 / 10	728 / -40	627 / -90	460 / -140	407 / -190	290 / -240
52	1220 / 1324	1271 / 1272	1318 / 1220	1359 / 1168	1394 / 1116	1423 / 1064	1446 / 1012	1463 / 960	1474 / 908	1479 / 856	1480 / 804	1471 / 752	1458 / 700	1439 / 648	1414 / 596	1383 / 544	1346 / 492	1303 / 440	1254 / 388	1199 / 336	1141 / 284	1071 / 232	998 / 180	919 / 128	834 / 76	743 / 24	646 / -28	543 / -80	374 / -132	319 / -184	200 / -236
54	1190 / 1382	1239 / 1328	1284 / 1274	1323 / 1220	1356 / 1166	1383 / 1112	1404 / 1058	1419 / 1004	1428 / 950	1431 / 896	1430 / 842	1419 / 788	1404 / 734	1383 / 680	1356 / 626	1323 / 572	1284 / 518	1239 / 464	1188 / 410	1131 / 356	1071 / 302	999 / 248	924 / 194	843 / 140	756 / 86	663 / 32	564 / -22	459 / -76	288 / -130	231 / -184	110 / -238
56	1160 / 1436	1207 / 1380	1250 / 1324	1287 / 1268	1318 / 1212	1343 / 1156	1362 / 1100	1375 / 1044	1382 / 988	1383 / 932	1380 / 876	1367 / 820	1350 / 764	1327 / 708	1298 / 652	1263 / 596	1222 / 540	1175 / 484	1122 / 428	1063 / 372	1001 / 316	927 / 260	850 / 204	767 / 148	678 / 92	583 / 36	482 / -20	375 / -76	202 / -132	143 / -188	20 / -244
58	1130 / 1486	1175 / 1428	1216 / 1370	1251 / 1312	1280 / 1254	1303 / 1196	1320 / 1138	1331 / 1080	1336 / 1022	1335 / 964	1330 / 906	1315 / 848	1296 / 790	1271 / 732	1240 / 674	1203 / 616	1160 / 558	1111 / 500	1056 / 440	995 / 384	931 / 326	855 / 268	776 / 210	691 / 152	600 / 94	503 / 36	400 / -22	291 / -80	116 / -138	55 / -196	-70 / -254
60	1100 / 1530	1143 / 1470	1182 / 1410	1215 / 1350	1242 / 1290	1263 / 1230	1278 / 1170	1287 / 1110	1290 / 1050	1287 / 990	1280 / 930	1263 / 870	1242 / 810	1215 / 750	1182 / 690	1143 / 630	1098 / 570	1047 / 510	990 / 450	927 / 390	861 / 330	783 / 270	702 / 210	615 / 150	522 / 90	423 / 30	318 / -30	207 / -90	30 / -150	-33 / -210	-160 / -270
62	1070 / 1570	1111 / 1508	1148 / 1446	1179 / 1384	1204 / 1322	1223 / 1260	1236 / 1198	1243 / 1136	1244 / 1074	1239 / 1012	1230 / 950	1211 / 888	1188 / 826	1159 / 764	1124 / 702	1083 / 640	1036 / 578	983 / 516	924 / 454	859 / 392	791 / 330	711 / 268	628 / 206	539 / 144	444 / 82	343 / 20	236 / -42	123 / -104	-56 / -166	-121 / -228	-250 / -290
64	1040 / 1604	1079 / 1540	1114 / 1476	1143 / 1412	1166 / 1348	1183 / 1284	1194 / 1220	1199 / 1156	1198 / 1092	1191 / 1028	1180 / 964	1159 / 900	1134 / 836	1103 / 772	1066 / 708	1023 / 644	974 / 580	919 / 516	858 / 452	791 / 388	721 / 324	639 / 260	554 / 196	463 / 132	366 / 68	263 / 4	154 / -60	39 / -124	-142 / -188	-209 / -252	-340 / -316
66	1010 / 1634	1047 / 1568	1080 / 1502	1107 / 1436	1128 / 1370	1143 / 1304	1152 / 1238	1155 / 1172	1152 / 1106	1143 / 1040	1130 / 974	1107 / 908	1080 / 842	1047 / 776	1008 / 710	963 / 644	912 / 578	855 / 512	792 / 446	723 / 380	651 / 314	567 / 248	480 / 182	387 / 116	288 / 50	183 / -16	72 / -82	-45 / -148	-228 / -214	-297 / -280	-430 / -346
68	980 / 1660	1015 / 1592	1046 / 1524	1071 / 1456	1090 / 1388	1103 / 1320	1110 / 1252	1111 / 1184	1106 / 1116	1095 / 1048	1080 / 980	1055 / 912	1026 / 844	991 / 776	950 / 708	903 / 640	850 / 572	791 / 504	726 / 436	655 / 368	581 / 300	495 / 232	406 / 164	311 / 96	210 / 28	103 / -40	-10 / -108	-129 / -176	-314 / -244	-385 / -342	-520 / -380
70	950 / 1680	983 / 1610	1012 / 1540	1035 / 1470	1052 / 1400	1063 / 1330	1068 / 1260	1067 / 1190	1060 / 1120	1047 / 1050	1030 / 980	1003 / 910	972 / 840	935 / 770	892 / 700	843 / 630	788 / 560	727 / 490	660 / 420	587 / 350	511 / 280	423 / 210	332 / 140	235 / 70	132 / 0	23 / -70	-92 / -140	-213 / -210	-400 / -280	-473 / -350	-610 / -420
72	920 / 1695	951 / 1623	978 / 1551	999 / 1479	1014 / 1407	1023 / 1335	1026 / 1263	1023 / 1191	1014 / 1119	999 / 1047	980 / 975	951 / 903	918 / 831	879 / 759	834 / 687	783 / 615	726 / 543	663 / 471	594 / 399	519 / 327	441 / 255	351 / 183	258 / 111	159 / 39	54 / -33	-57 / -105	-174 / -177	-297 / -249	-486 / -321	-561 / -393	-700 / -465
74	890 / 1706	919 / 1632	944 / 1558	963 / 1484	976 / 1410	983 / 1336	984 / 1262	979 / 1188	968 / 1114	951 / 1040	930 / 966	899 / 892	864 / 818	823 / 744	776 / 670	723 / 596	664 / 522	599 / 448	528 / 374	451 / 300	371 / 226	279 / 152	184 / 78	83 / 4	-24 / -70	-137 / -144	-256 / -218	-381 / -292	-572 / -366	-649 / -440	-790 / -514
76	860 / 1712	887 / 1636	910 / 1560	927 / 1484	938 / 1408	943 / 1332	942 / 1256	935 / 1180	922 / 1104	903 / 1028	880 / 952	847 / 876	810 / 800	767 / 724	718 / 648	663 / 572	602 / 496	535 / 420	462 / 344	383 / 268	301 / 192	207 / 116	110 / 40	7 / -36	-102 / -112	-217 / -188	-338 / -264	-465 / -340	-658 / -416	-737 / -492	-880 / -568
78	830 / 1713	855 / 1635	876 / 1557	891 / 1479	900 / 1401	903 / 1323	900 / 1245	891 / 1167	876 / 1089	855 / 1011	830 / 933	795 / 855	756 / 777	711 / 699	660 / 621	603 / 543	540 / 465	471 / 387	396 / 309	315 / 231	231 / 153	135 / 75	36 / -3	-69 / -81	-180 / -159	-297 / -237	-420 / -315	-549 / -393	-744 / -471	-825 / -549	-970 / -627
80	800 / 1710	823 / 1630	842 / 1550	855 / 1470	862 / 1390	863 / 1310	858 / 1230	847 / 1150	830 / 1070	807 / 990	780 / 910	743 / 830	702 / 750	655 / 670	602 / 590	543 / 510	478 / 430	407 / 350	330 / 270	247 / 180	161 / 110	63 / 30	-38 / -50	-145 / -130	-258 / -210	-377 / -290	-502 / -370	-633 / -450	-830 / -530	-913 / -610	-1060 / -690
82	770 / 1702	791 / 1620	808 / 1538	819 / 1456	824 / 1374	823 / 1292	816 / 1210	803 / 1128	784 / 1046	759 / 964	730 / 882	691 / 800	648 / 718	599 / 636	544 / 554	483 / 472	410 / 390	343 / 308	264 / 226	179 / 144	91 / 62	-9 / -20	-112 / -102	-221 / -184	-336 / -266	-457 / -348	-584 / -430	-717 / -512	-916 / -594	-1001 / -676	-1150 / -758
84	740 / 1688	759 / 1604	774 / 1520	783 / 1436	786 / 1352	783 / 1268	774 / 1184	759 / 1100	738 / 1016	711 / 932	680 / 848	639 / 764	594 / 680	543 / 596	486 / 512	423 / 428	354 / 344	279 / 260	198 / 176	111 / 92	21 / 8	-81 / -76	-186 / -160	-297 / -244	-414 / -328	-537 / -412	-666 / -496	-801 / -580	-1002 / -664	-1089 / -748	-1240 / -832
86	710 / 1670	725 / 1584	740 / 1498	747 / 1412	748 / 1326	743 / 1240	732 / 1154	715 / 1068	692 / 982	663 / 896	630 / 810	587 / 724	540 / 638	487 / 552	428 / 466	363 / 380	292 / 294	215 / 208	132 / 122	43 / 36	-49 / -50	-153 / -136	-260 / -222	-373 / -308	-492 / -394	-617 / -480	-748 / -566	-885 / -652	-1088 / -738	-1177 / -824	-1330 / -910
88	680 / 1648	695 / 1560	706 / 1472	711 / 1384	710 / 1296	703 / 1208	690 / 1120	671 / 1032	646 / 944	615 / 856	570 / 768	536 / 680	486 / 592	431 / 504	370 / 416	303 / 328	230 / 240	151 / 152	66 / 64	-25 / -24	-119 / -112	-225 / -200	-334 / -288	-449 / -376	-570 / -464	-697 / -552	-830 / -640	-969 / -728	-1174 / -816	-1265 / -904	-1420 / -992
90	650 / 1620	663 / 1530	672 / 1440	675 / 1350	672 / 1260	663 / 1170	648 / 1080	627 / 990	600 / 900	567 / 810	530 / 720	483 / 630	432 / 540	375 / 450	312 / 360	243 / 270	168 / 180	87 / 90	0 / 0	-93 / -90	-189 / -180	-297 / -270	-408 / -360	-525 / -450	-648 / -540	-777 / -630	-912 / -720	-1053 / -810	-1260 / -900	-1353 / -990	-1510 / -1080

Appendix XI

Payoff Matrix for Duopolist 2

Dissimilar Cost Curves

Complete Information

DUOPOLIST 2"

DUOPOLIST 1"

	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90
30	1550 / 360	1623 / 330	1692 / 300	1755 / 270	1812 / 240	1863 / 210	1908 / 180	1947 / 150	1980 / 120	2007 / 90	2030 / 60	2043 / 30	2052 / 0	2055 / -30	2052 / -60	2043 / -90	2028 / -120	2007 / -150	1980 / -180	1947 / -210	1911 / -240	1863 / -270	1812 / -300	1755 / -330	1692 / -360	1623 / -390	1548 / -420	1467 / -450	1320 / -480	1257 / -510	1190 / -540
32	1520 / 472	1591 / 440	1658 / 408	1719 / 376	1774 / 344	1823 / 312	1866 / 280	1903 / 248	1934 / 216	1959 / 184	1980 / 152	1991 / 120	1998 / 88	1999 / 56	1994 / 24	1983 / -8	1966 / -40	1943 / -72	1914 / -104	1879 / -136	1841 / -168	1791 / -200	1738 / -232	1679 / -264	1614 / -296	1543 / -328	1466 / -360	1383 / -392	1234 / -424	1199 / -456	1100 / -488
34	1490 / 578	1559 / 544	1624 / 510	1683 / 476	1736 / 442	1783 / 408	1824 / 374	1859 / 340	1888 / 306	1911 / 272	1930 / 238	1939 / 204	1944 / 170	1943 / 136	1936 / 102	1923 / 68	1904 / 34	1879 / 0	1848 / -34	1811 / -68	1771 / -102	1719 / -136	1664 / -170	1603 / -204	1536 / -238	1463 / -272	1384 / -306	1299 / -340	1148 / -374	1111 / -408	1010 / -442
36	1460 / 680	1527 / 644	1590 / 608	1647 / 572	1698 / 536	1743 / 500	1782 / 464	1815 / 428	1842 / 392	1863 / 356	1880 / 320	1889 / 284	1890 / 248	1887 / 212	1878 / 176	1863 / 140	1842 / 104	1815 / 68	1782 / 32	1743 / -4	1701 / -40	1647 / -76	1590 / -112	1527 / -148	1458 / -184	1383 / -220	1302 / -256	1215 / -292	1062 / -328	1023 / -364	920 / -400
38	1430 / 778	1495 / 740	1556 / 702	1611 / 664	1660 / 626	1703 / 588	1740 / 550	1771 / 512	1796 / 474	1815 / 436	1830 / 398	1835 / 360	1836 / 322	1831 / 284	1820 / 246	1803 / 208	1780 / 170	1751 / 132	1716 / 94	1675 / 56	1631 / 18	1575 / -20	1516 / -58	1467 / -96	1380 / -134	1303 / -172	1220 / -210	1131 / -248	976 / -286	935 / -324	830 / -362
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