Since firm m-1 is a taker with respect to 1,..., m-2, and the latter exhibit constant output reaction functions,

$$\sum_{i=1}^{m-2} \frac{dx_i}{dx_{m-1}} = 0 .$$

And from (11), we know $\frac{dx_m^*}{dx_{m-1}} = -\frac{1}{2}$. Thus, using (9) and (10),

$$x_{m-1}^* = \frac{a-c-b \sum_{i=1}^{m-2} x_i}{2b} = \frac{p-c}{b/2} \tag{12}$$

To obtain m-2's profit-maximizing condition, we have to calculate m-1's and m's rational responses to a change in x_{m-2}. From (1) we know that

$$\frac{dx_{m-1}^*}{dx_{m-2}} = -1/2 . \tag{13}$$

And from (10),

$$\frac{dx_m^*}{dx_{m-2}} = \frac{\partial x_m^*}{\partial x_{m-2}} + \frac{\partial x_m^*}{\partial x_{m-1}} \cdot \frac{dx_{m-1}^*}{dx_{m-2}} = -1/4. \tag{14}$$

Hence, again using (9),

$$x_{m-2}^* = \frac{a-c-b \sum_{i=1}^{m-3} x_i}{2b} = \frac{p-c}{b/4} . \tag{15}$$

Similarly, we find that

$$x^*_{m-3} = \frac{a-c-b \sum_{i=1}^{m-4} x_i}{2b} = \frac{p-c}{b/8} , \tag{16}$$

$$x^*_{m-4} = \frac{a-c-b \sum_{i=1}^{m-5} x_i}{2b} = \frac{p-c}{b/16} ,$$

$$\begin{array}{cc} \cdot & \cdot \\ \cdot & \cdot \end{array}$$

$$x^*_1 = \frac{a-c}{2b} = \frac{p-c}{b/2^{m-1}} \tag{17}$$

The resulting size distribution of firms is obviously

$$x^*_{m-i} = x^*_m \, 2^j , \; j = 0, 1, \ldots, m-1. \tag{18}$$

D. <u>Corollaries</u>

It is interesting to note from (17) that the first firm always produces the simple monopoly output. Its solution output, and correspondingly the solution outputs of subsequent makers, is therefore unaffected by the addition of new firms to the industry.

There is also a corollary concerning the "concentration ratio" of our industries. It is that the t-firm concentration ratio, the share of the top t firms in the industry, decreases as the number of firms in the industry increases. From the above theorem, the total output of the top t firms in the industry can be written:

________, "A Pure Theory of Strategic Behavior and Social Institution," Amer. Econ. Rev., June 1981, pp. 300-31.

Thompson, E. A., Faith, R. L., and Rooney, R. F., "Competition and Vertical Integration in the Domestic U.S. Oil Industry," manuscript, 56 pages.

Thompson, Velma M., "Inefficient Labor Market Discrimination Under Competitive Conditions," UCLA Ph.D. Dissertation, 1977.

Von Neumann, John and Morgenstern, Oscar, Theory of Games and Economic Behavior, 3rd Ed., Princeton, 1953.

Williamson, Oliver, "Predatory Pricing: A Strategic and Welfare Analysis," 87 Yale Law Journal, 284, 1977.