AN INSTRUCTIONAL EXERCISE IN COST-RAISING
STRATEGIES AND PERFECT COMPLEMENTS PRODUCTION

By

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Abstract

A “case study” of the contract negotiations between the United Auto Workers (UAW) and Ford Motor Company is presented to assist students in developing facility with perfect complements production/cost functions and cost-raising strategies. Specifically, this discussion seeks to answer the question of why the UAW targeted Ford for contract negotiations to establish a benchmark for subsequent negotiations with Chrysler and General Motors? Contrary to the popular business press that asserted at the time that “Ford drew the short straw” in being the first of the “Big Three” automakers to negotiate with the UAW, we believe it is not implausible that this arrangement served the economic interests of both Ford and the UAW. To wit, the UAW targeted Ford because it was more likely to go along with a liberal wage and benefits package given its investment in robotics. In turn, Ford was able to raise, albeit indirectly, its rivals’ costs.

1. Introduction

When I first began teaching economics, more than twenty years ago, I spent a great deal of time talking with undergraduates and MBA students in an attempt to identify their major frustrations with the economics instruction they received. The most frequent comment that I received in response to my inquiry was that “economics was all theory that bears no relation to reality.” This was somewhat surprising to me because I had spent more than a decade immediately following graduate school working as an economist at a Fortune 500 Corporation and I dealt with real-world applications of economics everyday. The obvious question therefore concerned why these applications were not finding their way into the classroom?

For me personally, the beauty of economics lies in its ability to provide answers to questions that elude more cursory analysis. Hence, I felt quite strongly that if I could demonstrate for my students the ability of economics to answer these more difficult questions, they would naturally find the discipline worthy of their time and effort. And,
while I cannot lay claim to turning all of my undergraduate students on to the power of
economic analysis, these techniques have worked for the majority of the students that
have found their way into my classroom over the last two decades.

The discussion that follows is based on one of my more successful attempts—as
measured by student reactions—to enlighten undergraduates and MBA students to the
power of economic analysis in bringing the real world into the classroom. Specifically, I
discuss the contract negotiations between the United Auto Workers (UAW) and Ford
Motor Company that took place in 1993 to motivate the concepts of perfect complements
production and the strategic behavior of raising rivals’ costs.1 In truth, this discussion is
more along the lines of a “well-motivated story” than an actual case study because the
factual basis for certain parts of the analysis cannot be verified with complete certainty.
And yet, much like any good teaching exercise, this well-motivated story likely serves to
raise more questions than it answers.

The format for the remainder of this paper is as follows. The institutional
background for this “case study” is presented in Section 2. Section 3 develops the
economic analysis underlying this “case study.” The various types of possible strategic
behavior are discussed in Section 4. Additional discussion questions are contained in
Section 5. Section 6 summarizes the key points and concludes.

2. Institutional Background

The stylized facts underlying the institutional foundation for the contract negotiations
between Ford and the UAW are as follows:

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1 See Salop and Scheffman (1983, 1987) and Krattenmaker and Salop (1986) for a formal discussion of
cost-raising strategies and Carlton and Perloff (2005, pp. 371-375) for an overview of the literature.
1) In the early 1990’s, Ford motor company initiated a massive capital investment program (Baxter, 1993; PR Newswire, 1993; Kyoto News Service, 1993). The result of this program was a greater utilization of robotics and hence a lower utilization of labor per vehicle relative to its domestic rivals, General Motors (GM) and Chrysler.

2) In 1993, the UAW chose to negotiate first with Ford before engaging in contract negotiations with GM and Chrysler (The Economist, September 4, 1993). Notably, in the last series of contract negotiations three years prior, GM was the target rather than Ford (Levin, 1993).

3) Ford agreed to what was then generally considered a fairly liberal wage and benefits package with the UAW.2 While negotiations went down to the wire, there was no strike or work stoppage of any kind.

4) The UAW’s contract with Ford established a benchmark for its negotiations with GM and Chrysler (The Economist, September 4, 1993).

The fundamental questions for analysis concern why Ford agreed to a liberal wage and benefits package with the UAW and whether this contract and the pattern it set for subsequent negotiations with the other “Big Three” automakers constitutes strategic behavior on the part of Ford and/or the UAW?

3. Economic Analysis

A. Production Functions

We begin the economic analysis by attributing to Ford and GM/Chrysler a production function for automobiles that reflects the institutional background outlined in the previous section. As capital and labor are not substitutable in the short-run in the

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2 One industry analyst observed that “Ford and Chrysler negotiators might agree to more generous benefits for long-term jobless, figuring that only G.M. had too many workers” (Levin, 1993). Another auto analyst, David Healy of S.G. Warburg & Company, observed that “the new contract would widen the gap between General Motors’ labor costs and those of Ford. Mr. Healy estimates that it already costs G.M. $800 more to assemble a car than Ford” (Bennet, 1993).
production of automobiles, the functional form of the production function is that of perfect complements.\(^3\)

The production function for Ford (F) is assumed to be given by:

\[
(1) \quad Q^F = \min \{1/2K, 1/3L\},
\]

where \(Q^F\) denotes the physical number of automobiles produced by Ford, \(K\) is capital and \(L\) is labor. This production function indicates that Ford requires 2 units of capital and 3 units of labor to produce each automobile efficiently—with no excess capital or labor.\(^4\) The isoquant map for the production function in (1) is illustrated in Figure 1.\(^5\)

The production function for GM/Chrysler (G/C) is assumed to be given by:

\[
(2) \quad Q^{G/C} = \min \{1K, 1/5L\},
\]

where \(Q^{G/C}\) denotes the physical number of automobiles produced by GM or Chrysler. This production function indicates that GM/Chrysler requires 1 unit of capital and 5 units of labor to produce each automobile efficiently. The isoquant map for the production function in (2) is illustrated in Figure 2. Recognize that Ford uses more capital and less labor per automobile relative to GM/Chrysler due to its significant investment in robotics.

\section*{B. Cost Functions}

Suppose that prior to contract negotiations with the UAW the price of capital per unit is $4,000 and the price of labor per unit is $2,000. Since Ford requires 2 units of capital and 3 units of labor per automobile, its cost function is given by

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\(^3\) Some textbooks refer to this method of production as “Leontief production” after Wassily Leontief, the 1973 winner of the Nobel Prize in economics who employed this type of production function in his pioneering work on input-output analysis. See Leontief (1951).

\(^4\) This type of production function is also referred to as a \textit{fixed proportions production function} because efficient production requires that the inputs be combined in fixed proportions.

\(^5\) The EPL (efficient production locus) in Figures 1 and 2 represents the efficient combinations of \(K\) and \(L\) required to produce any given level of output. The slope of the EPL is the efficient capital-labor ratio.
The marginal and average cost of an automobile for Ford is therefore $14,000.

Similarly, since GM/Chrysler requires 1 unit of capital and 5 units of labor per automobile, its cost function is given by

$$C^{G/C} (Q^{G/C}) = [(1 \times \$4,000) + (5 \times \$2,000)]Q^{G/C} = \$14,000Q^{G/C}.$$  

The marginal and average cost of an automobile for GM/Chrysler is therefore $14,000, the same as for Ford. Hence, prior to the contract negotiations with the UAW, none of the “Big Three” automakers enjoys a cost advantage over its domestic rivals.

Following the contract negotiations with the UAW, the price of labor per unit is assumed to rise from $2,000 to $3,000 to reflect the new wage and benefits package. The price of capital per unit is unaffected by the contract negotiations and remains unchanged at $4,000 per unit. Also, because the production function is of the perfect complements type, there is no flexibility on the part of the automakers to substitute capital for labor, at least in the short-run, in response to the increase in the price of labor. Consequently, the input requirements per automobile remain unchanged as a result of the contract negotiations. The post-contract negotiation cost functions for Ford and GM/Chrysler are therefore given, respectively, by

$$C^{F} (Q^{F}) = [(2 \times \$4,000) + (3 \times \$3,000)]Q^{F} = \$17,000Q^{F},$$

and

$$C^{G/C} (Q^{G/C}) = [(1 \times \$4,000) + (5 \times \$3,000)]Q^{G/C} = \$19,000Q^{G/C}.$$  

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6 The technique of determining the efficient input requirements per unit of output and extrapolating to any given level of output to derive the cost function is valid only for a production function that exhibits constant returns to scale.
Examination of (5) and (6) reveals that the marginal and average cost of an automobile increased for all of the “Big-Three” automakers, but Ford now enjoys a $2,000 per unit, or approximately 12%, cost advantage over GM and Chrysler. The cost advantage derives from the fact that Ford’s more intensive utilization of robotics tempers the cost impact on Ford of higher union wage rates.

4. Strategic Behavior

When I first present this well-motivated story to my students they are somewhat incredulous. The most common question is “why would a rational firm ever choose to shoot itself in the foot?” The more relevant question for analysis concerns whether a firm can secure an advantage—in this case a cost advantage—over its rivals by engaging in some form of strategic behavior? The key point is that a firm may rationally choose to engage in behavior that raises its own costs if it simultaneously raises the costs of its rivals even more.

In terms of strategic behavior, there are a number of possibilities to consider. First, did the UAW target Ford for contract negotiations because it recognized that Ford’s investment in robotics would render it more likely to go along with a liberal wage and benefits package for its union members? Second, did Ford agree to the liberal wage and benefits package in order to raise its rivals’ costs? Third, did Ford and the UAW coordinate their actions strategically (collude) against GM/Chrysler?

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7 Williamson (1968) was perhaps the first to observe that a firm might willingly concede to, or even orchestrate, a labor union’s demand for a higher wage rate if the higher wage rate serves to increase a rival’s marginal cost more than it increases the firm’s own marginal cost.

8 Sappington and Weisman (2005 forthcoming) show that a vertically-integrated, regulated firm that is required by regulatory fiat to provide essential inputs to rivals at “cost-based” rates may have incentive to raise the costs of the those inputs and/or diminish their quality in order to secure a competitive advantage.

9 Notably, an article in The Economist of September 4, 1993 observes that “Ford drew the short straw on August 30th when it was picked by the United Auto Workers (UAW) to lead this year’s negotiations.”
Of course, if these actions constitute strategic behavior on the part of the Ford and/or the UAW, it would be difficult to establish this definitively unless one of the participants involved in the negotiations were willing to speak publicly about the matter. Ford could seemingly justify its actions by declaring publicly that paying its workforce a fair wage is consistent with its focus on quality. In turn, it would be difficult for the government to meet the burden of proof necessary to establish that the actions of Ford and/or the UAW had as a primary, rather than ancillary, intent to inflict harm on GM/Chrysler.

5. Additional Questions for Discussion

The story outlined above leaves a number of questions unanswered. First, the analysis assumes, albeit implicitly, that there are only three automakers and that all three are subject to contract negotiations with the UAW. In fact, the “Big Three” automakers face stiff competition from Japan and Germany and more recently from Korea where the UAW has no presence. Hence, strategically raising domestic labor rates may prove self-defeating for Ford if its overseas rivals do not have to raise wages in concert. Second, higher wage rates today would provide increased incentives for capital investment in robotics tomorrow. Should not the UAW be concerned about the substitutability of capital for labor in the longer run? How does the UAW balance higher wages today against reduced labor utilization tomorrow? These are just a few of the outstanding questions raised by this “case study.”

10 The share price performance of Ford and GM may provide some additional, albeit anecdotal, support for the “cost-raising” hypothesis. When Ford’s contract with the UAW was announced on September 15, 1993, Ford’s share price increased modestly over the next two weeks from 54.75 on the day of the announcement to 55.25 on September 30. Conversely, over this same time period, GM’s share price declined sharply from 47.25 to 41.75. A definitive analysis of the effects of the UAW contract on the share prices of Ford and GM would require a formal event study.
6. Conclusion

A “case study” of the contract negotiations between the UAW and Ford is employed to develop students’ facility with perfect complements production/cost functions and cost-raising strategies. Specifically, we inquire as to why the UAW broke with past practice and targeted Ford for contract negotiations with the “Big Three” automakers. Notably, these contract negotiations occurred after Ford had made a significant investment in the use of robotics to produce automobiles.

This “case study” prompts a number of questions for analysis. Did the UAW target Ford because it believed that it would be more likely to go along with a liberal wage and benefits package given its investment in robotics? Did Ford agree to a liberal wage and benefits package with the UAW because it recognized that its rivals would be disproportionately harmed as a result? If we appeal to the rationality axiom in economics—economic agents behave in their own self-interest—this well-motivated story provides a seemingly plausible explanation for the behavior of Ford and the UAW during these contract negotiations.
References


Carlton, Dennis W. and Jeffrey M. Perloff, Modern Industrial Organization, Boston: Addison-Wesley, 2005.


Figure 1.
Automobile Isoquant Map For Ford

Figure 2.
Automobile Isoquant Map For GM/Chrysler