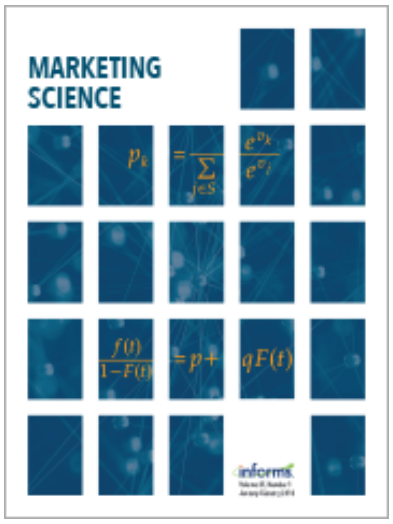

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Commentary

An Industry Equilibrium Analysis of Downstream Vertical Integration: Twenty-Five Years Later

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The goal of this brief note is to provide the reader with an appreciation of how this paper was initially conceived, to state what I think are the paper's key insights, and to outline a few of the many challenges and opportunities that still exist in studying channel management issues.

Background

This paper has a long history.[1] The genesis for the paper came from my involvement as an expert witness in a legal case involving an automobile dealer and Ford Motor company. My task was to comment on the impact of a factory retail outlet on the profits of a nearby franchised Ford dealership. At the time of the case (1971), there were few published papers on channel structure and no models that included competition at both the retail and manufacturer level. This led me to build a model to help me better understand and explicate the forces impacting both the upstream and downstream channel members without having to collect any data. I quickly decided that my training in economic analysis was lacking (at the time I had just graduated with a Ph.D. in Statistics and had only taken a few courses in economics), and so I approached Timothy McGuire, a noted economist who also was at Carnegie Mellon University. He agreed to work with me on the case and help me develop a model of channel structure.

After the case was settled (our side won) we began to expand on our initial efforts. A few years later (1974), we finished the first complete draft of what is now the 1983 paper. It took another two years before we worked out all of the issues. After presenting our model and results to the Econometrics Society in 1976, we sequentially submitted our paper for publication to three major economics journals (*American Economics Review, Bell Journal of Economics*—now the *RAND Journal*—and the *Journal of Industrial Organization*). Each time the paper was rejected. The main reason given (if I remember correctly) was that there was nothing new, and in any case it was not particularly relevant to the journal's readership. Undeterred, we began working with a Ph.D. student and published a variation of our basic model in an AMA Summer Conference proceeding (Doraiswamy et al. 1979). The discussant on this paper was even harsher than the three different review teams, saying that our model was too abstract and that our conclusions should be totally disregarded. Given the lack of any really positive feedback, Tim and I decided to put this line of research aside and start working on other projects.

A couple of years later, Don Morrison and Frank Bass started *Marketing Science*. Don (who was the first editor) asked me to be a reviewer for what turned out to be the Jeuland and Shugan (1983) channel coordination paper (which also appears in this special issue). Although I liked their paper—I suggested the paper be accepted—I felt that the paper written by Tim and me provided a different but very relevant perspective on channel relationships, including channel coordination. Consequently, I suggested to Tim that we revise our paper and submit it to Marketing Science. The rest is history.

Postscript. It is interesting how the field has progressed since our 1983 paper. Initially, most of the follow-on work that built on our equilibrium approach and our four-player model of channel structure appeared in marketing journals (e.g. Coughlan 1985; Moorthy 1987, 1988; Coughlan and Wernerfelt 1989; Chu and Desai 1995; Purohit 1997). However, within a few years, papers covering the same issues and using the same basic model setup began to appear in economic journals (e.g., Bonnano and Vickers 1988, Rey and Stiglitz 1988). More recently, we have seen a number of channel management papers published by an Operations Management faculty (e.g. Cachon and Lariviere 2005). Thus, the basic paradigm

[1] For a more detailed discussion see McGuire (2001) and Staelin (2001).

put forward in our paper has diffused into a number of related fields.

Key Issues That We Needed to Solve

It may be hard for people to remember back to the 1970s in terms of the existing knowledge base for economic analyses. Suffice it to say, there were no symbolic language computer packages that could be used to help solve complex games. In fact, most models of channel relationships were either monopoly models or models of pure competition, since this was the only tractable way to address vertical relationships. Our goal at that time was to capture the key aspects of the situation being modeled and yet be able to solve the model by hand. This led us to develop a model that had the following characteristics:

1. Allow for competition at both the retail and manufacturer level while still noting that each player faces a downward sloping demand curve.

2. Make specific the information available to each channel member and the rules (strategies) that they can use to make their decisions.

3. Adequately capture the demand facing each player and the impact that each player has on the other players.

4. Ensure that equilibrium solutions could be derived using matrix algebra.

We initially postulated a six-player game with two manufacturers each selling to two retailers. (The idea was that we wanted each manufacturer to be able to sell to one decentralized dealer and one vertically integrated dealer.) However, after struggling with this set-up for a long while, we realized that we could get most of the results we were looking for by limiting our attention to four players; two manufacturers and two retailers. We also realized that the manufacturer was the "first mover" in that the manufacturer set the wholesale price first and the retailer set the retail price later. In contrast, we did not see the need to assume such a leader-follower relationship between the two manufacturers since in our setting both manufacturers were of "equal" strength and ability. This led us to use a Stackelburg leader framework and the Nash Equilibrium concept. Since we were interested a marketing problem, we chose price (versus quantity) as the key decision variable.

Our next modeling issue was to specify the demand function. At the time, most marketing papers assumed a demand function versus deriving demand using an underlying utility formulation (e.g., a Hotelling line, etc.) Consequently, it is not surprising that we almost immediately assumed a linear demand formulation; the only issue, then, was how many parameters we should include. Tim felt that we should use a very parsimonious demand function with only one or two parameters. I wanted to start with the most general formulation possible. Ultimately, we compromised by starting with a four-parameter model (note that the maximum number of possible parameters is six) and then showing that it was possible to "suck up" three of these parameters by rescaling prices and quantities into different units. The net result was the very simple demand function $q_i = 1 - p_i + \theta p_j$, where $i = 1, 2$, $j = 3 - i$, and q_i, p_i, and p_j are in rescaled units, i.e., not in real dollars and real quantity units.

Although parsimonious, this "simple" formulation has a number of hidden implications. First the rescaled aggregate (industry) demand increases with θ, holding prices fixed. However, in our model, increases in θ imply a more homogeneous set of products. Any standard spatial model of consumers and products would imply that the total pool of customers who might be interested in either product would probably decrease or at least not increase with θ. Thus, this characteristic is "strange." Second, since our solutions were in terms of rescaled prices, quantities, and profits and the rescaling factor varies across different values of θ, it is not possible to directly compare the actual (real) prices, quantities, and profits *across* different values of θ. For example in Figure 2 of our 1983 paper, we show that manufacturer profits (rescaled) for each of the different channel structures increase with θ. Again, one would expect just the opposite relationship, since as the products become more similar, standard economic theory implies that profits should decrease. In fact this decrease occurs in our model, but only after mapping the solutions back to real dollars and real quantities, using Equations 4-11 to 4-14 and noting the discussion of Equations 4-3 to 4-10 concerning the restrictions needed on our four-parameter model as a function of θ.

I point these features out since a number of subsequent papers have used our parsimonious demand function and then compared solutions across different values of θ or conducted comparative statics with respect to θ without first transforming the results back to the unscaled units. Not doing so can lead to possibly erroneous conclusions.

Key Insights from the Paper

1. It was well known by 1983 that as long as there are no efficiency gains from going through an intermediary, the manufacturer is better off in an integrated system (Spengler 1950). However, this result was shown for a bilateral monopoly. By extending the model to include more than one manufacturer and one retailer, we were able to show that vertical integration is not always optimal. The key insight driving this result is that by going through an intermediary, each manufacturer's ability to compete on price is

constrained because of double marginalization. Thus, just like product differentiation, vertical externality reduces price competition across manufacturers.

2. The fact that vertical integration is not always optimal has significant implications with respect to channel coordination. We often see schemes put forward that set out to coordinate the channel system via some mechanism, e.g., a two-part tariff, money back guarantees, etc. Often this is the correct objective. However, if the channel members are operating in a competitive environment and their offerings are not well differentiated from those of the competition, then it is not optimal for all firms to "vertically integrate," i.e., to become completely coordinated. Instead, the upstream firms may want to use another transfer pricing mechanism to "buffer" itself from a price war (McGuire and Staelin 1986) to get higher total channel profits and possibly higher manufacturer profits. In other words, when the competing products are poorly differentiated, the channel efficiency gain from decentralization is so great that it not only leads to higher total channel profits but also to higher profits for the manufacturer, even though the manufacturer has to share channel profits with the retailer.

3. Our model analysis was the first example in marketing in which the optimal channel structure emerges from an equilibrium analysis of a game played between the two competing manufacturers. Not only did we derive equilibrium solutions for each possible channel structure, but also we analyzed the "super-game" of these separate subgames. It is this latter game that allowed us to determine the equilibrium channel structure for different levels of product differentiation.

Existing Challenges and Opportunities

The above discussion leads me to put forth a few challenges to our profession. First, I believe we need to develop a demand function that has enough flexibility to capture the numerous spatial and competitive situations that exist when modeling channel relationships. This function needs to have "nice" properties, i.e., it has to ensure equilibrium solutions while holding the basic underlying market characteristics such as total number of potential buyers, potential buyers' price sensitivity, etc. constant. Right now, many modelers use a Hotelling formulation. However, this formulation can not easily capture heterogeneity on more than one attribute, e.g. spatial location, individual tastes, etc. Expanding the formulation can lead to kinked demand curves, forcing the modeler to look at many different situations or to limit the exploration to a given region of the derived demand curve. Another possible approach is to acknowledge that we now have very powerful computers and to resort to numerical solutions. Here the trick is to parameterize the demand formulations so that each parameter is bounded. Thus, all one needs to do is to conduct analyses over the appropriate range of feasible parameters and then show the results graphically. To date, only a few marketing papers have used this approach, although it has gained some popularity in the economics journals.

Another key issue associated with deriving equilibrium solutions is specifying the appropriate rules of the game. At the time of our model development the manufacturer was the logical "leader" in most channel situations. However, with the advent of big box stores, private labels, and the Internet, it is less clear who is the leader, i.e., who anticipates the reaction of the other channel member when setting any given marketing mix variable. It is often assumed that the retailer now is in charge of setting the wholesale price. If in fact this is the case, then we are really looking at a vertically integrated channel. However, if the retailer states that it wants a given margin and the manufacturer reacts to this "demand," the issue becomes more complicated. This is because the optimal response for the retailer after the manufacturer responds to the retailer's initial margin request is not the retailer's initially stated margin (Lee and Staelin 1997). This implies that this set of rules is not stable unless the retailer makes a credible commitment to the initial demand. I believe we need to develop a better approach for capturing the fact that retailers exhibit "power" (i.e., the retailer limits, but does not control, the options of the upstream channel members). Perhaps we should think in terms of a bargaining framework.

A third challenge concerns the information available to each decision maker and that most managers exhibit biases. Much has been learned about how managers go about making decisions. Our paper (like most of today's analytic models) assumes complete rationality and perfect information among the players. What would happen if the decision makers do not have complete knowledge of the market, but instead use simple heuristics to set prices? Will we find the same equilibrium solutions as those obtained using full information? Very few analytic papers have attempted to answer this question, even though the implications can be huge. (For a more detailed discussion of this issue, see Narasimhan et al. 2005.) Again, I believe the solution to this issue may require our field to deviate from the standard paradigm found in most analytic papers (and the approach used by Tim and myself when we wrote our paper). Perhaps a study that determines a set of possible heuristics used by managers that do *not* change our equilibrium results would be helpful. We would then know

how robust our findings are to the full information, rational behavior assumptions of our current models.

Finally, I think it is time for a good review article that summarizes what we know about channel management issues. How does what we know relate to the recently emerging channels, such as the Internet, two-sided markets, etc? What is the set of channel management findings that holds over a broad range of applications? Moorthy (1993) made the observation that each analytic paper is really one cell in a large thought experiment. We need to start conducting some meta analyses that allow us to pull the individual experiments together to form some overarching theories.

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