

THE APPLICATION OF INDUSTRIAL ORGANIZATION ECONOMICS TO SUPPLY CHAIN MANAGEMENT RESEARCH*

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Economics is a powerful discipline, with the potential for rich contributions to the younger, newer business school disciplines. This article first discusses the different ways economics can influence a business school discipline, followed by perspectives on the field of supply chain management. The core sections of the paper are, first, the influence of economics on supply chain management through empirical methods, and second, the influence of economics on supply chain through theories.

Keywords: supply chain management; industrial organization economics; transaction cost economics; competitive dynamics; strategy

INTRODUCTION

I am pleased to respond to the request of *JSCM* co-editor-in-chief Craig Carter to submit an invited article on the application of industrial organization economics to supply chain management research. After more than 25 years of authoring academic articles, I welcome the opportunity to address this interesting and important topic in a less formal manner. As such, I will approach the article quite differently from the typical research publication. This article will contain a minimum of references. Anyone wishing a more formal and well-referenced approach to the subject matter is referred to Cheng and Grimm (2006). The article will be informal, more personal than a normal research article. The article will contain my opinions and observations on the interface of economics and supply chain management.

Given the nature of the article, I will briefly describe my background on the subject matter so that the reader can best place my remarks in the proper context. I have undergraduate, masters and doctoral degrees in economics, with a focus in my PhD program on industrial organization economics. I am now in my 25th year of teaching and research at the Robert H. Smith School of Business, University of Maryland and will draw on this experience. My research has focused on applying economics to both

supply chain and strategic management, with a particular emphasis on competition, competition policy, deregulation and microeconomic reform both in the United States and overseas.

Since the 1980s, my teaching has included a doctoral seminar, every 2 years, on the application of industrial organization economics to strategic management and supply chain management. The course has been required for both our supply chain and strategy students. I have also been a co-developer of a course on empirical research in supply chain, taught most recently in fall 2007. While other PhD seminars in our department explore logistics-based supply chain research, the focus of our course is empirical supply chain research in journals such as *Journal of Operations Management* and *Management Science*. I have worked extensively with doctoral students in both strategy and supply chain, and have been involved in curriculum development in both strategy and supply chain. I have been active in professional organizations dealing in strategic management and supply chain, as well as economics.

This article will proceed with the following organization. The next section will provide my perspective on the different ways economics can influence a business school discipline. This will be followed by my perspectives on the field of supply chain management. Two core sections of the article come next, first, the influence of economics on supply chain through empirical methods, and second, the influence of economics on supply chain through theories. A conclusion finishes the paper.

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WHAT ARE THE DIFFERENT WAYS THAT ECONOMICS CAN INFLUENCE A DISCIPLINE?

Given that the subject matter is the application of economics to supply chain, an appropriate place to begin the discussion is with the broader issue of how economics might influence a business school discipline. Of course, economics is an old discipline, particularly in relation to all of the business school disciplines. It is a rich and vast discipline. It represents one of the fundamental social sciences, along with psychology.

Economics is a powerful discipline, with the potential for rich contributions to the younger, newer business school disciplines. Because the field is so old and vast, the wide range of fringe theories and contributions are very rich indeed, in addition to the extensive work within the mainstream. Economics is a large discipline, with virtually every university containing this area as an academic unit and focus of teaching and research. But there are also a host of think tanks, government agencies and research bureaus, not to mention private companies, with large groups of economists. Economists from all of these vantage points combine to produce prodigious output serving as a potential influence to other fields.

The influence of the discipline also originates from the formalization of economics, largely in the past 50 years. Economic theory has been "re-invented" predominantly through the use of mathematical models. While one can criticize theory based on mathematical models as unrealistic and impenetrable, there is no question in the mind of the author that "mathematicizing" theory contributes to the power and influence of a discipline within academia. When theory is based on mathematical models, it is easy to see how each subsequent paper relates to and builds on previous work. Thus the extant theory expands over time. Also, the formal models make very clear the assumptions and the precise degree to which conclusions rest on assumptions and logic. Given actors who are utility maximizers and firms who are profit maximizers, along with other behavior and market assumptions, one can proceed with lemma and proof. This is a powerful characteristic of a discipline. Not unimportantly, the mathematical basis of economic theory facilitates an image of the discipline as rigorous and "academic."

Economics also has power to influence other disciplines with regard to its extensive application of formal empirical methods. The discipline is at the forefront among social sciences with respect to applying formal statistical tools to the analysis of data. The emphasis within economics is on archival data; while researchers in other disciplines might refer to this as "secondary data," economists just refer to it as "data" — there is no other game in town. As business school disciplines look to upgrading the rigor of their statistical methodologies, economics provides fertile ground for this

endeavor. More recently, economics has also been very active in developing experimental methods and methodologies. This provides a further basis of the discipline's influence.

Given the power of economics to influence, it is no surprise that all of the business school disciplines have been profoundly affected by economics. Compared with economics, all of the business school disciplines are young; they all emerged in a nascent state at a time when economics was already well formed as a discipline. Also there is a natural overlap of the subject matter of economics, especially microeconomics, with business. Production economics deals with firms and profit maximization; this is readily applied to firms and business applications. Consumer economics deals with households and consumption; this is readily applied to marketing and elsewhere.

There are two ways in which economics can influence a business school discipline. The business school discipline can import and "borrow" elements from economics, but retain its own methodologies, approaches to developing theory, and influence from other disciplines. Or, alternatively, economics can "take over" a discipline, re-creating the discipline in its own orientation. When one examines the degree to which economics has influenced the business school disciplines, the "take over" has been common. One could argue that finance, for example, has been subsumed by economics; most consider it now as a subfield of economics. Anyone pursuing a PhD in finance does extensive graduate work in economics as a core of the program. Most of the leading contributions to finance theory are published in economics journals. Importantly, the economists' approach to theory, with sole reliance on mathematical models, has been fully adopted in the finance field. One can browse through any finance journal and observe a strong reliance on formal mathematical models from economics. More recently, the field of Accounting has been influenced by economics in largely the same fashion. Again, if one peruses a leading accounting journal, such as the *Journal of Accounting*, one discovers that mathematical approaches to theory are ubiquitous. Like their counterparts in finance, Ph.D. students in accounting are mandated to do graduate work in economics. A third example of economics taking over a discipline is provided by Marketing. In the past 10 years or so, marketing has also gone this direction, importing from economics not only the mathematical modeling, but also, increasingly, the experimental methods. Interestingly, for many years marketing was more strongly influenced by psychology, for example employing survey methods and broader social science approaches to statistics. However, more recently, economics has been far more influential, with regard to use of mathematical modeling, archival data methods, and experimental methods, with corresponding less reliance on traditional survey methodology.

The best example of a discipline that has imported elements of economics, but retained its own identity, is the field of strategic management. Clearly the strategy field has imported from economics to a great extent over the past thirty years. First of all, the primary data and methodology focus is on archival data and econometric, regression-based statistical methods. Initially through the work of Michael Porter (1980), industrial organization (IO) economics has been a major influence on strategy theory and research. For example Porter drew on decades of economics work, in particular the structure-conduct-performance paradigm, and applied it to strategy in the form of his Five Forces Model. This model has been very influential in strategy research and pedagogy. Only the perspectives are different — monopoly or extensive market power in an industry turns from a “bad” in the IO economics perspective to a “good” in Porter’s assessment of market structure. Strategy has also been influenced by transaction cost economics, spawning scores of research articles driven by this theory. Work by Schumpeter has been applied to competitive dynamics. Work of Penrose and other economists has been a basis for the resource-based view. Despite the large influence of economics, strategy has not been taken over by economics in the way other business school disciplines have been. Researchers can still draw upon theories and methods from other disciplines within the field of strategy. One can still publish survey-based research in the leading strategy journals. Importantly, the basis for theory in leading strategic management journals such as the *Academy of Management Journal*, *Strategic Management Journal*, and *Academy of Management Review*, is still verbally based arguments and statements of hypotheses, not mathematical models. While a more formal economics modeling approach is prevalent within strategy departments at a few schools, economics has been incorporated into strategy, for the most part, without economics taking over the discipline. We draw on this context, then, to examine the interface of economics with supply chain management.

THE EVOLUTION OF SUPPLY CHAIN MANAGEMENT

An important building block for the discussion is the development of supply chain management and the relationship of supply chain to other business school disciplines. Supply chain management has emerged as a fundamental discipline within business schools. Many definitions of supply chain exist; a selection of the author’s favorites is provided in Cheng and Grimm (2006). Supply chain encompasses the specific activities within logistics and operations management, internal to the firm, as well as linkages across organizations. A definition by Handfield and Nichols (1999) emphasizes the latter: “Supply chain is a network of connected and interde-

pendent organizations mutually and co-operatively working together to control, manage and improve the flow of materials and information from suppliers to end users . . . Supply chain management is the management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole” (p. 2). Common threads with most definitions of supply chain management are attention to relationships with partners outside the firm, and an emphasis on strategic choices with regard to the supply chain to achieve competitive advantage.

Many disciplines with business schools have moved into supply chain management in recent years. The channels area within marketing has been a natural jumping-off point for supply chain. Strategy has also developed a body of research and overlap with supply chain. This is because of the growing importance of supply chain management (SCM) as a fundamental element of firm strategy and competitive advantage. Also, the movement over time in the strategy field away from overarching, generic strategies, and toward the individual elements of overall strategy has increased the emphasis on supply chain strategies. Cheng and Grimm (2006) discuss the latter point in more detail.

Operations management (OM) and logistics are clearly two disciplines most closely related to supply chain. Both have developed large research agendas, and in the view of many, have, at least in some cases, virtually been transformed from these base disciplines into SCM. This is particularly true regarding logistics; witness the transformation of the Council of Logistics Management to the Council of Supply Chain Management Professionals, and the renaming of many logistics academic programs now adopting a supply chain moniker. But operations management has also adopted supply chain research and curriculum to a great extent. Accordingly, there is increasingly an overlap between logistics and OM, as both have moved into supply chain. This is especially true on the empirical side of both fields, as evidenced by the ever-increasing overlap in research topics and methodologies in research outlets such as the *Journal of Business Logistics* and the *Journal of Operations Management*.

INFLUENCE OF ECONOMICS ON SUPPLY CHAIN: EMPIRICAL METHODS

Clearly, empirical methods within economics have had an initial influence on research in supply chain management. The discipline of economics is poised to have a larger influence in the future on the empirical side. One aspect of this is in conjunction with a movement away from survey methodology as a predominant empirical method, for example in flagship empirical journals such as *Journal of Business Logistics* and *Journal of Operations Management*. To the extent these journals move to a more

balanced set of empirical methodologies, with more use of archival data, the methods of econometrics will prove to be even more relevant and influential.

Second, the field of experimental economics is increasingly well developed. Scholars within marketing have adopted to a great extent these experimental methods, in many cases, along with archival in conjunction with reduced use of survey data. For example, literature in both logistics and operations management has explored experiments using the Beer Game to gain insights on drivers of the bullwhip effect within inventory management. Croson and Donohue (2002, 2003), Machuca and Barajas (2004), and Steckel, Gupta and Banerji (2004) provide examples of this literature. It is my view that significant potential exists to apply experimental methods within supply chain. One impetus for realizing this potential is the proliferation of powerful supply chain games and computer simulations, which will allow for testing supply chain relationships well beyond the bullwhip effects from the Beer Game. As these games become vetted within supply chain research and pedagogy as the Beer Game now is, researchers will begin to use such games to advance supply chain research. In addition, advances in computer technology and support structures such as experimental labs increasingly available at research institutions will greatly facilitate further research using experimental methodologies.

INFLUENCE OF ECONOMICS ON SUPPLY CHAIN: THEORY

The first way that theory within economics can and will increasingly influence research in supply chain management is the mathematical modeling aspect of economic theory. This dimension of economics is a natural fit with the mathematical aspects of supply chain, in particular, supply chain research drawing from operations research (OR). The New Industrial Organization (Tirole 1988) has developed a host of sophisticated mathematical modeling tools to economic problems. Foremost among these tools has been game theory. However, many other tools have been developed, including optimization-based models of oligopoly behavior, and other approaches such as auction theory. These models have already had influence on the OR dimensions of supply chain, and will be expected to increase this influence in the future.

However, the main focus of this discussion is the application of IO economics theories to theory-driven empirical work within supply chain management. There are a number of theories that can be powerfully applied to supply chain research. While these theories have to a limited degree heretofore been applied, the potential is significant to draw on these theories to a much greater extent, particularly in conjunction with a movement and

call to have a strong, overarching theory as a starting point for empirical research within supply chain. These theories can be well applied both to internal, within firm views of supply chain from the operations or logistics perspectives, as well as to interorganizational research questions in supply chain.

We start with the structure-conduct-performance (SCP) paradigm from IO economics (Scherer and Ross 1990). This is the classic theory within IO, dating back to pioneer work within the field in the 1950s. The focus of the theory is the role of industrial structure (e.g., the number of firms or concentration) on conduct (e.g., degree of rivalry), and in turn on performance (e.g., economic efficiency — consumer plus producer surplus). For the economist, the ideal structure is one with many small firms, giving rise to intense competition, which will in turn maximize consumer plus producer surplus (it will all be consumer surplus; producer surplus will be zero). The work of Michael Porter (1980, 1985), in particular his five-forces model, translated the SCP paradigm into a firm-oriented perspective. This variant of the theory has proven very useful to strategic management, and is also the most powerful for supply chain. Porter's theoretical contribution also includes development of the value chain, which is relevant to an internal process focus of supply chain.

We next turn to transaction cost theory (Coase 1937; Williamson 1975, 1985). Transaction cost theory is very powerful with regard to the interorganizational aspects of supply chain, and issues such as firm boundaries. An initial step for supply chain managers is to design the supply chain. In that regard, firms must decide which components they will produce in-house, and for which they will rely on outside suppliers. To the extent firms choose the latter, this provides the first step to coordination of the supply chain. Transaction cost theory is very powerful with regard to this make-or-buy decision. Transaction cost theory posits that firms will prefer internal hierarchy, or making components internally, as opposed to purchasing through the market, when transaction costs (costs of using the market) are high. Transaction costs are driven by the degree of asset specificity, frequency, and uncertainty. As each goes up, transaction costs also go up.

Transaction cost theory also is a powerful theory for supply chain implementation. Once a firm determines which components will be produced outside the firm, the firm must then settle on establishing relationships with suppliers. One key decision is the degree to which firms employ a long-term relationship with a supplier, governed by a detailed contract, or just procure components through the spot market. Again, transaction cost economics suggests where transaction costs are high, due to elevated asset specificity, frequency and/or uncertainty, the firm would be more likely to establish long-term relationships. Furthermore, the nature of the contract will

also be driven by the extent of transaction costs. Where costs are high, firms will tend to develop longer-term contracts, and contracts with more complex features and clauses.

Next is the resource-based view (Wernerfelt 1984; Barney 1991; Peteraf 1993) and the related dynamic capability theory (Teece, Pisano and Shuen 1997). These theories posit that the key to competitive advantage are resources, defined as aspects of firms that are valuable, rare and inimitable. This also relates to Porter's notion of the value chain, where an effort is made to examine within the firm the particular sources of cost advantage or service quality advantage. Within the value chain the role of logistics is prominent as a potential source of competitive advantage. Increasingly, in the era of globalization, firms have realized that supply chain within the global context is so complex and so important, that doing it well or poorly is often the difference between success and failure. Otherwise stated, supply chain, in its many dimensions, can indeed be a resource. It is so complex within the company and involves many well-developed partnerships and interorganizational relationships; thus, it is very difficult to ascertain, much less duplicate. It can also be influenced by scale economies, as evidenced by Wal-Mart's success, bringing together application of the SCP paradigm, the value chain and the resource-based view of the firm. Dynamic capability extends the resource-based view to the dimension of how well a firm can change over time. Given the dynamic nature of today's global business environment, the ability to assess the environment and change rapidly is a key to supply chain and business success. Accordingly the insights from dynamic capability theory are also very applicable to supply chain.

While the above theories are perhaps the most prominent and powerful in their application to supply chain research, there are many other theories within economics that could be applied to supply chain. One is evolutionary economics, associated with the work of Nelson and Winter (1982) and Schumpeter (1934, 1942). Theory influenced by the work of Schumpeter has spawned a dynamic theory developed within strategic management known as competitive dynamics (Grimm and Smith 1997). This theory focuses on the dynamics of market interaction over time. In particular, it examines competition among firms in the form of actions and reactions. The corresponding empirical side with regard to testing these theories focuses on structured content analysis of actual firm actions, generally drawn from trade press and other published sources. The PhD dissertation work of Donovan (2006) is an example of how competitive dynamics can be applied to the supply chain area. This work uses archival sources to study competition between supply chains in the grocery industry. In the author's view, the competitive dynamic approach has rich potential for scholarly research regarding competition within and between supply chains. Cheng and Grimm (2006) provide examples of where

economic theories have been applied in the supply chain literature within strategy and logistics. There has been nascent use of these theories within supply chain, but researchers can and should move to more theory-based research, where use of overarching theories such as these are seen as essential for good research.

CONCLUSION

In the author's view, industrial organization has much to offer to the field of supply chain, and can help research in this discipline advance in quality and stature. In this regard, I would like to see greater influence of economics in the supply chain area, including greater use of economics theories and empirical methods. I stress, however, that the model of economics as influencing business school disciplines as found in strategic management is in my opinion the most desirable outcome. Economics methods can be increasingly incorporated, but not at the exclusion of alternative methods such as surveys, and alternative disciplinary perspective. Importantly, I would not like to see a "hostile takeover" of supply chain by economics such as has occurred in other business school disciplines, where theory is no longer seen as rigorous unless based on a mathematical model.

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