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# AN APPLICATION OF CORE THEORY TO ELECTRONIC MARKETS

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## Abstract

*It is generally believed that Internet and related electronic commerce communication technologies (ICT, henceforth) intensify competition in many industries. Terms such as “perfect markets”, “frictionless markets” and “hyper competition” are frequently used in both the academia and the trade press to describe the impact the Internet may have on the conduct of business. Most of the arguments assume pure-exchanges and do not take production possibilities into account. Interestingly, under some circumstances, intense competition may make both consumers and producers worse off. In this paper, we introduce Core Theory and derive an applied framework, which can be used to understand competition and cooperation. We illustrate the applicability of the framework by using it to reexamine why a specific electronic market did not form.*

## Introduction

It is generally believed that Internet and related electronic commerce communication technologies (ICT, henceforth) intensify competition in many industries. Terms such as “perfect markets”, “frictionless markets” and “hyper competition” are frequently used in both the academia and the trade press to describe the impact the Internet may have on the conduct of business (Brynjolfsson and Smith, 2000, Economist 1997). It is argued that, ICT, by substantially bringing down the transaction costs, allows firms to form unrestricted relationships with one another (Malone et.al., 1987). It is also believed that more competition brought about by ecommerce can only lead to beneficial outcomes, at least for consumers (buyers).

Interestingly, under some circumstances, intense competition may make both consumers and producers worse off. Consider the following example. In the US airline industry immediately after deregulation in the 80's, when price-cutting was extreme, most firms in the industry were losing money even though buyers wanted the product and were willing to pay higher than prevailing prices. A seemingly strange practice that evolved in the US airline industry resembles a cartel-like behavior: over 550 airlines worldwide share fare information on a nearly real time basis through an intermediary (see <http://www.atpco.net/index2.htm>). A second practice followed by airlines is a sophisticated form of price discrimination called revenue management. Revenue management systems allow airlines to use historical data on load factors on a flight as well as real time load factors to adjust prices for different classes of fares. This results in different customers paying different prices based on the time and even the channel of purchase, apart from the fare class. While many observers would disagree with the practice of an airline seat being sold at widely different prices, many researchers argue that airlines cannot be profitable unless they do so. Instances such as these lead us to look at the notion of competition and efficiency from a broader perspective.

In this paper, we use Core Theory to provide a framework for thinking about competitive and non-competitive market arrangements. We interpret some Core Theory constructs so as to make them applicable to new business models enabled by various ICT. The framework suggests that, under some conditions, non-competitive market structures and practices such as monopolies, cartels, restrictions on transactions among industry members, deferred rebates, price-discrimination etc. may have an efficiency-enhancing role.

This paper is organized as follows: Section 2 provides a brief introduction to some terminology necessary for understanding the concept of the core. Section 3 summarizes the main points of this paper. A case study will be discussed during the presentation.

## Basic Concepts and Definitions of Core Theory

Core Theory concepts are closely related to standard coalitional games. Its application to industrial organization problems is of interest in this paper. We briefly outline some definitions and concepts in this section.

1. There are a group of  $n$  individuals (or firms) in a market; some of whom are buyers and others are sellers. They can all trade with each other in a single market, or in sub markets, or may decide not to trade at all.
2. The buyers and sellers can measure the *gains from trade*. For the buyer it is the maximum amount the buyer is willing to pay for the quantities purchased less the amount actually paid. For the seller, it is the amount actually received less the amount the seller would have been willing to accept.
3. The buyers and sellers can contract with each other and form groups called *coalitions* to maximize their gains from trade. Such a process of contracting can be either unrestricted or restricted depending on the nature of the industry. What the members of the coalitions get is called an *allocation*.

With three members, there are a total of  $2^3 - 1 = 7$  possible coalitions, excluding the coalition with no members. These are  $\{S\}$ ,  $\{B1\}$ ,  $\{B2\}$ ,  $\{S, B1\}$ ,  $\{S, B2\}$ ,  $\{B1, B2\}$ ,  $\{S, B1, B2\}$ . Coalitions with single members are called *singletons* and coalition with all members is called the *grand coalition*.

4. An allocation is *dominated* if some members of the coalitions can do better for themselves by leaving one coalition and joining another coalition. If the members cannot do better by leaving their existing coalition then the allocation is undominated.
5. A buyer or a seller would be member of a coalition as long as they can do at least as well as they could in any other coalition (it is important to point out that deciding not to trade or being alone is also a possible coalition).

The approach is to consider all possible coalitions of traders, recognizing that any coalition of traders will only participate in the market as a whole if and only if they can do at least as well as they could in another coalition. In the decision of a member as to which coalition to join, the maximum payoff available in all other coalitions provides the lower bound.

6. If we have a coalition with all the buyers and sellers in it (called the *grand coalition*) then it means that each buyer and seller feel that this is the coalition which would maximize their gains otherwise they would not be in the coalition.

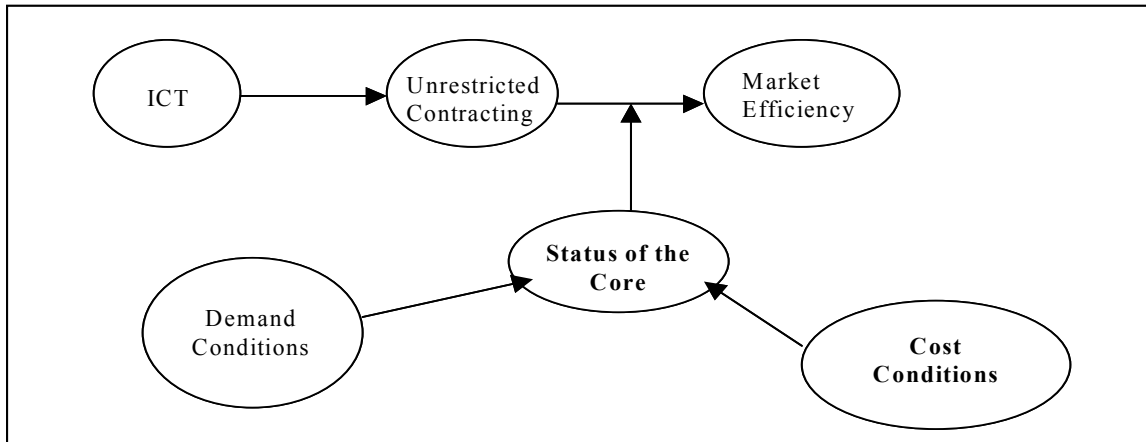
The grand coalition is analogous to a single electronic market in which all traders choose to participate. Such words as exchanges, virtual communities of interest, junction boxes, hub and spoke networks, butterfly-patterns of relationship etc. may all be descriptions of a grand coalition.

7. The grand coalition should therefore offer to each buyer and seller at least as much as they could get in any other coalition they can form i.e., it should be an undominated allocation. The allocation from each possible coalition therefore imposes a lower bound on the payoff for each member, which must be satisfied for the grand coalition to exist.
8. If there exists no other coalition, which can make at least one person better off without making another person worse off, then economists call such a situation "*Pareto Optimum*". An allocation is an *efficient* allocation if it is a Pareto optimal allocation.
9. If such a "grand coalition" exists, then we say that a core exists. The core therefore consists of all the undominated allocations.

If a grand coalition is the core, then all members choose to be in the market-like many to many relationship rather than forming sub-markets or groups.

10. The core may sometimes have either one allocation or many allocations. It is also possible that there may not be any allocation in the core. This is called an *empty core*. The empty core implies that there is no *stable coalition*. Whatever coalition can be formed, there is always an incentive for some subgroup to benefit by leaving it.

When the core is empty, there is no Pareto-optimal situation. In the specific context, it means that members may switch among multiple coalitions opportunistically. Telser (1987, 1994) uses the word "chaos" to describe this situation. The argument is graphically illustrated in Fig. 1.



**Figure 1. The Theoretical Model**

## Discussion and Conclusions

Prior MIS literature argues that ICT will improve market efficiency. Core theory suggests that it may not always be the case. Specifically, under some combination of cost and demand conditions in an industry, a competitive equilibrium may not exist. This leads to an empty core.

By lowering transaction costs, ICT enable firms to engage in nearly more contracting with fewer restrictions. Unrestricted contracting, enabled by ICT, increases market efficiency if a core already exists. With an empty core, however, it leads to a “chaotic” situation which is not a pareto-improvement for all traders (buyers and sellers). To solve the problem (i.e., resolve the core), additional restrictions may be imposed to limit the ability of firms to form unrestricted relationships with one another.

The equilibrium resulting from such restrictions is more efficient compared to “chaotic” outcomes produced by the empty core. We believe that the framework may help understand why some promising “pure” B2B exchanges have failed in recent times.

## Selected Reference

Telser, L.G. The Usefulness of the Theory of the Core. *The Journal of Economic Perspectives*, June 1994.