Quality is Not Strategy: Nash Equilibrium and International Market Entry

Philip Vos Fellman[*], **Nicholas Nugent, Sr.** [†]**, Jonathan Vos Post**[‡]**, and David Doyon**[§]

Abstract: A recent Harvard Business Review Article by Suarez and Lanzolla (2001) entitled the Half-truth of First Mover Advantage argued that this is a business concept which has so much intuitive appeal that its validity is almost taken for granted. In the following paper, we illustrate how typical applications of game theory to describe first mover advantage in the context of international markets are generally set up use an improper theoretical framework and compare incommensurable qualities and quantities. We then review the work of Porter (1996) and others with respect to sustainable competitive advantage and suggest that the Nash equilibrium may provide some guidance as to the kinds of circumstances in which a profitable first mover advantage may or may not be obtainable when entering international markets.

[*] Professor of International Business Strategy, Southern New Hampshire University
[†] Professor of International Marketing, Southern New Hampshire University
[‡] C.E.O., Computer Futures and sometime professor of mathematics, Woodbury University
[§] Assistant Professor of Accounting, Southern New Hampshire University

Imitating the Japanese, Total Quality, Cross-Group Subsidization, and Market Flooding:

In describing the success of Japanese corporations, many authors invoke market leaders, such as SONY (Suarez and Lanzolla, 2001; Eisenmann, 2003). SONY is probably a poor choice because even in his early criticism of Japanese firms whose only strategy was quality control and who ultimately found themselves engaged in destructive competition, Porter (1996) argues that the problem with Japanese firms lay not with leaders in innovation like SONY, but rather with the average Japanese firm which was content to duplicate its rivals' plant layouts, manufacturing processes, value chain and market entry approaches. However, even with market leaders, excessive competition can provoke unintended market consequences particularly if a market is the type where early market entry may lead to occupying the entire market niche (Modis, 1998). As Eisenmann (2003) remarks:

> "…The stakes can be enormous when firms race to acquire customers: if winners take most, little is left for losers. In extreme cases, racing can yield disastrous results for all parties. This was true for many industries in which firms pursued learning curve strategies. After cutting prices, these firms found it difficult to gain sustainable cost advantages. Often they were unable to keep their learning proprietary due to technological spillovers: competitors copied their new and improved techniques."

Eisenmann treats this problem in typical economic fashion, describing customer acquisition as a convex curve with characteristics similar to those of classical pollution abatement problems (see Figure 1). However, there are additional considerations, largely those developed by Porter which indicate in at least a graphical sense the different elements required for sustainable advantage (see Figure 2 and Figure 3).

Eisenmann is not insensitive to Porter's analysis, and his approach is to catalogue the standard requirements for competitive advantage as factors which increase customer acquisition cost. He see's the main pitfall of the customer race, or the race for first mover advantage to arise from attempts to broaden a company's products beyond the core demand characteristics of the bundle of goods and services most likely to appeal to its customers. Understanding the structure of these bundles is not prima facie terribly difficult. In Figure 2 we have developed a simplified chart designed to express the tradeoffs between price and quality that Porter explores more fully in his cost-focus matrix. Porter's more complex underlying argument however, is that in the long-run for a firm's competitive strategy to succeed it must achieve above average profitability.

In order to do this, the firm requires a more complex competitive strategy, based on a more nuanced set of tradeoffs between cost and focus (as shown in Figure 3.)

Globalization and Strategic Planning: The Example of Japan

Globalization adds a particularly difficult and complex dimension to strategic planning, despite the conventional wisdom that geographical diversification is less problematic than product portfolio diversification. Both Porter and the Wharton School's Mauro Guillen have provided considerable commentary which runs counter to this conventional wisdom, even though Porter has been frequently interpreted as supporting the conventional wisdom. For example, in looking at Japan's approach to the globalization of markets, in 2003 (Fellman, Takei and Wright), we undertook a very specific analysis of Japan's position with respect to the globalization of information and financial markets. We drew a great deal of inspiration for our approach from the work of Guillen, in particular, his prize winning paper, "Business Groups in Emerging Economies: A Resource Based View" and his subsequent book, The Limits of Convergence.

Like Guillen, and legal scholar Amir Licht (2001, 1998) we felt that globalization was and remains an extremely complex process, which is neither static nor yet fully understood. In particular, we felt that the unique cultural and economic history of Japan required a specialized approach and that globalization processes were often more likely to require Japanese business groups to retain or accentuate their "Japaneseness" in order to remain competitive in the evolving global economy. Guillen phrases this approach nicely when he argues in the opening of his book:

> Conventional wisdom has it that the world is undergoing rapid globalization and that this process compels countries, industries, and firms to converge toward a homogeneous organizational pattern of "best practice" or "optimal efficiency". Those who fail to conform are doomed to fail in the global economy. I argue against this modernist, flat-earth view of globalization. Countries and organizations do not gravitate toward a supposedly universal model of economic success and organizational form as they attempt to cope with globalization. Rather, the mutual awareness that globalization entails invites them to be different, namely, to use their unique economic, political, and social advantages as leverage in the global marketplace.

In taking a quantitative approach to Guillen's argument, we used W. Brian Arthur's economics of increasing returns to look very specifically at technology subsidization (including the kind of "cross-subsidization" so heavily emphasized as the foundation of sustainable competitive advantage by Michael Porter). However, there is a particular importance in introducing the economics of increasing returns in the context of both globalization and Japanese corporate and financial governance. The quantitative point here is that while the statistical and game theoretic approaches used by Aoki, Kotaro and other REITI researchers often relies on a Nash equilibrium solution, that solution depends in most cases upon "closed" economic solutions of the form best characterized by decreasing marginal returns. The Arthur approach allows us to introduce network externalities, "open" systems and non-equilibrium dynamics, all features which we believe are particularly characteristic of the global information revolution (see also Katz, Shy, Shapiro and Varian, etc.)

In our 2003 article we then developed a more comprehensive treatment of technology diffusion and technology replaced based around the simulations developed by Paul Windrum of the University of Maastricht and Chris Birchenhall of the University of Birmingham (Windrum and Birchenhall, 2001). In subsequent years, we have been coding, developing and testing our own model of technology substitution (Fellman, Groothuis, and Mertz, 2006; Mertz, Groothuis and Fellman, 2006). One of the results of this model is to provide a quantitative explanation of the kinds of market collapse which result from the combination of an excessively intense race for first mover advantage combined with technology shocks, particularly in high-technology markets, where product life cycles tend to be considerably more brief than in other consumer segments.

Ultimately, both in our own simulation and in the Windrum-Birchen hall simulation we found two very interesting results which equilibrium economic models, including the kind of model used by Eisenmann to treat the costs of customer acquisition in a first mover advantage race, might not capture well, if at all. In one case a new technology replaced an old technology and the user base was also replaced with new users. This is a fairly well known phenomenon and is typical for markets like those for microprocessors where a new technology entirely outmodes the existing technology. In Japan, this kind of technology succession has given rise to some very interesting features on the geographical landscape, ceteris paribus the "stickiness" of

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Japanese capital investment, perhaps among the most notable being the Gomi-no-shima landfill in Tokyo bay.

The second interesting result occurred where a new technology replaced older technology, but the new technology went to a new user base, while a proportion of the older technology remained with the existing user base. A typical example of this kind of technology substitution is frequently observed with banking and medical records keeping where the sunk costs of operational management are often perceived to outweigh the improvements offered by the new technology. Globally, this is seen where many Latin American banks still use Wang computer technology even though the pricing of more modern hardware and software is clearly not prohibitive. In advanced industrial countries, such as the United States, the phenomena is seen (Evans and Wurster, 1997) in medical record-keeping where data processing (through incompatible modes and legacy systems) is believed to account for approximately one-third of all medical costs.

This second kind of distribution is, not unexpectedly, mathematically more "lumpy" or unpredictable (and often, in the case of technologies like software, heteroskedastic and generally ill-behaved) and, hence more difficult to deal with from the standpoint of strategy and planning. The principal contribution of agent-based modeling in this regard has been to recognize that with new technologies, that first mover advantages may play a crucial role (Arthur, 1994). However, these advantages are often "emergent" in nature and not discernible below a certain threshold of market penetration (Modis, 1998). As frustrating as this inherently complex model may be at times, it does offer some suggestions to strategic planners. In this case, Porter's (1996) maxim that strategic planning needs a time horizon of at least a decade (a recommendation which is highly consonant with Japanese business practice and policy and which is an avenue of differentiation which has historically led to competitive advantage for Japanese business groups competing internationally) is borne out both by the Windrum Birchenhall technology replacement model as well as the combinatorial market landscape approach which we have used in the Southern New Hampshire University International Business Modeling Laboratory simulation. Both models suggest that markets and consumers need to be "tolerant" of new product entrants or new product categories if they expect to raise overall economic welfare (or in Porter's favored language, firm profitability, the hardest of all the economic variables to

maximize), particularly if the expected mechanism of national prosperity is characterized as a punctuated equilibrium Aoki, (1997, 1998).

Curiously enough, this result has a bit of the flavor of the Chicago School of Economics' in their treatment of consumption and production. We found this a bit surprising insofar as our simulation in particular was aimed at modeling and understanding producer dynamics (following the Chalmers Johnson maxim that consumption is not difficult to organize, but rather that it is production especially national production which is difficult to organize). At present, this result seems to be attributable to what chaos and complexity theory characterizes as local rules of behavior. In part, this may result from the way in which we have coded our VenSim® simulation, but it coincides well with empirical data from Porter, Hovhanissian (2002), and others who argue that value clusters are built from the ground up, often using local rules of behavior (Holland, 1995, Kauffman 1995, Aoki, 1995B). Regardless of the underlying mechanism, however, the implications for strategic planning and forecasting are clear that structures which favor flexibility and longer time-scales are likely to represent a competitive advantage and these are particularly Japanese characteristics ("Ieyasu was patient").

More on the Complex Dynamics of Globalization

To this point we have reviewed approximately a half a dozen journal articles and some dozen odd conference papers by our own group and several times that amount of work by others on economic and computational simulation, Japanese corporate governance and the applications of agent-based modeling, chaos and complexity theory to business strategy. To have merely done this in order to state that "Michael Porter was right after all" would have been a rather trivial exercise. More importantly, we stand by our own earlier work and the fine work of Mauro Guillen, Amir Licht, Karl Kester and others on the difficult and complex nature of globalization and the generally overly simplistic, culturally shallow and mathematically weak arguments which have been put forth by a variety of authors on the topic of "global convergence".

As Johnson noted in his famous article "Japan: The Venice of the East", one area of trade where Japan has consistently excelled, and has excelled as the result of being able to take advantage of unique cultural and historical factors has been in cross-firm and cross-group market entry and early dominance of brand loyalty and market share. In the final text section of our article, we will apply a series of insights initially developed by Paul Hofer and Sir Partha

Dasgupta on what first-mover advantage actually means and how a proper understanding of Nash equilibrium can allow a firm to determine where and whether an actual first or second mover advantage exists and if so, where it is located.

What Determines A First Mover Advantage?

The competitive concept of the first mover advantage is easy to state in layman's terms. Simply put, a firm or a product is perceived to have a first mover advantage when the first firm to enter the market, or in some cases, to create the market, gets an overwhelming advantage, either filling the entire market niche or getting a lead of such great magnitude that competitors can never catch up (Modis, 1998). In contradistinction, a second mover advantage generally arises when a first mover incurs all of the costs of early market entry without being able to reap the benefits, whether due to changes in technology, markets, politics or other unforeseen factors. The experience of Pepsi-cola in India and the U.S.S.R. are both good examples of a firm that planned to capitalize on a first mover advantage and instead opened the door for its competitor, Coca Cola, to reap an almost overwhelming second mover advantage. However when we attempt to move from an anecdotal or purely conceptual description of first and second mover advantage to a more mathematically rigorous formulation of these concepts, particularly if we do so in game-theoretic terms, the exercise suddenly becomes dauntingly difficult and precision seems to slip away the harder one tries to define it.

To help unravel the complexities surrounding this topic we will turn to a rather interesting explanation by game theorist Paul Hofer (Hofer, 1998), taken in part from Cambridge University lectures by Professor Partha Dasgupta (see also Dasgupta, 2005). We provide a close reading of Hofer here because we feel the importance of his work demands more than a brief summary or even a modest synthesis. Hofer first provides an example of a game in normal form with an independent Nash equilibrium (shown in figure 4). He then modifies the payoff matrices as shown below, giving the advantage to whoever moves first, thus forcing the expansion of the game from normal form, where all the moves may be played simultaneously to the extensive form, where strategies are executed and outcomes are reaped sequentially (as shown in Figure 5). Hofer's next step is then to modify the payoff at the extreme lower right from 4;2 to 4;10. This modification produces a new structure which contains not one but two Nash equilibria. What is important here is that the sequential nature of the game, something which all students of

international trade and negotiations are familiar with, allows the player who moves to determine which of the two Nash equilibria the game actually arrives at. In being able to force a Nash equilibrium from one of multiple outcomes, by an early mover choice, we now have a genuine first mover advantage.[**]

In comparison to this example, Hofer argues that the traditional approach to understanding the second mover advantage has generally been fallacious. Some of this is just a poor choice of language, or poor mathematical understanding, but the deeper point to be made here is that a proper understanding of the application of the Nash equilibrium can then replace these questionable examples with a new category of properly defined second mover advantage. Naturally, this issue should be of considerable interest for those involved in strategic planning, particularly when planning whether or not to be the first entrant in a new, foreign market, a strategy which has often been central to the historical success of Japanese business groups.

The Traditional View of Second Mover Advantage

Hofer's example of the conventional treatment of second mover advantage uses as the setting of the industrial revolution with England being the first mover and Continental Europe being the second mover, a type of explanation familiar to students of political economy (shown in normal form in figure 6). Coincidentally, this also happens to be the kind of over-generalized approach of which Mauro Guillen is so rightfully critical in his analysis of the literature on globalization. Hofer then points out that if one examines this game carefully, its form is not different from that of game 1. What is perhaps more significant is that upon close inspection, there is no way to change these payoffs. Whether Britain industrializes first or second, the payoff remains the same, i.e., 20 for England and 45 for Europe, (shown in extensive form in figure 7).

This means that there is, at least in a scientific or mathematical sense, no meaningful way in which one can define the so-called "second mover advantage". The payoff for industrializing is simply higher for the second player. Choice, however, the sine qua non of strategic planning, is

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[**] Those readers who are interested in the architecture of games with multiple Nash equilibria and the recent discoveries of both new Nash equilibria in games previously thought to be solved as well as new kinds of Nash equilibria may wish to read Fellman (2004) or Fellman and Post (2006) at http://www.ArXiv.org

simply not involved!   This means that such characterizations of second mover advantage cannot be measured, nor can they provide meaningful decision heuristics for strategic planners.   They are, at best, academic fictions, and at worst, crackpot misrepresentations of game-theoretic metaphors which confuse and confound serious strategic issues.

An even worse consequence of this choice of game metaphor is the fact that if one tries to change the sequence of moves, then the outcome must change as must the equilibrium payoffs. This leads to what Hofer characterizes as "surprising, but irrefutable results". Because this kind of game has only a single Nash Equilibrium, the payoff remains at 20 for England and 45 for Europe no matter who moves first. Thus, mathematically speaking, it is essentially nonsense to speak of a second mover in this context. If one attempts to get around this difficulty by incorporating other factors, such as a postulated learning curve effect, then one can get different numbers, but the different payoffs then generated mean that one is now comparing different games, which is an incommensurability even worse than the initial case. The best such an approach can do is lead to a "fortuitous mistake". In more ordinary terms it means that this type of analysis will provide a false rationale and lead to false or unsupported strategic conclusions.

A New View of the Second Mover Advantage

Fortunately, this is not the end of Hofer's analysis. Behind this analysis lies the discovery of a different kind of second mover advantage, what we might be tempted to call a "real second mover advantage". This kind of second-mover advantage is one which is properly stated, and as a result is then defined by its Nash Equilibrium characteristics (no Nash equilibrium, but a solvable game via backward induction so long as the sequence of moves for each player is known). The example which Hofer uses is one where competing firms must decide whether to use common or proprietary technologies. This is the kind of issue which has played a strong role in the development of modern, information age technologies (Evans and Wurster, 1997; Windrum and Birchenhall, 2001). It is also an issue which has had a profound role in Japanese industrial policy (Johnson, 1983, 1995; Aoki, 2001) and in many situations has been driven by the traditional three-pronged Japanese approach of licensing, indigenization/diffusion and administrative guidance (although the latter has in part been translated from MEITI to Keidanren or the Bank of Japan in some circumstances). Hofer's example proceeds as follows:

(Suppose) there are two firms, call them Piccolo and Gigantic. They both produce similar products; however, Piccolo has only a small market share, while Gigantic controls a large proportion of the market. Both firms want to bring a new product onto the market, for which they must introduce one of two systems. But Gigantic has rather inferior technology compared to Piccolo. If both firms operate with the same system, then the whole market is in that very system, and can choose between the two technologies. It will presumably favour Piccolo. On the other hand, if the two firms operate different systems, Gigantic's customers are stuck with Gigantic's system and hence have no access to Piccolo's advanced technology, which hence can only be sold to Piccolo's market share.

According to this rationale the payoffs in are set as shown in Figure 8. Hofer then explains that even in the absence of a Nash Equilibrium, as long as the sequence of moves is know, we can calculate the outcome. If Piccolo moves first, they will choose System A, to which Gigantic will respond by choosing system B. If Gigantic moves first, they will choose System B, which will also be chosen by Piccolo. What is, perhaps, most interesting here is that both players do better (i.e., enjoy a second-mover advantage, or a higher payoff) when they go second. Unlike the counter-factual hypothetical explanation advanced for industrialization, this type of setting possesses a real second mover advantage, precisely because the second mover enjoys a higher payoff than if they had moved first. This is a model of second mover advantage which can be measured and directly applied to strategic planning decisions, particularly those regarding first or second mover strategies for foreign market entry.

Real First and Second Mover Advantages – Some Identifying Characteristics

Hofer uses a simple game of "musical chairs" in the Princeton University dining hall to illustrate how one can achieve an optimal payoff by moving second (Hofer, 1998). In the more complex setting of international business, anticipating one's rival is often a function of possessing accurate information. In this context, *disinformation* may well be one of the most powerful tools available for developing competitive strategies where a real second mover advantage is involved. Here, the principal identifier for the second mover advantage is being able to calculate the absence of a Nash equilibrium. However, there is also a second identifier which can easily be observed, and that is the presence of mixed strategies. If a competitive dynamic possesses mixed strategies, then the game will have at least one Nash Equilibrium. This is a direct consequence of Nash's proof where the correspondence of mixed and pure

strategies define the combinatorics of his argument (Nash, 1950, pp. 2-3). This leads us to two important conclusions. If we are attempting to formally define a true second mover advantage, then we can immediately rule out any strategic situation with mixed strategies. To satisfy the conditions of a genuine second mover advantage, there must be no Nash Equilibrium, which necessarily means no mixed strategies.

For first mover advantage, exactly the opposite situation obtains. We should be looking for the Nash Equilibria, and we should expect to find mixed strategies. From the standpoint of competitive strategy a company or group may quite possibly find it highly rewarding to inject a deliberate element of disinformation into the marketplace simply to make conditions more difficult for rivals attempting to determine the group's strategy (Egnor 1999; Billings, 1999; Sato, Akiyama and Farmer, 2002). This finding provides an interesting kind of negative corollary to the longstanding Japanese industrial policy of administrative guidance.

Conclusion

Those of us who have been assigned to what political economists used to refer to as the "revisionist" school of economic thought on Japanese industrial policy (although nowadays, largely thanks to the work of Masahiko Aoki and his colleagues, most of us would think of this group as mathematically and economically orthodox and the "old school" as having consisted largely of historical revisionists) have often been mistakenly criticized for praising MITI and MEITI for a policy of trying to "pick" products, technologies or markets which are "winners" or "losers". These critics then invoke the principles of neoclassical micro-economics to argue that such a system can never work and that "the market" is the only efficient mechanism for making such determinations and that given efficient markets, random walk theory dictates that their behavior cannot be predicted in advance.

While this approach has become one which has been increasingly discredited with the passage of time, as well as the introduction of computational modeling and the development of financial tools based on methods originally derived from the physical sciences, it too is "sticky" and tends to cling as an unspoken kind of assumption in both international economics, and perhaps more importantly in international business, particularly in areas where strategic planning has a longstanding operational or historical tradition.

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Figures and Illustrations

NPV Impact of Investments in Customer Acquisition
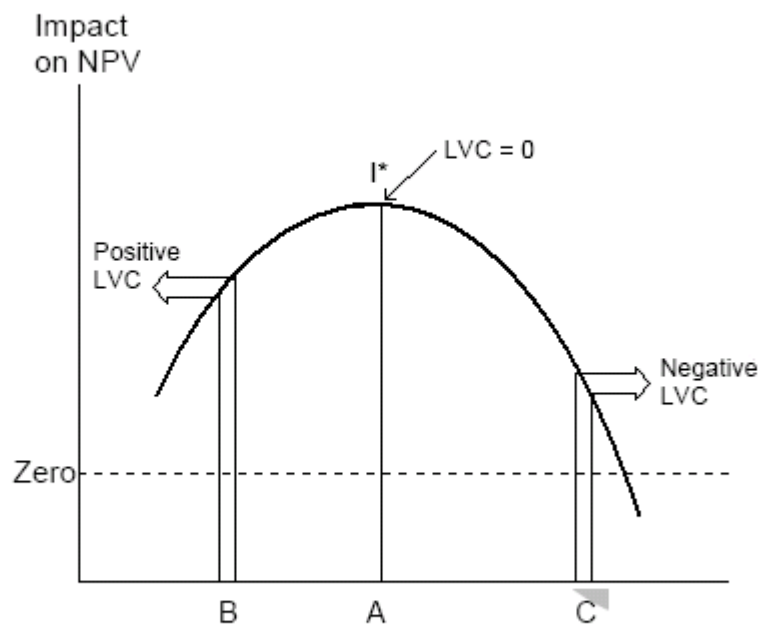
Current Period Investments in Customer Acquisition Activities (Note: LVC = Lifetime Value of the Customer (Eisenmann, 2003)

Figure 1

```
|          COST

        Hi                          Lo

Hi
        ┌──────────────┬──────────────┐
        │ Niche        │ Extraordinary│
        │ Products     │ Returns      │
        │              │              │
        │              │ The MICRO$OFT│
┌──────┐│              │ position     │
│FOCUS ││              │              │
└──────┘├──────────────┼──────────────┤
        │ Bankruptcy   │ Mass Market  │
        │              │ Products     │
        │ No Sustainable│             │
        │ Advantage    │              │
        └──────────────┴──────────────┘
Lo
```

Firgure 2: The Simplified Cost-Focus Matrix

Competitive Advantage

```
                Lower Cost        Differentiation
              ┌──────────────┬──────────────┐
     Broad    │              │              │
     Target   │ 1. Cost      │ 2. Differ-   │
              │    Leadership│    entiation │
C             │              │              │
o             │              │              │
m             ├──────────────┼──────────────┤
p             │              │              │
e    Narrow   │ 3a. Cost     │ 3b. Differ-  │
t    Target   │     Focus    │     entiation│
i             │              │     Focus    │
              └──────────────┴──────────────┘
```

Figure 3: Michael Porter's Cost-Focus Matrix

		player 2	
		plan A	plan B
player 1	plan A	7; 9	0; 1
	plan B	3; 5	4; 2

Figure 4: Normal Form Game With Independent Nash Equilibrium
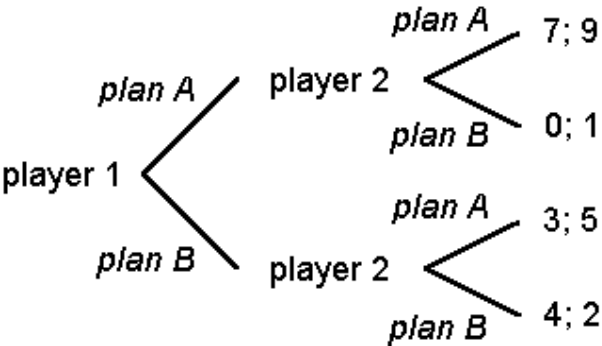
Figure 5: Extensive Form Game with Independent Nash Equilibrium

		Continental Europe	
		industrialise	don't industrialise
England	industrialise	20; 45	60; 10
	don't industrialise	10; 60	0; 0

Figure 6: The Traditional View of Second Mover Advantage
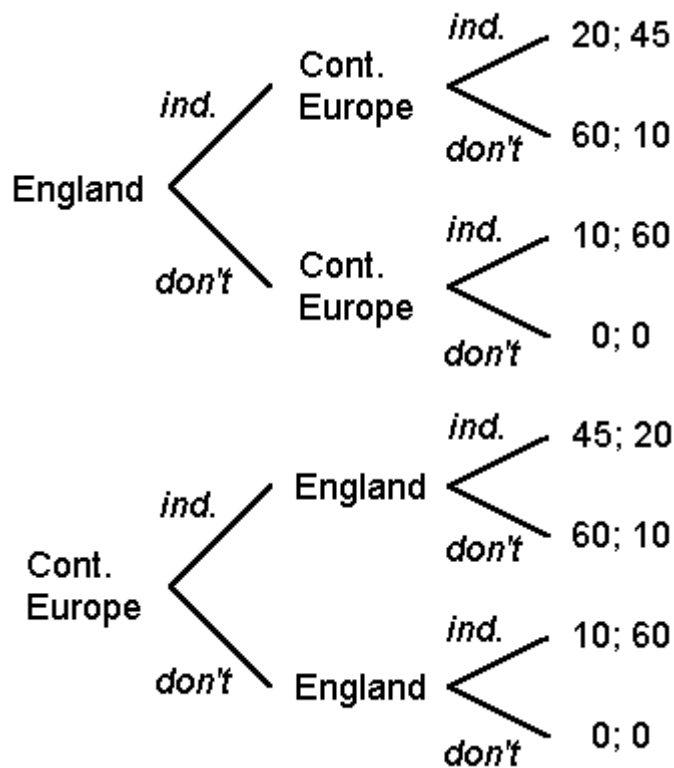
Figure 7: The Traditional View of Second Mover Advantage in Extensive Form

		Gigantic	
		system A	system B
Piccolo	system A	10; 4	3; 6
	system B	2; 7	9; 5

Figure 8: The Piccolo-Gigantic Payoff Matrix