

## COMPETITIVE ADVANTAGE: LOGICAL AND PHILOSOPHICAL CONSIDERATIONS

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*Strategic management theories invoke the concept of competitive advantage to explain firm performance, and empirical research investigates competitive advantage and describes how it operates. But as a performance hypothesis, competitive advantage has received surprisingly little formal justification, particularly in light of its centrality in strategy research and practice. As it happens, the core hypothesis—that competitive advantage produces sustained superior performance—finds little support in formal deductive or inductive inference, and the leading theories of competitive advantage incorporate refutation barriers that preclude meaningful empirical tests. This article explores the logical and philosophical foundations of the competitive advantage hypothesis, locating its philosophical foundations in the epistemologies of Bayesian induction, abductive inference and an instrumentalist, pragmatic philosophy of science. Copyright © 2001 John Wiley & Sons, Ltd.*

### COMPETITIVE ADVANTAGE AS PERFORMANCE HYPOTHESIS

Strategic management research attempts to explain the sustained superior performance of firms (Rumelt, Schendel and Teece, 1994). The leading hypothesis is that sustained superior performance arises from sustainable competitive advantages (Barney, 1997; Grant, 1998; Roberts, 1999). Theories differ as to the sources of competitive advantage—for example, whether superior performance takes the form of monopoly rents to protected market positions (Caves and Porter, 1977; Porter, 1980); or Ricardian rents to idiosyncratic firm-specific resources (Lippman and Rumelt, 1982; Wernerfelt, 1984); or “Schumpeterian rents” to the dynamic capability to renew advantages over time (Winter, 1987; Teece, Pisano and Shuen,

1997). Researchers have also debated the extent to which superior performance occurs at the level of the firm, business unit, corporation, or industry (Rumelt, 1991; Powell, 1996; McGahan and Porter, 1997; Brush, Bromiley and Hendrickx, 1999).

These debates notwithstanding, the hypothesis of competitive advantage dominates theories of sustained superior performance. Under any leading strategy theory, sustained superior performance exists, it has specifiable causes, and these causes are tied to the concept of competitive advantage.

Better explanations for superior performance may exist. Empirically-observed performance distributions may follow simple heuristics, or stem from a single process such as problem-solving (Popper, 1972), or researchers may conclude that every case of superior performance is unique, extreme and non-generalizable (see, for example, Starbuck, 1992, 1993). Sustained superior performance, not competitive advantage, is the dependent variable, and if another hypothesis provides a more fruitful understanding of performance, then researchers can subordinate the competitive

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advantage hypothesis, reconstruct it, or dispense with it altogether. If acceptance of competitive advantage persists in the face of empirical refutation and better theories, or if researchers devise strategies to shelter competitive advantage from falsification, then competitive advantage becomes something other than rigorous, empirically-testable social science—a form of ideology perhaps, or faith (Lakatos, 1970; Popper, 1972).

Whatever its epistemological status, the hypothesis of competitive advantage has had significant consequences for strategy research, practice and teaching. Competitive advantage has generated a large volume of scholarly output, both theoretical and empirical (Bowen and Wiersema, 1999; Rouse and Daellenbach, 1999); firms do, by all accounts, attempt to identify, create and leverage competitive advantages (Collis and Montgomery, 1995; Porter, 1996); and competitive advantage is universally accepted in strategic management courses and textbooks as an essential concept in strategy (Barney, 1997; Grant, 1998).

This paper examines the logical and philosophical foundations of the hypothesis of competitive advantage. In so doing we find that competitive advantage hypotheses are varied and ambiguous, and under no reasonable interpretation admit the inference that competitive advantage produces superior performance. Using a Bayesian argument, we identify two hidden assumptions that lead to false causal inferences in competitive advantage research. From this logical foundation, we then investigate the epistemological character of competitive advantage, and in particular its empirical claims and consequences. We conclude by showing how contemporary theories of competitive advantage may find justification in the epistemologies of abductive inference and a pragmatic, instrumentalist theory of truth.<sup>1</sup>

## LOGIC AND COMPETITIVE ADVANTAGE

A proposition is an assertion to which we assign a truth value, either T or F (Ambrose and Lazerowitz,

<sup>1</sup> This article deals specifically with hypotheses about sustained superior performance, not with all strategy theories (e.g., theories explaining organizational governance structures). The arguments do apply by analogy to corporate-level performance hypotheses that posit causes such as resource-based corporate advantages, “core competence” or “parenting” advantages.

1961; Salmon, 1973). We begin with two propositions:

*Proposition p: Firm i achieved sustained superior performance.*

*Proposition q: Firm i had one or more sustainable competitive advantages.*

These two propositions are not identical, though in strategy our vocabulary often interchanges them—p deals with a dependent variable (superior performance) and q with one proposed class of independent variables (competitive advantage).

Strategic management research has not produced significant debate on the logical form a competitive advantage hypothesis either does or should take. Most empirical studies infer the existence of competitive advantages from ex post performance observations, but then draw the converse conclusion—that creating competitive advantages ex ante produces sustained superior performance. The following expressions suggest three alternative forms of the competitive advantage hypothesis:<sup>2</sup>

- (1)  $p \supset q$  (if  $p$  then  $q$ ; if firm  $i$  achieved sustained superior performance, then firm  $i$  had one or more sustainable competitive advantages)
- (2)  $q \supset p$  (if  $q$  then  $p$ ; if firm  $i$  had one or more sustainable competitive advantages, then firm  $i$  achieved sustained superior performance)
- (3)  $p \equiv q$  ( $p$  if and only if  $q$ ; or if  $p$  then  $q$ , and if  $q$  then  $p$ )

Clearly, the form we accept depends on what we believe about the logical relations between competitive advantage and performance. Expression (1) asserts that any observation of sustained superior performance entails the presence of sustainable competitive advantage. Either this hypothesis or (3) would appear to govern empirical studies that propose sustainable competitive advantages as

<sup>2</sup> This paper uses the logical notation developed by Peano (1889), brought into modern usage by Whitehead and Russell (1910), and used in most contemporary logic texts in the analytic tradition. The operator  $\supset$  (material implication) signifies “if ... then” relations, and the operator  $\equiv$  (material equivalence) signifies “if and only if”. Other operators are as follows:  $\vee$  (disjunction) signifies “or”,  $\dots$  (conjunction) signifies “and”, and  $\sim$  (negation) signifies “not”. For convenience, we provide both the formal notation and a prose statement for each hypothesis.

explanations for ex post observations of superior performance.

In Expression (2), whenever sustainable competitive advantage is present, sustained superior performance is achieved. There may be instances of sustained superior performance in the absence of sustainable competitive advantage, but no firm with sustainable competitive advantage will fail to produce sustained superior performance. Researchers appear to adopt either (2) or (3) when advising managers to create competitive advantages in order to achieve superior performance.

But we cannot infer (2) from (1), owing to the general logical fallacy of “affirming the consequent”, i.e., inferring  $q \supset p$  from  $p \supset q$  (Hughes and Londey, 1965). Thus, if we adopt (1) as our hypothesis of competitive advantage, we cannot exclude the existence of firms that possess sustainable competitive advantages without achieving sustained superior performance. In more familiar terms, (1) asserts that sustainable competitive advantage is a necessary but not sufficient condition for sustained superior performance, (2) asserts that it is a sufficient but not necessary condition, and (3) asserts that it is both a necessary and sufficient condition.

Expression (3) is the strongest of the three hypotheses, asserting that whenever competitive advantage is present, superior performance is achieved, and that whenever superior performance is achieved, competitive advantage is present. Under (3), competitive advantage and superior performance are materially equivalent. If (3) were the prevailing hypothesis, we could easily explain the frequent conflation of the two expressions in the strategy literature—competitive advantage and superior performance would, indeed, arise only in the presence of the other.

On the other hand, (3) seems altogether implausible as an explanation of superior performance. One can easily conjure scenarios, both abstractly and experientially, of firms with advantage-producing idiosyncratic resources or capabilities (say, continual product innovation), that nonetheless failed to satisfy more fundamental competitive imperatives such as distribution capability, access to raw materials or general business acumen. In other words, it seems unreasonable to expect competitive advantage to imply superior performance no matter what else the firm may be doing wrong—if firms can have competitive advantages and competitive disadvantages at the same

time, then (3) is not a reasonable performance hypothesis.<sup>3</sup>

### The concept of competitive disadvantage

Strategy research has been slow to develop the notion of competitive disadvantage as something other than the dark side of competitive advantage. The two are quite independent—if competitive advantage stems from inimitable, idiosyncratic resources, competitive disadvantage is not merely the non-existence of such resources (which would create economic parity), but rather the failure even to satisfy the minimum success requirements, or “strategic industry factors” (Amit and Schoemaker, 1993), required of any firm. As depicted in Figure 1, any of four possibilities may obtain—a firm may find itself with both competitive advantage and disadvantage (quadrant 2), or with neither (quadrant 3), or with either without the other (quadrants 1 and 4).

In Figure 1, we expect to observe positive economic rents, whether monopoly, Ricardian, or otherwise, only from firms in quadrant 1 (i.e., firms with competitive advantages and without competitive disadvantages). Conversely, we expect negative rents from firms with the reverse profile (quadrant 4); and we assume for the moment that we can expect a distribution of economic rents from firms in quadrants 2 and 3, around a mean of zero. We will discuss quadrants 2 and 3 momentarily.

These ideas give rise to a third proposition, and three additional hypotheses:

*Proposition r: Firm  $i$  had competitive disadvantages.*

- (4)  $p \supset (q \dots \sim r)$  (if  $p$  then  $q$  and not- $r$ ; if firm  $i$  achieved sustained superior performance, then firm  $i$  had one or more sustainable competitive advantages and did not have competitive disadvantages)
- (5)  $(q \dots \sim r) \supset p$  (if  $q$  and not- $r$  then  $p$ ; if firm  $i$  had one or more sustainable competitive advantages and did not have competitive disadvantages, then firm  $i$  achieved sustained superior performance)

<sup>3</sup> Later we consider the argument that competitive advantage hypotheses are tautologous (true by definition, and therefore empirically meaningless): here we argue that, if (3) is not tautologous, it is empirically false.

Sustainable Competitive Advantages	Present	+	0
		1	2
Absent		3	4
	Absent	0	—
		Competitive Disadvantages	
		Absent	Present

Figure 1. Conditions of Sustained Superior Performance

- (6)  $p \equiv (q \dots \sim r)$  (both 4 and 5 are true—the expressions  $p$  and  $q \dots \sim r$  are materially equivalent)

In Expression (4), if we observe sustained superior performance, then it must be the case both that sustainable competitive advantage is present, and that competitive disadvantage is absent. However, even if we accept (4), its converse (5) cannot be validly inferred, because in (4) competitive advantage and competitive disadvantage are jointly necessary, but not sufficient, conditions for superior performance. If we accept Figure 1 (and assume that sustained superior performance never arises in the performance distributions of quadrants 2 or 3), then we believe that the presence of competitive advantage and the absence of competitive disadvantage jointly constitute necessary and sufficient conditions for superior performance, and we accept (6), which may be a defensible hypothesis about superior performance.

But where does (6) leave us with respect to our original hypotheses of the competitive advantage-performance relationship? It leaves us, again, with (1): that competitive advantage is a necessary but not sufficient condition for superior performance. As such, Hypothesis (1) is arguably the most plausible relation between sustainable competitive advantage and sustained superior performance—under assumptions thus far discussed, if we observed superior performance for firm  $i$ , then we would know that firm  $i$  both had sustainable competitive advantages and did not have competitive disadvantages.

Moreover, Hypothesis (1) redeems, after a fashion, the research method most commonly used to study performance, i.e., inferring competitive advantages from ex post performance observations. Certainly a research method founded on the ex ante observation of competitive advantages rather than performance, an attractive idea in concept, would not permit better inferences—even if we could observe competitive advantages ex ante, we could not make unqualified performance inferences unless we also took account of competitive disadvantages.

On the other hand, (1) has sharp limitations. As we have seen, it is not valid to infer from (1) that sustainable competitive advantage produces sustained superior performance. Although this conclusion appears often in strategy research, it amounts to the fallacy of affirming the consequent—as we have seen, quadrant 2 firms have sustainable competitive advantages without sustained superior performance. Even more troubling for (1) is the uncertain performance of firms in quadrants 2 and 3. Though we have assumed otherwise, it is empirically conceivable that some quadrant 2 firms might achieve superior performance despite having one or more competitive disadvantages, and conceivable also that some quadrant 3 firms might achieve sustained superior performance even without sustainable competitive advantages. There may, for example, be industries in which no firms possess sustainable competitive advantages (Waring, 1996), so that some competitor achieves sustained superior performance merely by superior

avoidance of competitive disadvantages. If this can occur, then sustainable competitive advantage is neither a necessary nor sufficient condition for sustained superior performance.

Under this latest scenario, an observation of sustained superior performance would only permit the inference that either sustainable competitive advantages were present or that competitive disadvantages were absent, but not necessarily both:

- (7)  $p \supset (q \vee \sim r)$  (if  $p$  then  $q$  or not- $r$ ; if firm  $i$  achieved sustained superior performance, then either firm  $i$  had one or more sustainable competitive advantages or firm  $i$  did not have competitive disadvantages)

### A Bayesian analysis

In Hypothesis (7) we have the weakest view of competitive advantage thus far discussed—that sustainable competitive advantage is neither a necessary nor sufficient condition for sustained superior performance. On the other hand, under (7) it seems clear that an observation of sustained superior performance does, in fact, provide non-trivial evidence about the presence of sustainable competitive advantages. If we suppose, for example, that 10% of firms have sustainable competitive advantages, then if we observe sustained superior performance in firm  $i$ , we should—if competitive advantage has a non-trivial linkage to performance—safely infer that the probability that firm  $i$  has sustainable competitive advantage is something greater than 0.10. This Bayesian process suggests the following hypothesis:

- (8)  $\text{prob}(p \supset q) > \text{prob}(p \supset \sim q)$  (the probability of firm  $i$  having sustainable competitive advantages is greater in the presence of sustained superior performance than in its absence)

Figure 2 presents a Bayesian analysis of (8) using hypothetical estimates for all parameters (Ross, 1993; Hogg and Craig, 1970). Using these estimates, our prior probability that firm  $i$  possesses sustainable competitive advantages is 0.10, but our revised estimate—based on the empirical observation of firm  $i$ 's sustained superior performance—is 0.53. Clearly, the resulting probabilities depend entirely on the estimates we supply, but the principle holds for any estimates: that our expectations of sustainable competitive advantage improve

under the empirical observation of sustained superior performance.

This analysis explains, without justifying, the inductive inference of competitive advantages from observations of sustained superior performance—sustainable competitive advantage is more probable in firms that achieve sustained superior performance, though not necessarily highly probable. The Bayesian analysis also raises into relief two hidden assumptions that produce false inferences about sustainable competitive advantages in strategy research, namely (1) that probability  $p/q$  is non-zero (some firms with sustainable competitive advantages achieve superior performance), and (2) that either probability  $\sim q = 0$  (all firms have competitive advantages), or probability  $p/\sim q = 0$  (no firms lacking competitive advantage achieve superior performance). In other words, the only way ex post performance data can justify the inference that competitive advantage (and only competitive advantage) produces superior performance, is by assuming what it seeks to prove, namely that competitive advantage produces superior performance, and the absence of competitive advantage precludes superior performance. Because these assumptions could only be justified in a world without competitive disadvantage, the conclusion again emerges that superior performance cannot be understood apart from competitive disadvantage.

### The syllogistic form

Thus far, we have expressed our propositions and hypotheses as separate premises, rather than as major and minor premises in a syllogistic argument. By way of summarizing our conclusions thus far, we represent the competitive advantage argument expressed in Hypothesis 1 in the more familiar syllogistic form, as follows:

Major premise	(1): If firm $i$ achieved sustained superior performance, then firm $i$ had one or more sustainable competitive advantages
Minor premise	$p$ : Firm $i$ achieved sustained superior performance
Conclusion	$\therefore q$ : Firm $i$ had one or more sustainable competitive advantages

We assume a researcher correctly determines that Alpha Company has achieved sustained superior performance, and now wants to estimate the probability that Alpha had sustainable competitive advantages. We use the following propositions:

- p*: Alpha achieved sustained superior performance.
- q*: Alpha had one or more sustainable competitive advantages.
- ~q*: Alpha did not have one or more sustainable competitive advantages.

The researcher has made the following prior probability estimates (where  $p/q$  is the conditional probability “ $p$ , given  $q$ ”):

- $\text{prob}(q) = .10$  (10% of all firms have sustainable competitive advantages)
- $\text{prob}(\sim q) = .90$  (90% of all firms do not have sustainable competitive advantages)
- $\text{prob}(p/q) = .50$  (50% of all firms that have sustainable competitive advantages achieve sustained superior performance)
- $\text{prob}(p/\sim q) = .05$  (5% of all firms without sustainable competitive advantages achieve sustained superior performance)

The probability that Alpha had sustainable competitive advantages given that it achieved sustained superior performance is:

$$\text{prob}(q/p) = \frac{\text{prob}(p/q) \times \text{prob}(q)}{[\text{prob}(p/q) \times \text{prob}(q)] + [\text{prob}(p/\sim q) \times \text{prob}(\sim q)]} = \frac{(.50)(.10)}{(.50)(.10) + (.05)(.90)} = .53$$

Two conclusions follow:

- (1) The researcher's estimate of  $p = .10$  - the prior probability of Alpha having sustainable competitive advantage - is revised to  $p = .53$  given the information that Alpha has achieved sustained superior performance;
- (2) The common assumption that  $\text{prob}(q/p) = 1.00$  is only justified if (a)  $\text{prob}(q)$  and  $\text{prob}(p/q)$  are nonzero, and (b) either: (i) all firms have sustainable competitive advantages [ $\text{prob}(\sim q) = 0$ ]; or (ii) no firm can achieve sustained superior performance in the absence of sustainable competitive advantages [ $\text{prob}(p/\sim q) = 0$ ]. (a) assumes competitive advantage exists and causes superior performance; (i) is absurd under any theory of competitive advantage, and (ii) assumes sustainable competitive advantage is a necessary condition for sustained superior performance, which is part of what competitive advantage research is attempting to discover.

Figure 2. A Bayesian Analysis

Although this is obviously a valid syllogistic form, most strategy studies do not make the major premise explicit. As we have seen, the major premise is arguably false, or at best stochastic as in (8), in which case the conclusion may also be false. We have also shown that, even if we accept the major premise, we cannot infer that sustainable competitive advantages produce sustained superior performance, and we posit competitive disadvantage as an essential missing ingredient in theoretical and empirical work on competitive advantage.

## PHILOSOPHICAL CONSIDERATIONS

Thus far, we have given little consideration to the actual content of any competitive advantage hypothesis. For analytical convenience, we assumed that the diverse perspectives on competitive advantage share the common logical feature of making claims that entail material implication or material equivalence between competitive advantage and performance. This enabled our conclusions to apply, for example, to a resource-based hypothesis as readily as to one based on protected market positions. Indeed, our conclusions thus far would apply to any propositions  $p$  and  $q$  so long as they were arranged in parallel logical forms.

But this simplification, and our broad construal of sustainable competitive advantage, does poor justice to the complexity and distinct flavor of contemporary strategy theories. In this section, we move beyond formal logical relations to examine the epistemological and ontological foundations of leading theories of sustainable competitive advantage.

The resource-based view is, by many accounts, the leading theory of competitive advantage (e.g., Barney, 1991, 1997; Mahoney and Pandian, 1992; Peteraf, 1993). Though the resource-based view invites varied economic and behavioral interpretations, under any version it conceives sustained superior performance as a firm-specific phenomenon deriving from resources and capabilities that produce economic rents by virtue of their value, scarcity, imperfect imitability and rent appropriability. The notion of imperfect imitability has received particular attention, with rents persisting not merely because of first-mover advantages or market positions protected by entry or mobility barriers, but due to “isolating mechanisms” such as causal ambiguity, social complexity, and

time compression diseconomies. As such, Ricardian or Schumpeterian rents may accrue to idiosyncratic, intangible, internal inputs such as leadership, culture, relationships, processes, or arcane, dynamic, difficult-to-specify interactions among complex technological and behavioral variables (Barney, 1986; Grant, 1991; Dierickx and Cool, 1989; Connor, 1991; Reed and DeFillippi, 1990).

The resource-based view, in all its incarnations, begins with the assumption of firm heterogeneity, i.e., that no two firms  $i$  and  $j$  possess identical resource/capability portfolios. This assumption, though true, raises epistemological problems quite apart from those discussed earlier, in that it is not an empirical statement at all, but rather a logical consequence of the definitions of “two” and “identical”. No empirical observation could produce the value  $F$  (two different firms with identical resource portfolios), and the proposition’s converse—that two different firms are identical—is absurd: two identical firms would be one firm, not two.

In philosophy, this notion takes two forms—the “identity of indiscernibles”, and its converse, “the indiscernability of identicals” (also known as Leibniz’s Law). Under either, to hold that two things are identical is not false, but simply absurd (Sanford, 1995). Accordingly, the strategy proposition “no two firms are identical” carries no more empirical content than the statement “there exists more than one firm”, which is an empirical proposition, though a relatively non-controversial one.<sup>4</sup>

Of course, resource-based approaches, like all hypotheses that insist on firm-specific advantages, need the heterogeneity assumption to explain empirical observations that violate perfectly competitive equilibrium conditions and outcomes. But perfect competition—a very large number of different, identical firms—is neither empirical nor rational, but axiomatic. Microeconomists, like other deductive theorists, are free to adopt any axioms they like, including rationally-absurd ones, or the empirically-impossible. The error is not in microeconomics, but in ourselves, when we insist that their axioms make sense or take empirical referents.

<sup>4</sup> To express this in logical terms, the propositions “ $i$  and  $j$  are firms” ( $p$ ) and “ $i$  and  $j$  are heterogeneous” ( $q$ ) are related not by material implication ( $p \supset q$ ), which is empirically testable, but by definitional implication ( $p \supset_{\text{def}} q$ ).

Whereas perfectly competitive conditions (identical, different firms) cannot be true either rationally or empirically, the heterogeneity assumption (different, non-identical firms) cannot be false. The heterogeneity assumption is what philosophers have called, since Kant's *Critique of Pure Reason*, an *analytic* proposition (Kant, 1965; Hospers, 1956; Russell, 1961; Heil, 1995). An analytic proposition—e.g., *the bachelor is unmarried*—is definitionally true, or tautological, in that its predicate (*is unmarried*) adds no information to its subject (*the bachelor*). To deny an analytic proposition results not in empirical error, but in self-contradiction—*the bachelor is married* is not false, but absurd.

Analytic propositions do not require empirical investigation because they make no assertions about how things stand in the world. By contrast, the proposition *My brother is unmarried* is *synthetic*, i.e., meaningful and empirically-testable—its predicate adds information to its subject, and one can easily conceive of circumstances where the proposition might be either true or false. Only synthetic propositions make assertions about empirical states of affairs. Analytic propositions may surprise us by producing non-obvious and even useful outcomes, but these outcomes hinge entirely on analogies between real-world phenomena and propositional terms, not from determining whether an analytic proposition is true. All analytic propositions are, by definition, true.

That the heterogeneity assumption is analytic is more than a philosophical curiosity, for three reasons. First, virtually all resource-based propositions are analytic, no matter what their micro-economic or sociological foundations, or how they disguise themselves in empirical language. As a consequence, researchers may believe they are testing the truth value of competitive advantage propositions, when in fact they are looking for coincidence between empirical phenomena and phenomena named in propositions that cannot be false. Second, it prompts us to investigate the characteristics of analytic propositions, and to consider whether researchers might justify such propositions under any philosophy of science. And finally, if our leading propositions are analytic, and our findings logically inconclusive (as shown earlier), researchers may want to reconsider the role of competitive advantage as a basis for managerial prescription. We now evaluate these points in order.

### Competitive advantage as analytic hypothesis

The resource-based view has attracted significant empirical study (Henderson and Cockburn, 1994; Powell and Dent-Micallef, 1997; Yeoh and Roth, 1999). Typically, a resource-based researcher, upon observing that firm *i* has achieved sustained superior performance, will conduct interviews, search archival sources, make on-site observations, write cases, administer surveys, etc. in search of the firm-specific resources or capabilities that caused the performance. And it would not be surprising if the researcher located such factors—in the firm's culture perhaps, or processes or skills, or the interaction of culture, process, skills and technology—and explained their sustainability through isolating mechanisms such as causal ambiguity.

This approach exploits the *ex post* observability of performance outcomes, comprising, as it were, an empirical test of Hypothesis (1): having observed superior performance (*p*), the researchers locate its causes in resource-based factors and interactions (collectively, *q*). And presumably, if a succession of studies successfully located resource-based competitive advantages (*q*), then the strategy research community could accept with increasing confidence the explanatory power of the resource-based theory, as shown in the earlier Bayesian analysis.

Suppose, however, that a researcher failed to locate any sources of competitive advantage whatsoever, and claimed to have found in firm *i* an anomaly—a firm with sustained superior performance and no sustainable competitive advantages. If resource-based propositions were synthetic (i.e., had empirical content), this would exist as a possibility, i.e., there would be a possible world in which resource-based propositions were false. But if the theory precludes these possible worlds by asserting, for example, that sustainable competitive advantages *must be there somewhere* because superior performance has been observed, then clearly the theory has made itself analytic ( $p \supset_{\text{def}} q$  rather than  $p \supset q$ ). Moreover, if the theory claims that competitive advantages escaped the researcher's detection by means of attributes inherent in those very advantages—intangibility, invisibility, complexity, causal ambiguity, etc.—then again the theory is analytic and, of course, refutation-proof.

Strategy researchers occasionally accuse one another's theories of "tautology" (Porter, 1991; Black and Boal, 1994), and this apparently is



what they mean—that their claims are not empirically falsifiable, or are merely verbal. Certainly under the scenario just described, resource-based propositions are tautologous, with no empirical evidence bearing on their truth or falsity. The intangibility, invisibility, and general unobservability of resource-based constructs has been thoroughly explored elsewhere (e.g., Itami and Roehl, 1987; Hall, 1993; Godfrey and Hill, 1995), and here we merely highlight the philosophical difficulties of proposing causal hypotheses in which the causal factors make no sensory impressions; are defined as too complex to understand; can neither be acquired nor replicated; and, perhaps most damaging to the integrity of a causal theory, are causally ambiguous.

Philosophers have attached a variety of labels to such propositions, most of them considerably less flattering than “analytic”. They have been called “emotive” propositions and metaphysical nonsense (Ayer, 1946); ideological and theological (Feyerabend, 1978); pseudo-scientific (Popper, 1976); and grammatical and metaphorical (Wittgenstein, 1958). Philosophers also hold that the propositional attitude “knowledge” cannot apply to propositions of this character (Prichard, 1950; Braithwaite, 1967). Philosophers define a “propositional attitude” as a person’s psychological orientation toward a proposition, e.g., certainty, belief, acceptance, hope, rejection, skepticism, faith, or anger (Armstrong, 1973; Wagner, 1995). Analytic propositions, bolstered by unobservable constructs and an invulnerable infrastructure of empirical irrefutability, have an inherent religious or metaphysical character that cannot support propositional attitudes of “empirical certainty” or even “probability”, but only attitudes such as opinion, belief, or faith (Popper, 1972; Lakatos, 1970; Wittgenstein, 1922; 1958).

In strategy, this predicament is not unique to the resource-based perspective. Alternative theories scarcely perform better, and indeed the resource-based view arose in response to insuperable difficulties in theories that explain performance without reference to firms’ internal resources and capabilities. Certainly, notions such as strategic groups, cost leadership, differentiation, niche and “stuck in the middle” have metaphysical and empirical problems as great as those in the resource based view, and many industry-level phenomena are causally and ontologically ambiguous (e.g., is product differentiability a firm-specific or industry

level phenomenon? Exogenous or endogenous?). Moreover, industry and strategic group propositions partake in precisely the same post hoc performance observation, and barriers to imitation logic, that produced in the resource-based view the false logical inferences and philosophical ambiguities already described. Supporters of industry-level hypotheses may argue that these entail measurable, falsifiable claims, but rather than argue the point philosophically, resource-based researchers have observed that industry hypotheses have, in fact, been falsified, or at least shown less powerful than firm-level explanations (Hansen and Wernerfelt, 1989; Rumelt, 1991). At the moment, there appears to be no falsifiable, unfalsified theory of competitive advantage, nor any competitive advantage propositions defensible without resort to ideology, dogmatism or faith.

### **Competitive advantage as pragmatic, abductive inference**

Ideologies and faith do have consequences and, in a practical domain like strategy—with an explicit mission to connect with management practice—descriptive accuracy may matter less than generating effective action (Brunsson, 1982; Starbuck, 1982; Weick, 1987). Indeed, nearly all good theories, even the most esteemed theories of the physical and biological sciences, have metaphysical qualities, incorporating devices shielding them from empirical falsification. Philosophers of science from Pierre Duhem to Paul Feyerabend have found theological elements in the history of scientific belief (Duhem, 1954; Feyerabend, 1978), and Duhem argued, in any case, that no scientific proposition can be falsified exclusively from empirical evidence, or through any crucial experiment. Physicists, for example, have proposed entities (ether, phlogiston) at least as imperceptible as intangible-invisible assets (Feyerabend, 1978; Chalmers, 1999); and one can hardly conceive of empirical evidence that would lead biologists, or for that matter social scientists, to abandon theories of natural selection—not because natural selection theory is correct, but because it has no serious rivals and carries sufficient auxiliary hypotheses to remain consistent with any empirical state of affairs (Popper, 1976).

We can argue, then, that theories founded on analytic propositions need not be rejected outright, and may even enable intellectual and practical

progress. On the other hand, it is essential that strategy researchers appreciate the consequences of working with such propositions, of which three consequences are of primary importance. First, as we have seen, empirical studies can neither prove nor disprove competitive advantage propositions. This is essential for those who conduct empirical work in strategy. Analytic propositions are already true—the only empirical question is whether there exist entities or phenomena analogous to those named in competitive advantage propositions.

Second, competitive advantage propositions not only contain unobservables, but have the especially ironic feature that their entities and phenomena only function properly so long as no one observes or understands them. The argument is refutation-proof, and would thereby be rejected under conventional standards of philosophy of science (Popper, 1972; Kuhn, 1962; Lakatos and Musgrave, 1970), or indeed under standards applied in courts of law or in common-sense discourse: since observation and comprehension would disable resource-based advantages, we are foreclosed from corroborating (or falsifying) the resource-based hypothesis.

For these reasons, the theories of truth most widely accepted in epistemology—the correspondence and coherence theories—are quite irrelevant to the search for sustainable competitive advantage. Strategy researchers are not trying to determine whether empirical realities correspond to competitive advantage propositions: these propositions would correspond to any empirical reality. Nor do we seek a mere logical coherence with a set of other acceptable propositions: as in other disciplines with practical consequences, strategy research needs empirical grounding.

The search for competitive advantages relies for its epistemological justification not on correspondence or coherence theories, but on an instrumentalist theory of truth. Under this approach, developed by pragmatist philosophers such as William James, John Dewey and C. F. Pierce, empirical states of affairs are indifferent to our propositions about them—they are neither true nor false, but simply, *are* (James, 1907; Stich, 1990). Therefore truth is not a property of propositions or of empirical reality, or of their relations, but rather a practical concern of human beings desiring an advance in understanding or scientific discovery. To a pragmatist, a true proposition is one that facilitates fruitful paths of human discovery. So long as a

proposition provides a profitable leading, we retain it, deploy it, and improve it. But when it begins to frustrate discovery, and alternative propositions become more attractive, we abandon our original proposition, and call it false. But we need never insist that our propositions copy reality, or remain wholly consistent with one another—if they produce results, we keep them.

The pragmatist epistemology stands in contrast to prevailing positivist and anti-positivist views of scientific discovery. Whereas positivism emphasizes the objective, lawlike properties of a brute reality independent of observation (Donaldson, 1992; Wicks and Freeman, 1998), anti-positivism emphasizes the creative role of active, subjective participants, none of whom owns a privileged claim on truth (Burrell and Morgan, 1979; Astley, 1985; Martin, 1990). Pragmatism, on the other hand, rejects positivism, on grounds that no theory can satisfy its demands (objectivity, falsifiability, the crucial experiment, etc.); and rejects anti-positivism, because virtually any theory would satisfy them. As such, the pragmatist proposes to reorient the assessment of theories around a third criterion: the theory's capacity to solve human problems (Rorty, 1989; Stich, 1990). To a pragmatist, the mandate of science is not to find truth or reality, the existence of which are perpetually in dispute, but to facilitate human problem-solving. According to pragmatist philosopher John Dewey, science should overthrow "the notion, which has ruled philosophy since the time of the Greeks, that the office of knowledge is to uncover the antecedently real, rather than, as is the case with our practical judgements, to gain the kind of understanding which is necessary to deal with problems as they arise." (Dewey, 1988: 14)

The pragmatic reorientation provides one epistemological justification for theories possessing the peculiar characteristics of prevailing strategy theories. Theories of firm-specific competitive advantage may fail to satisfy conventional epistemological demands, but to the pragmatist they could be construed as a legitimate attempt to solve the central problem facing strategy researchers—*explaining sustained superior performance*—as well as the central problem facing managers—*creating sustained superior performance*. If the competitive advantage hypothesis helps us advance on these problems—as evidenced by, say, a vigorous stream of research, or increased adoption rates

among managers—then researchers may be justified in overlooking the theory's failure to attain the philosopher's ideals of knowledge, truth or reality.

Moreover, pragmatism enables researchers to overcome the logical problems raised earlier by avoiding strict reliance on conventional inductive and deductive inference. Under pragmatism, hypotheses can be justified through the inferential method of "abduction", sometimes called "inference to the best explanation" (O'Hear, 1989; Sklar, 1995). Inference by abduction does not require a theory to conform to the ordinary demands of formal logic, so long as the theory has been subjected to fair, sustained and rigorous competition among plausible rivals. From this perspective, one might argue that, even if deductive or inductive reasoning cannot prove that competitive advantage produces superior performance, competitive advantage has itself survived competition among rival performance theories. Perhaps we need not concern ourselves much about formal logic or epistemological truth, having gained the wisdom that in an imperfect world we work with imperfect theories, and that our task as scholars is not perfection or non-contradiction, but intellectual progress. So long as we conduct a fair and rigorous competition among rival theories, then we have done our best to ensure the integrity of the prevailing theory.

Having said that, strategy scholars should acknowledge that the search for sustainable competitive advantages almost certainly arises from a false mental picture, namely the idea that a competitive advantage resides somewhere in time and space, findable in the same way that we find a misplaced fountain pen, or a sunken ship. The pragmatist epistemology allows the possibility of intellectual progress, but not the comfort of having located hard and ultimate realities. It should by now be obvious, but we point it out anyway, that competitive advantages, especially resource-based advantages, do not exist as sensible entities, and researchers will not discover them sunken deep within organizations, Titanic-like, creating sustained superior performance.

In the best case, competitive advantage serves as a metaphor, a "language game" or way of seeing that directs scholars to remove problems that lie in the way of discovery about sustained superior performance (Wittgenstein, 1958; Rorty, 1989). And in that role competitive advantage can serve a useful and arguably scientific purpose. Rival propositions may someday show us a better way

of seeing superior performance, and if they do, or if we find ways to construct synthetic performance propositions, then we should not hesitate to jettison the hypothesis of competitive advantage—not because it is empirically wrong or false, but because it frustrates discovery about superior performance.

## CONCLUDING REMARKS

Every discipline, from physics to psychology, experiences periods when widely-accepted propositions have discomfiting characteristics—sometimes the prevailing wisdom is analytic, contains unobservables, or founders on obvious logical inconsistencies and unexplainable empirical anomalies (Kuhn, 1962; Lakatos, 1970). Intellectually awkward periods, like the adolescent stage marking a child's transition to adulthood, can stimulate scholars to resolve logical inconsistencies, explain anomalies, and generate, sometimes in the revolutionary manner described by Kuhn, the very advances the field requires. But epistemological problems arise when such propositions begin to linger and dominate the field, which is arguably the case with resource-based theories. In this paper, we suggest that pragmatism may constitute a viable epistemological justification for the present state of strategic management research, and a foundation for future advance.

Though we have emphasized research, pragmatism plays an equally significant role as a philosophical foundation for transferring knowledge to managers. It has not been widely appreciated by researcher-consultants that our leading competitive advantage propositions—entailing constructs managers can neither observe, understand, replicate nor acquire—are philosophically untenable. In strategy sessions and executive workshops, managers are instructed to find sustainable competitive advantages among their resources, and they do indeed find them, albeit sometimes with great difficulty. Without being cynical, one might suggest that, if asked and similarly prompted, managers could also perceive animal shapes in cloud formations or anger in a tree. But these are ways of seeing, not empirical discoveries.

Strategy prescription needs consistent epistemological foundations, in large part because the process of strategy research has so little in common with what managers must actually do to create

superior performance. Researchers design their work to explain known performance outcomes, but managers do the reverse, identifying and mobilizing factors to create superior performance in periods to come. Whereas the manager predicts the risk, feasibility and consequences of various courses of action, and deploys these into an uncertain future, the researcher writes history, and, as with any history, many stories could be told. What Carr (1986) has said about historians applies equally to strategy researchers: we do not render a photographic copy of the real world, but instead select, out of the infinite ocean of facts, the minute fraction that best supports our purpose (see Carr, 1986:98-99). But whatever story the researcher tells, the manager is never absolved from working out his or her own corporate salvation—not abstractly and not at arm's length, but with profound existential fear and trembling. One could reasonably doubt whether any researcher's performance history bears genuinely on the risks and anxieties surrounding the practicing manager's performance-creation problem.

Pragmatism and the abductive theory of inference cannot fully bridge this divide, but they do give strategy researchers a consistent intellectual foundation from which to connect with management practice. Our competitive advantage hypotheses are not true or real or acceptable—either scientifically or practically—under any positivist or anti-positivist epistemology. But as tools for gaining ground on the problems of explaining and creating superior performance, they have survived (thus far) in a rigorous competition among rival explanations, and they provide ways of seeing that, by all accounts, do help solve the problems managers face. If history is any guide, our best competitive advantage hypotheses will illuminate new problems that in turn require new solutions, and therefore new theories. In strategic management research, we need not require strict conformance to conventional epistemology, so long as we apply ourselves diligently to staging a fair and vigorous competition of ideas around the problems that face researchers and practicing managers. On that basis, we can—despite the circumstances that divide research from management practice—defend the intellectual and practical integrity of our work.

Of course, the pragmatic perspective does exact a price, namely the concession that our perpetual war of ideas moves us no closer to ultimate

truth or reality. Under pragmatism, our prevailing concepts—competitive advantages, barriers to resource imitation—constitute the language game through which strategy researchers and managers presently solve their problems. But so long as we can resist the vanity that we are gaining on objective truth or reality, we will not misunderstand our achievements, and will stand on defensible philosophical foundations.

## REFERENCES

- Ambrose A, Lazerowitz M. 1961. *Logic: The Theory of Formal Inference*. Holt, Rinehart and Winston: New York.
- Amit R, Schoemaker P. 1993. Strategic assets and organizational rent. *Strategic Management Journal* **14**(1): 33–46.
- Armstrong DM. 1973. *Belief, Truth and Knowledge*. Cambridge University Press: London.
- Astley G. 1985. Administrative science as socially constructed truth. *Administrative Science Quarterly* **30**: 497–513.
- Ayer AJ. 1946. *Language, Truth and Logic*. Dover: New York.
- Barney J. 1986. Organizational culture: Can it be a source of sustainable competitive advantage?. *Academy of Management Review* **11**(3): 656–665.
- Barney J. 1991. Firm resources and sustained competitive advantage. *Journal of Management* **17**(1): 99–120.
- Barney J. 1997. *Gaining and Sustaining Competitive Advantage*. Addison-Wesley: Reading, MA.
- Black J, Boal K. 1994. Strategic resources: traits, configurations and paths to sustainable competitive advantage. *Strategic Management Journal*, Summer Special Issue **15**: 131–148.
- Bowen H, Wiersema M. 1999. Matching method to paradigm in strategy research: limitations of cross-sectional analysis and some methodological alternatives. *Strategic Management Journal* **20**(7): 625–636.
- Braithwaite R. 1967. The nature of believing. In *Knowledge and Belief*, Griffiths AP (ed.). Oxford University Press: London, 28–40.
- Brunsson N. 1982. The irrationality of action and action rationality: decisions, ideologies, and organizational actions. *Journal of Management Studies* **19**: 29–44.
- Brush T, Bromiley P, Hendrickx M. 1999. The relative influence of industry and corporation on business segment performance: an alternative estimate. *Strategic Management Journal* **20**(6): 519–547.
- Burrell G, Morgan G. 1979. *Sociological Paradigms and Organizational Analysis*. Heinemann: London.
- Carr EH. 1986. *What is History?* (2nd ed.). Macmillan: London.
- Caves R, Porter M. 1977. From entry barriers to mobility barriers: conjectural decisions and contrived deterrence to new competition. *Quarterly Journal of Economics* **91**: 241–262.

- Chalmers A. 1999. *What Is This Thing Called Science?* 3rd edition. University of Queensland Press: St. Lucia.
- Collis D, Montgomery C. 1995. Competing on resources: strategy in the 1990s. *Harvard Business Review* **73**(4): 118–128.
- Connor K. 1991. Theory of the firm: firm resources and other economic theories. *Journal of Management* **17**(1): 121–154.
- Dewey J. 1988. *The Middle Works of John Dewey* Vol. 4. SIU Press: Carbondale, IL.
- Dierickx I, Cool K. 1989. Asset stock accumulation and sustainability of competitive advantage. *Management Science* **35**: 1504–1511.
- Donaldson L. 1992. The Weick stuff: managing beyond games. *Organizational Science* **3**: 461–466.
- Duhem P. 1954. *The Aim and Structure of Physical Theory*. Princeton University Press: Princeton, NJ.
- Dyson R. 1990. *Strategic Planning: Models and Analytical Techniques*. John Wiley & Sons: New York.
- Feyerabend P. 1970. Consolations for the specialist. In *Criticism and the Growth of Knowledge*, Lakatos I, Musgrave A (eds). Cambridge University Press: London; 197–230.
- Feyerabend P. 1978. *Against Method: Outline of an Anarchistic Theory of Knowledge*. Verso: London.
- Frankena W. 1973. *Ethics*. Prentice-Hall: Englewood Cliffs, NJ.
- Godfrey P, Hill C. 1995. The problem of unobservables in strategic management research. *Strategic Management Journal* **16**(7): 519–533.
- Grant R. 1991. The resource-based theory of competitive advantage. *California Management Review* **33**(3): 114–135.
- Grant R. 1998. *Contemporary Strategy Analysis*. Blackwell: Malden, MA.
- Hall R. 1993. A framework linking intangible resources and capabilities to sustainable competitive advantage. *Strategic Management Journal* **14**(8): 607–618.
- Hansen G, Wernerfelt B. 1989. Determinants of firm performance: the relative importance of economic and organizational factors. *Strategic Management Journal* **10**(5): 399–411.
- Heil J. 1995. Analytic-synthetic distinction. In *The Cambridge Dictionary of Philosophy*, Audi R (ed.). Cambridge University Press: Cambridge; 23–24.
- Henderson R, Cockburn I. 1994. Measuring competence? Exploring firm effects in pharmaceutical research. *Strategic Management Journal*, Winter Special Issue **15**: 63–84.
- Hogg R, Craig A. 1970. *Introduction to Mathematical Statistics*. Macmillan: New York.
- Hospers J. 1956. *An Introduction to Philosophical Analysis*. Routledge & Kegan Paul: London.
- Hughes G, Londey D. 1965. *The Elements of Formal Logic*. Methuen & Co: London.
- Itami H, Roehl T. 1987. *Mobilizing Invisible Assets*. Harvard University Press: Cambridge, MA.
- James W. 1907. *Pragmatism*. Longmans, Green & Co: New York.
- Judson R. 1990. *Making Strategy Happen*. Basil Blackwell: Cambridge, MA.
- Kant I. 1965 (originally published 1781). *Critique of Pure Reason*. St. Martin's: New York.
- Kuhn T. 1962. *The Structure of Scientific Revolutions*. University of Chicago Press: Chicago, IL.
- Lakatos I. 1970. Falsification and the methodology of scientific research programmes. In *Criticism and the Growth of Knowledge*, Lakatos I, Musgrave A (eds). Cambridge University Press: London; 91–196.
- Lakatos I, Musgrave A (eds). 1970. *Criticism and the Growth of Knowledge*. Cambridge University Press: London.
- Lippman S, Rumelt R. 1982. Uncertain imitability: an analysis of interfirm differences in efficiency under competition. *Bell Journal of Economics* **13**: 418–438.
- Lippman S, Rumelt R. 1992. Demand uncertainty and investment in industry-specific capital. *Industrial and Corporate Change* **1**(1): 235–262.
- Mahoney J, Pandian J. 1992. The resource-based view in the conversation of strategic management. *Strategic Management Journal* **13**(5): 363–380.
- Martin J. 1990. Deconstructing organizational taboos: the suppression of gender conflict in organizations. *Organization Science* **1**: 339–359.
- McGahan A, Porter M. 1997. How much does industry matter, really? *Strategic Management Journal*, Summer Special Issue **18**: 5–14.
- O'Hear A. 1989. *An Introduction to the Philosophy of Science*. Oxford Press: Oxford.
- Peano G. 1889. *Arithmetices Principia*. Turin Publishing: Turin.
- Peteraf M. 1993. The cornerstones of competitive advantage: a resource-based view. *Strategic Management Journal* **14**(3): 179–191.
- Popper K. 1972. *The Logic of Scientific Discovery*. Hutchinson of London: London.
- Popper K. 1976. *Unended Quest: An Intellectual Autobiography*. William Collins Sons: Glasgow.
- Porter M. 1980. *Competitive Strategy*. Free Press: New York.
- Porter M. 1991. Towards a dynamic theory of strategy. *Strategic Management Journal*, Summer Special Issue **12**: 95–117.
- Porter M. 1996. What is strategy? *Harvard Business Review* **74**(6): 61–78.
- Powell T. 1996. How much does industry matter? An alternative empirical test. *Strategic Management Journal* **17**(4): 323–334.
- Powell T, Dent-Micallef A. 1997. Information technology as competitive advantage: the role of human, business and technology resources. *Strategic Management Journal* **18**(5): 375–405.
- Prichard HA. 1950. *Knowledge and Perception: Essays and Lectures*. Oxford University Press: London.
- Reed R, DeFillippi R. 1990. Causal ambiguity, barriers to imitation, and sustainable competitive advantage. *Academy of Management Review* **15**(1): 88–102.
- Roberts P. 1999. Product innovation, product-market competition, and persistent profitability in the U.S. pharmaceutical industry. *Strategic Management Journal* **20**(7): 655–670.
- Rorty R. 1989. *Contingency, irony and solidarity*. Cambridge Press: New York.

- Ross S. 1993. *Introduction to Probability Models*. Academic Press: San Diego.
- Rouse M, Daellenbach U. 1999. Rethinking research methods for the resource-based perspective: isolating sources of sustainable competitive advantage. *Strategic Management Journal* **20**(5): 487–494.
- Rumelt R. 1991. How much does industry matter? *Strategic Management Journal* **12**(3): 167–185.
- Rumelt R, Schendel D, Teece D. 1994. *Fundamental Issues in Strategy*. Harvard University Press: Cambridge, MA.
- Russell B. 1961. *The History of Western Philosophy*. Alden Press: Oxford.
- Salmon W. 1973. *Logic*. Prentice-Hall: Englewood Cliffs, NJ.
- Sanford D. 1995. Indiscernibility of identicals. In *The Cambridge Dictionary of Philosophy*, Audi R (ed.). Cambridge University Press: Cambridge; 367.
- Sklar L. 1995. Philosophy of science. In *The Cambridge Dictionary of Philosophy*, Audi R (ed.). Cambridge University Press: Cambridge; 611–615.
- Starbuck W. 1982. Congealing oil: inventing ideologies to justify acting ideologies out. *Journal of Management Studies* **19**(1): 3–25.
- Starbuck W. 1992. Learning by knowledge-intensive firms. *Journal of Management Studies* **29**(6): 713–740.
- Starbuck W. 1993. Keeping a butterfly and an elephant in a house of cards: the elements of exceptional success. *Journal of Management Studies* **30**(6): 885–921.
- Stich S. 1990. *The Fragmentation of Reason*. MIT Press: Cambridge, MA.
- Teece D, Pisano G, Shuen A. 1997. Dynamic capabilities and strategic management. *Strategic Management Journal* **18**(7): 509–533.
- Wagner S. 1995. Proposition. In *The Cambridge Dictionary of Philosophy*, Audi R (ed.). Cambridge University Press: Cambridge; 658–659.
- Waring G. 1996. Industry differences in the persistence of firm-specific returns. *American Economic Review* **86**(5): 1253–1265.
- Weick K. 1987. Substitutes for strategy. In *The Competitive Challenge*, Teece D (ed.). Center for Research in Management: Berkeley, CA; 221–233.
- Wernerfelt B. 1984. A resource-based view of the firm. *Strategic Management Journal* **5**(2): 171–180.
- Whitehead AN, Russell B. 1910. *Principia Mathematica*. Cambridge Press: Cambridge.
- Wicks A, Freeman R. 1998. Organization studies and the new pragmatism: positivism, anti-positivism, and the search for ethics. *Organization Science* **9**: 123–140.
- Winter S. 1987. Knowledge and competence as strategic assets. In *The Competitive Challenge*, Teece D (ed.). Center for Research in Management: Berkeley, CA; 159–184.
- Wittgenstein L. 1922. *Tractatus Logico-Philosophicus*. Routledge & Kegan Paul: London.
- Wittgenstein L. 1958. *Philosophical Investigations*. Basil Blackwell: Oxford.
- Yeoh P-L, Roth K. 1999. An empirical analysis of sustained advantage in the U.S. pharmaceutical industry: impact of firm resources and capabilities. *Strategic Management Journal* **20**(7): 637–653.