

## **What Should Strategic Management's Dependent Variable Be?**

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The field of strategic management has traditionally had as its central concern the **performance of the firm and the factors that affect firm performance**. For purposes of our discussion here, we retain this focus. What follows are four related perspectives that we hope will inform new thinking about the dependent variable in strategic management.

### **Taking the Dynamics of Performance Seriously**

Constance Helfat

Much of the discussion of performance in strategic management revolves around competitive advantage and what makes it possible for a firm to perform better than its competitors—and especially to sustain an advantage. Despite the interest in sustained competitive advantage, researchers typically measure firm performance at a point in time, often using financial measures that rely on accounting data or stock prices. Although the latter reflect a forecast of future returns, the forecast is at a particular point in time (Lieberman, Balasubramanian, and Garcia-Castro, 2018). Even when a study examines data over a several year time period, the research often focuses on factors during the time period of analysis that affect roughly contemporaneous firm performance. Research that goes beyond examining contemporaneous performance tends to examine a change in performance from one time period to the next, for example as the result of a merger or diversification move.

These approaches to understanding firm performance do not directly address the question of how firms can maintain their success, particularly beyond the immediate future. Our understanding of the ups and downs of firm performance over time is limited as well. A relatively small number of large successful firms have maintained their advantage over long periods of time (O'Reilly and Tushman, 2008). Other firms have survived over long periods even if they are not among the highest performers. If we cannot explain why some firms achieve longer-term success, we may have little to say other than “build a better mousetrap and milk the returns until someone else comes along with an even better (perhaps entirely different) mousetrap.” In an era when, as the saying goes, the only constant is change, this hardly seems satisfactory.

These considerations point to *firm performance over longer time spans* as an important dependent variable in strategic management. Beyond this general proposition, which more specific types of dependent variables might enable us to better understand firm performance over longer time spans? It would help to consider measures of overall firm performance that more directly tie to the longer run and that take the time path of performance into account. In addition, we can consider important determinants of performance in the longer run as dependent variables themselves. With respect to the latter, strategic management research uses dependent variables such as technological innovation, the introduction of new products and processes, and business reconfiguration. Studies that use these sorts of dependent variables could track them over longer time spans so that we can draw conclusions that apply beyond a particular time (and setting). With respect to an overall measure of firm performance, it is worth paying more attention to

the growth in firm size as an alternative to profits. As I have noted previously, “[i]n the absence of growth, firms can improve their performance only by reducing costs or raising prices” (Helfat et al., 2007: 103)—and firms may reach their limits to do both. Moreover, in a competitive economy, firms that grow put pressure on other firms. Short of a sustained boom in (potentially irrational) external funding, firms will find it difficult to sustain unprofitable growth in sales over longer periods of time.

Beyond these sorts of measures of performance, we need to better unpack the factors that do and do not lead to firm success (or failure) over longer time spans, including what enables some firms but not others to recover from external shocks and from missteps. That is, we need to better understand the time path of firm performance and its determinants. We have candidate explanations in the strategic management literature, and we likely need more, but do not know which (if any) of these candidates will hold up when longer time spans are considered. This requires a more systematic, and inherently evolutionary, analysis.

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## Challenge of Real-time Measures of Performance in Evolving Worlds

Dan Levinthal

The firm can be viewed as being characterized as a state variable in a dynamic system --- a dynamic system of sequential choices over an unfolding set of circumstances. From an optimal control perspective, the value of the enterprise at a given state is premised on optimizing choices from that state and subsequent states, as well as well-specified beliefs regarding future events in the world --- whether competitors’ actions, technological advances, regulatory changes and so on. While well posed and solvable in “small worlds” (Savage, 1954), in more natural settings of business enterprises, the problem suffers the curse of dimensionality (Bellman, 1961) and, as a result, the strategy problem inevitably becomes a behavioral one (Levinthal, 2011). Managers and consultants may use various techniques of rational choice, but as March (1994) notes, those techniques should be understood as processes not normative statements, as preceding any analytic effort is a

prior act of forming a relatively simple cognitive representation (Gavetti and Levinthal, 2000) of a more complex problem.

Per Winter's (1987) observation regarding the "imputation problem", a critical role of cognitive representations is the valuation of the enterprise and the adjacent possible states, where the adjacent possible are the states that are accessible to the firm at any time, as the set of accessible states is constrained as a result of path-dependence in the movement of the firm through the possible state space.<sup>1</sup> This imputation problem is a challenge both to actors within the firm and those external to it --- whether financial analysts or strategy scholars. Within the firm, the firm's artificial selection environment (Levinthal, 2021) provides the performance gradients that the firm as a whole and actors and units within it climb. These measures help to address the credit assignment problem noted in early work on artificial intelligence (Samuels, 1959; Holland, 1975) of how to assign value to "stage-setting" moves --- in the context of business firms' initial investments and strategic investments --- that may not yield meaningful or indicative contemporaneous outcome measures in the marketplace (Denrell, Fang, and Levinthal, 2004).

The firm's artificial selection environment may or may not correspond to a coherent theory of the firm's strategy (Felin and Zenger, 2017). Certainly metrics may be articulated based on beliefs about vectors of progress, whether features of product offerings or market opportunities; but, they also may be reflective of political contestation (Kaplan, 2008; Levinthal and Pham, forthcoming) and legacies of prior market conditions (Burgelman, 2002). External observers of enterprises, again financial analysts or strategy scholars, form their own valuation function, but a value function based on a more restricted set of observables than available to actors within the firm. In particular, the observables for external evaluators are inevitably a set of outcomes that are somewhat downstream from those available to the enterprise. Further, as Benner and Zenger (2016) note, the firm's strategy may be more or less opaque to external actors and therefore the mapping from a set of observables to valuation may be more problematic for external actors in some instances than in others.

With these conceptual issues in mind, let us now return to the starting question of assessing firms' performance.<sup>2</sup> Assume for a moment that we could solve the dynamic

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<sup>1</sup> As Levinthal (2021, Chapter 3) notes, the behavioral, and in particular the evolutionary economics tradition, tends to offer a "glass half-empty" perspective on path-dependence, highlighting the boundedness of what constitute adjacent possible states, while discussions of real options offers a "glass half-full" perspective of what states might be realized as a result of current actions. Whether backward-looking as in the behavioral perspective or forward-looking as in the real options perspective, both perspectives highlight the role of path-dependence.

<sup>2</sup> In considering firm performance here, I am taking on a narrow firm-centric perspective. As the long-standing discussion of a broader stakeholder perspective, such an approach is clearly limited and problematic. However, this limited problem has in itself enormous complexities and challenges and suggests that even if we can address the assessment of performance from the perspective of diverse stakeholders, the ensuing firm-level problem would still have the conceptual difficulties pointed to here.

programming problem that yields the firm's current value, implying that the firm acts in some optimal manner as the state space of the world reveals itself over time. This analytic solution certainly solves the financial analyst's problem of stock valuation, but what does it say about the performance of the firm with regard to the cleverness of its strategies and its strategists? One interesting implication of posing this hypothetical optimum is that it provides a reference point for evaluating how mere mortals, actual managers and strategists, perform. We probably should assess the performance of the captain of a sinking ship, or the CEO of a firm facing an unanticipated negative shock, differently than a firm that wakes up to find itself on the right side of history. Thus, while valuation should be treated as an absolute measure, performance arguably should be thought of with respect to what is possible given some existing state relative to what in fact was realized from that existing state. When we assess the strategic performance of the corner bodega, we probably should have a different reference point in mind than when we assess Google.

Much of our discussion of "performance" is in fact a discussion of valuation. Of course, the two discussions are not unrelated. For instance, a common approach to assess the strategic wisdom of an acquisition is to assess the change in the firm's valuation by the stock market subsequent to the acquisition. However, by conflating a consideration of performance with the question of valuation, we invite managers to construct unrealistic narratives to tell themselves, their employees, and markets --- narratives that might enhance current assessments of valuation, but that narrative maybe detached from an assessment of performance relative to what constitutes the adjacent possible.<sup>3</sup> This view of performance is evocative of that trite, frustrating, and likely psychological damaging, entreatment to "do one's best". The problem with this bit of encouragement is that one's best is not well defined. Our best is some unclear, unknowable, latent possible. The unknowability of what is possible is why aspiration levels form a cornerstone of the behavioral theory of the firm (Cyert and March, 1963). The fact that aspiration levels adapt to experience is not a "bug", but rather an inherent feature of a world in which dynamic programming does not provide the guidelines as to what can be achieved. Thus, a firm is performing well or less well as understood by some plausible aspirations for the enterprise. Further, the conversation around aspiration levels has the limitation that it tends to focus on "bottom-line" outcomes, such as sales or current measures of profits, and not the intermediate "state-setting moves" that are antecedent to future performance. Thus, our consideration of performance poses the challenge of the latent possible and the assessment of movement toward that latent possible. These are deep, unlikely to be fully resolvable problems, but I hope by posing the performance issue in this manner to offer some possibly useful intermediate stage-setting steps.

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<sup>3</sup> The adjacent possible in this regard should be understood not just in its immediate value, but as a launching point for further moves in a dynamic process. That is, the adjacent possible valuation should include the stage setting value of that state.

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## **What Fischer Black Taught Besides How to Price An Option**

Bruce Kogut

For the sake of coherence in our discussions, I choose to comment on an experience I had while a PhD student at the Sloan School at MIT. Time and page being short, to the point: the experience consisted of a debate between Robert Merton and Fischer Black about social security and its financial viability. Whereupon “Fischer” asked if you would prefer to predict the probability of bankruptcy by knowing the unconditional probabilities or the conditional probabilities, where conditional meant the state of the world(s). This is a pretty simple way of saying “information” matters to strategies: it’s helpful to know what the state of the world is.

### ***Theory, Models and Concepts***

There is another way to understand what Fischer (perhaps) meant: conditional probabilities are not helpful if you have a bad model. Steven Figlewski noted at the time of Fischer’s early death that ‘. . . What he thought was important was “to build the most truthful model you could, even if you couldn’t solve it analytically or accurately.”’ He probably thought the model should be mathematical, but either way, he thought a model should also be appropriately conceptual per the problem.

Observation 1: Here is a strategy example. Agent-based simulations involve modeling choices of space and time that constrain agents. In a standard NK model, the space is a regular graph (all nodes are connected and have the same degree) that defines a hypercube (the topology). Time proceeds by sequential choices of agents deciding locally to change addresses. Question is whether the agent is able to sample the fitness in its neighborhood or has no information on fitness before moving. If it has no information, then movement is a random drift, which is how physics originally modeled it. In the no information case, selection is required to tilt the dynamics toward better average fitness. (There is no memory in the standard model by which agents could learn to tilt through learning.) Choice, and particularly strategic choice, plays no role. This may seem very impoverished, but to the contrary, as Levinthal 1997 showed, it is a fascinating and austere model for understanding the implications of complementarities (the K in NK) for topology of fitness. It comes at a cost. It’s not particularly behavioral in a modern sense: 1) there is no description of utilities, such as, loss aversion and 2) there is no social interaction between agents (and hence no social network) in the same way that researchers dropped the Erdos-Renyi regular graphs in the initial small world literature for social networks, especially if they wanted to do empirical research.

## ***Empirical Measurements, Testing and Learning***

The Black-Scholes model for valuing financial options had its breakthrough by introducing riskless arbitrage. Nevertheless, the initial Black-Scholes model had a disastrous assumption for valuation of traded financial options by assuming that variance was constant over time. In practice, plotting the long-term historical variance compiled by Robert Shiller did not evidence a constant variance whose plot would be linear. Instead, it was a “volatility smile”. (A volatility smile is a plot of the strike price and implied volatility.) The random walk down Wall Street (i.e., changes in stock prices) did not pass the second moment test. This discovery of non-linearity in time series of price variance opened up a wide path to studies in behavioral finance and other adjustments. These adjustments include tinkering with utility functions to account, for example, for loss aversion, altering discounting in reaction to hyperbolic preferences, swapping out random drift for mean-reverting stochastic processes, etc. Here is a simple sketch of adjustments in the context of strategy and organizations.

Observation 2: Evolutionary Models of Organizational Change Sometimes Need Humans to Tune Them.

Nalin Kulatilaka and I wrote several economics and strategy papers on hysteresis as a way to think about and to model inertia characterizing organizational and strategic change. As an illustration, our article in AMR, 2004, provided a simple comparative statics by simulation of ways organizations can reduce status quo bias through organizational change. We “tune” the binary policy parameter to be “frequent” or “infrequent”. In state one, the firm infrequently reviews its budget. In state 2, it reviews more frequently. The adoption of more frequent reviews decreases costly errors in budgeting. This result is consistent with evidence from the accounting literature that multinational corporations adopted new internal accounting rules in response to higher volatility of monetary currencies following the collapse of a fixed currencies. A cornerstone of evolutionary models is fitness, and not surprisingly organizations and their managers seek to be behaviorally adaptive to external shocks. Of course, there may be also perverse incentives for managers too “to cover their posteriors”, but we leave this task to the poet of these words to complete.

## ***Data***

Finance, economics, and many fields have a strong advantage in access to high quality data. At a moment in which AI and NLP offers new opportunities to learn from data and to even create data from generative algorithms, strategy is moving. As a life-long consultant, Fischer understood the value of data and provided a remunerative service selling his estimates of stock price variance that could be derived (“generated”) from the option pricing model. No doubt, generative AI and machine learning will stimulate similar efforts, including in strategy, to extract and to generate new data from new measurements.



Observation 3: As an example of creating data staying consistent with the option pricing tradition, Sid Balanchandran, Hitesh Harnal, and I studied the effects of option compensation on creating excessive risk taking by US banking institutions. For that we also created a new measure for firm risk relying on estimates of implied volatility and its effects on the probability of default. Implied volatility estimates were backed out from an GARCH regression, and led to daily measures of bankruptcy risk from before and after the initial crisis shock using financial market data. It's a good example of generating new data, even if not from "generative models". The paper made two contributions, one providing evidence that excessive pay incentives increased bankruptcy risk, the other generating a new measure of firm risk that dominated the then current state of art relying on annual financial accounting data. AI is, and will, open large opportunities for creating new latent measures from language and textual sources that will revolutionize empirical research.

### **Reflections**

Clearly, these few pages is a tip of the hat to Professor Black, as I called him, who taught my colleagues, along with me, science. Everyone has their PhD origin story and there are paths from and towards. Fischer was not the only influence, but his candor in pursuit of answers no matter the path or discipline it took him had a resonance for me and, I am sure, for many others in the strategy field.

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**Which Way is Up?**  
**Dimensional Choices, Time Horizons, and Performance Measure Heterogeneity**  
Ron Adner

A central tenant of the behavioral theory of the firm is that firms do not optimize performance relative to a global maximum, but rather manage towards pre-set goals, with success being defined as meeting or exceeding these benchmarks (e.g., Cyert and March). This conceptual engine, one which has been central in differentiating the perspective of ‘strategy’ from more traditional ‘economics’, holds both inside the firm (the direction of activities and interpretation of product market feedback), across firms (ecosystem partners) and external resource sources (financial markets reacting to companies making or missing their quarterly projections). Digging deeper into the details and the grammar of the dimensions of goal setting would be of value to the field.

Strategic decisions are ‘strategic’ because they extend into murkier horizons, and carry heavier competitive implications, than more mundane operational decisions (e.g., Porter, 1996). While the final assessment of a strategic initiative’s ultimate success can be captured in financial and accounting measures, the way in which progress is measured along the way – before definitive market reactions can be observed in mature transaction volumes and margins – presents a critical set of organizational choices (e.g., Adner and Levinthal, 2008).

These choices specify the dimensions along which objective, observable near-term progress is measured, but serve as models through which managers project forward expectations of future, longer-term progress. In this way, the choice of dimensions and measures, and the choice of the time horizons applied, are an empirical embodiment of the firm’s theories of progress. These govern both the assessment of current progress, as well as the allocation of resources that will enable further progress. As in more traditional research, better measures offer clues to better experiments and better theory development. Poorer, shallower measures do the opposite.

Taking the collection of internal measures as objects for observation – the extent to which they embody (or fail to embody) richness, originality, appropriateness, customization, heterogeneity – and their evolution, within and across organizational subunits; within and across organizations, and within and across 3<sup>rd</sup> party evaluators – can be powerful indicators of strategy dynamism and dynamics.

Stepping back and considering consistency and contradiction in these measures across the participating actors in a collaborative effort can be an interesting indicator of coherence, and an approach to characterizing the extent to which such coherence actually matters in the grand scheme.

Variance in the internal measures used to measure progress should itself be a measure of interest for strategic management, whether as a dependent variable (what predicts a richer

conceptualization of strategy) or as an independent variable (the extent to which a richer conceptualization actually impacts other performance measures). Considering the dimensions along which expectations are set and progress is measured as core units of observation offers a way to distinguish between operational vs operational drivers of market performance. This too seems a critical question for the field to revisit in a serious way.

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