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Applying complexity theory: A primer for identifying and modeling firm anomalies☆

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ABSTRACT

This essay elaborates on the usefulness of embracing complexity theory, modeling outcomes rather than directionality, and modeling complex rather than simple outcomes in strategic management. Complexity theory includes the tenet that most antecedent conditions are neither sufficient nor necessary for the occurrence of a specific outcome. Identifying a firm by individual antecedents (i.e., non-innovative versus highly innovative, small versus large size in sales or number of employees, or serving local versus international markets) provides shallow information in modeling specific outcomes (e.g., high sales growth or high profitability)—even if directional analyses (e.g., regression analysis, including structural equation modeling) indicates that the independent (main) effects of the individual antecedents relate to outcomes directionally—because firm (case) anomalies almost always occur to main effects. Examples: a number of highly innovative firms have low sales while others have high sales and a number of non-innovative firms have low sales while others have high sales. Breaking-away from the current dominant logic of directionality testing—null hypotheses statistic testing (NHST)—to embrace somewhat precise outcome testing (SPOT) is necessary for extracting highly useful information about the causes of anomalies—associations opposite to expected and "statistically significant" main effects. The study of anomalies extends to identifying the occurrences of four-corner strategy outcomes: firms doing well in favorable circumstances, firms doing badly in favorable circumstances, firms doing well in unfavorable circumstances, and firms doing badly in unfavorable circumstances. Models of four-corner strategy outcomes advances strategic management beyond the current dominant logic of directional modeling of single outcomes.

Aplicación de la teoría de la complejidad: un *primer* para identificar y modelar anomalías empresariales

RESUMEN

Palabras clave:
Anomalías
Complejidad
Conocimiento
Direccionalidad
Modelo
Resultados
Estrategia

En este artículo se desarrolla la utilidad de abarcar la teoría de la complejidad, modelar los resultados más que la direccionalidad y modelar los resultados complejos más que los simples en la gestión estratégica. La teoría de la complejidad incluye el principio de que la mayoría de las condiciones precedentes no son ni suficientes ni necesarias para la aparición de un resultado específico. Identificar a una empresa por sus antecedentes individuales (es decir, no innovadora frente a muy innovadora, tamaño de ventas o número de empleados pequeño frente a grande, u operar en mercados locales frente a internacionales) brinda información poco profunda al modelar resultados específicos (p. ej., un elevado crecimiento de ventas o una alta rentabilidad), incluso si los análisis direccionales (p. ej., el análisis de regresión, incluido el modelo de ecuaciones estructurales) indican que los (principales) efectos independientes de los antecedentes individuales se relacionan con los resultados direccionalmente, porque las anomalías empresariales (casos) casi siempre se producen en los efectos principales. Ejemplos: un número de empresas altamente innovadoras tienen bajas ventas, mientras que otras tienen unas ventas elevadas y un número de empresas no innovadoras tienen bajas ventas, mientras que otras tienen unas ventas elevadas. Desprenderse de la lógica dominante actual de las pruebas de direccionalidad —pruebas de significación de la hipótesis nula (NHST)— para adoptar una prueba de resultados algo precisa (SPOT) es necesario para extraer información muy útil sobre las causas de las anomalías-asociaciones opuestas a lo esperado y a los principales efectos «estadísticamente significativos». El estudio de las anomalías se extiende a la identificación de las incidencias de los resultados de la estrategia de los cuatro pilares: las empresas que logran buenos resultados en circunstancias favorables, las empresas que obtienen malos resultados en circunstancias favorables, las empresas que logran buenos resultados en circunstancias desfavorables y las empresas que obtienen malos resultados en circunstancias desfavorables. Los modelos de resultados de la estrategia de los cuatro pilares adelantan la gestión estratégica más allá de la lógica dominante actual del modelo direccional de los resultados individuales.

Introduction

"An anomaly is a fact that doesn't fit received wisdom ... an anomaly marks an opportunity to learn something very valuable. In science, anomalies are the frontier, where the action is" (Rumelt, 2011, pp. 247–248). Most studies in the behavioral sciences and the sub-disciplines of business/management (e.g., accounting, finance, marketing, organizational behavior, and strategy) ignore anomalies in their testing of directionality of relationships (i.e., increases in X associates with increases in Y). These studies also fail to examine specific outcomes (e.g., firms with top-quintile profitability) and the antecedents to these outcomes—they focus on reporting precision in the directionality of relationships (e.g., $p < 0.05$) rather than constructing algorithms (i.e., screens) that accurately and consistently predict the occurrence of a given outcome.

While several treatises are available that convincingly argue that the thousands of available studies in the leading journals in the behavioral sciences and sub-disciplines of business that construct and test theory based only on directionality (i.e., increases in X associate with increases in Y) represent mounds of rubbish (cf. Armstrong, 2012; Hubbard, 2016; Woodside, 2016, 2017a; Ziliak & McCloskey, 2008), a pervasive shift-away from the use of null hypothesis statistical tests (NHST) to somewhat precise outcome testing (SPOT) has yet to occur. The essay here is to nudge along this shift and to indicate how, why, and when (now) the shift is occurring.

Hubbard (2016) and Ziliak and McCloskey (2008, 2009) describe how bad science is pervasive and dominates several disciplines. "We find the results strange. The part of civilization claiming to set empirical standards for science and policy has decided to use illogical instruments [NHST] and irrelevant empirical standards [$p < 0.05$] for science and policy. In journals such as *Nature*, *Science*, *The New England Journal of Medicine*, *The Journal of Clinical Psychiatry*, *Annals of Internal Medicine*, *Educational and Psychological Measurement*, *Epidemiology and Infection*, *Administrative Science Quarterly*, *Decision Sciences*, and the *American Economic Review*, size does not matter. Oomph does not matter. Something is wrong" (Ziliak & McCloskey, 2009, p. 2306). The present essay is not to review the literature on how bad science and method—the use of NHST and symmetric testing using regression analysis and structural equation modeling—dominates research relating to innovation and knowledge. Reading Hubbard (2016), Woodside (2016, 2017a, 2017b), and Ziliak and McCloskey (2008) provides