Bridging micro and macro through experimental information acceleration

Tim R. Coltman
University of Wollongong, tcoltman@uow.edu.au

Pierre Richard

Follow this and additional works at: https://ro.uow.edu.au/infopapers

Part of the Physical Sciences and Mathematics Commons

Recommended Citation
https://ro.uow.edu.au/infopapers/816

Research Online is the open access institutional repository for the University of Wollongong. For further information contact the UOW Library: research-pubs@uow.edu.au
Bridging micro and macro through experimental information acceleration

Abstract
Among leading organizations in all sectors there is evidence that successful managers possess the capability to deal with contradictory tensions within their “macro” competitive and institutional environments. Furthermore, the strategic thinking and decision-making capabilities expected of managers highlight the importance of “micro” processes within organizations. Although macro and micro perspectives are intuitively linked, the empirical literature often separates these two perspectives into either strategy content or process. This paper demonstrates how an experimental method based on “discrete choice analysis” and “information acceleration” can be used to bridge the divide between “micro” managerial processes and the “macro” environmental contexts framing them. This method is behaviorally sound and provides greater control over alternate explanations. Practically, we unpack the role managers play as orchestrators of exploitation and exploration.

Keywords
macro, acceleration, bridging, information, micro, experimental

Disciplines
Physical Sciences and Mathematics

Publication Details

This conference paper is available at Research Online: https://ro.uow.edu.au/infopapers/816
Bridging micro and macro through experimental information acceleration

Tim Coltman  
*University of Wollongong, tim_coltman@uow.edu.au*

Pierre Richard
Bridging micro and macro through experimental information acceleration

Abstract
Among leading organizations in all sectors there is evidence that successful managers possess the capability to deal with contradictory tensions within their “macro” competitive and institutional environments. Furthermore, the strategic thinking and decision-making capabilities expected of managers highlight the importance of “micro” processes within organizations. Although macro and micro perspectives are intuitively linked, the empirical literature often separates these two perspectives into either strategy content or process. This paper demonstrates how an experimental method based on “discrete choice analysis” and “information acceleration” can be used to bridge the divide between “micro” managerial processes and the “macro” environmental contexts framing them. This method is behaviorally sound and provides greater control over alternate explanations. Practically, we unpack the role managers play as orchestrators of exploitation and exploration.

Keywords
macro, acceleration, bridging, information, micro, experimental

Publication Details
ABSTRACT

Among many leading organizations, in all sectors of industry, commerce and government, there is evidence that successful managers possess the capability to deal with contradictory tensions in the “macro” competitive and institutional environments. Furthermore, the strategic thinking and decision-making capabilities that are expected of managers highlights the importance of “micro” processes within organizations. Although the macro and micro perspectives are intuitively linked the empirical literature often separates these two perspectives into either strategy content or strategy process research. This paper demonstrates how an experimental method based on “discrete choice analysis” and “information acceleration” can be used to bridge the divide between “micro” managerial decision-making processes and the “macro” environmental contexts in which they are taken. Methodologically we show that the method is behaviorally sound and provides greater control over alternate explanations. Practically, we unpack the role that managers play as the conductors and orchestrators of the organizational capabilities underlying exploitation and exploration.

Keywords: decision-making; discrete choice analysis; information acceleration; exploration and exploitation

Short title: Bridging micro and macro through experiments
BRIDGING MICRO AND MACRO THROUGH EXPERIMENTAL INFORMATION ACCELERATION

PROPOSAL OUTLINE

Assuring alignment between the choice of strategy necessitated by the external macro environment, and the processes involved in arranging the internal capabilities required to execute that strategy is an important challenge. The management and strategy literature has, to date, often under emphasized the micro role that managers play in the processes that support strategic thinking and decision-making. Drawing on foundations in organizational economics, dominated as it is by more macro competitive concerns, managers have been viewed as little more than routine conduits through which the organization’s structure is applied to complex market contexts. Such a viewpoint fails to integrate well established behavioral literature, which have established that managerial decision-making can impede optimization within organizations (Baron, 2008).

In contrast, recent studies have drawn attention to the micro role of managers in achieving organizational success (Gavetti and Rivkin 2007). Researchers have argued that high performing organizations are more adept at simultaneously managing competing priorities such as exploration and exploitation, flexibility and efficiency, cost reduction and product differentiation (Cao, Gedajlovic, and Zhang, 2009; Gibson and Birkinshaw, 2004; Smith and Tushman, 2005). Although the idea that organizations undertake micro processes in pursuing alignment with macro competitive and institutional features is neither new nor surprising, we have little comprehensive data on how managers deal with market and organizational tensions when pursuing organizational alignment. To improve this situation, we need rigorous quantitative research methods that are better aligned with the decision strategies and processes used by managers. These methods must be able to guide strategic thinking and decision-making. They must also be able to control for information variance, recognizing that not all managers have access to the same information or have the same information processing abilities.

In this proposal we evaluate a quantitative approach that captures the characteristics of micro decision-making in a way that is behaviorally sound and also allows macro features to be controlled and measured. Specifically, we propose the use of a discrete choice experiment (DCE) and information acceleration in which the characteristics of interest are systematically varied using statistical design theory. Pioneered at the Massachusetts Institute of Technology (MIT) in the early 1990s (Urban et al., 1997) and extended by the Future Choice Initiative (Devinney et al., 2004), this approach uses multimedia technology to ‘accelerate’ respondent learning and experience. This enables the researcher to develop and implement DCEs that include a wide array of information, features, risks/benefits and contexts. Critically, this approach allows experimenters to address and formatively measure the aspects of the macro environment in which micro decisions are made.

A representation of the mediating role of managers managerial decision processes is presented in Figure 1. As illustrated, managerial decision rules and beliefs mediate the influence of the macro competitive environment on the firm’s form and structure. According to this thinking, strategy is based on a set of beliefs micro-foundations, including heuristics and beliefs, that ‘limits the strain on individual cognition’, rather than one that seeks first-best optimization (Tversky and Kahneman, 1974).

The remaining sections of the proposal are organized as follows. The next section reviews the proposed methodology. This includes: (1) an assessment of the ability of a DCE to capture the micro discrete choices of managers, and (2) a discussion of how an information acceleration can bridge across micro and macro features. This is followed by an illustrative empirical application of information acceleration to the management of contradictory tensions to explore and exploit. The question of how to
BRIDGING MICRO AND MACRO THROUGH EXPERIMENTAL INFORMATION ACCELERATION

distribute limited resources and capabilities in response to conflicting tensions between exploitation and exploration to meet the needs of the market, is one of the most significant challenges facing a firm's decision makers.

THE EXPERIMENTAL METHODOLOGY

Modeling micro discrete choices of managers

Survey techniques face limitations in terms of the decision-making inferences that can be drawn (Cheon et al., 1993; Im and Grover, 2003). Specifically, the absolute measures obtained by survey methods based on reflective and formative measurement scales are not suited to capturing the combinatorial trade-offs that managers are required to make. To effectively understand and analyze the entire decision construct one needs to include systematic and stochastic (random) components. The use of structural equation and latent class modelling can provide evidence of the roles played by key variables by inferring them from outcomes (Lewis et al., 2003; Coltman et al., 2007), but they are not designed to directly capture the trade-offs involved in compensatory decision making.

Pioneered by McFadden (1986), the discrete choice approach focuses on addressing both individual choices decision-making processes and the ways in which researchers measure and predict these choices. An individual's utility for alternatives is latent—it exists in an individual's head—and cannot be observed directly by researchers. Random utility theory proposes that these latent utilities can be decomposed into a systematic or explained component, and a random or unexplained component. The relationship can be expressed as:

$$ U_{in} = V_{in} + e_{in} $$

where $U_{in}$ is the latent or unobserved utility that individual $n$ associates with choice option $i$, $V_{in}$ is the systematic or explained component of utility that individual $n$ associates with option $i$, and $e_{in}$ is the random component associated with individual $n$ and option $i$. A respondent's response to systematic manipulations of attributes is used to derive their underlying utility preferences (McFadden et al., 2005). The DCE approach allows for the rationality of decision-makers is directly accounted for in the experimental design, which explicitly considers the notion of value (utility) to establish reference points. Importantly, DCE has been found to produce preference structures closely simulating those in real markets, as well as accurately capturing the decision strategies used to resolve such choices (Louviere et al., 2000).

Accelerating contextual learning to capture micro and macro features

Another key limitation of survey methods in strategy research is that they downplay the macro context of decision-making. Diverse contexts make it difficult to design cross sectional surveys that capture all relevant variables. In contrast, the controlled environment in a DCE provides a means of addressing the heterogeneity of macro measurement contexts. Experimental designs can be used to ensure that the attributes are orthogonal, and that adequate controls are in place to explain variation in context. Random assignment of participants can also control for micro perceptions regarding the context that could otherwise act as a confounding variable between micro and macro features.

However, DCE has limitations that need to be acknowledged. It assumes that researchers can identify all (or at least as many as possible) drivers of choice and express these factors in terms understood by decision-makers (Swait and Ben-Akiva, 1987). This requirement is challenging whenever decision-makers are required to make choices from amongst alternatives that are not well understood. In such cases there is a need for 'information bridges' that provide sufficient contextual understanding (Krieger et al., 2003). Information acceleration can provide the information bridge when managers lack complete and accurate information.

First developed in the early 1990s, the information acceleration technique provides an information bridge for respondents that is based on the premise that if you can realistically provide a decision-maker with the same experience and information today that he or she will have in the future, then data regarding information conditions, preferences, and intentions can be collected and modeled (Urban et al., 1997). Information technologies can be used to create a virtual environment that reflects a precise decision context.
BRIDGING MICRO AND MACRO THROUGH EXPERIMENTAL INFORMATION ACCELERATION

The central idea is to 'accelerate' the process by which decision-makers acquire information and experience new technologies and environmental changes. For example, one of the first information acceleration projects was initiated at Wharton's Alfred West Jr. Learning Lab, where information acceleration was used to evaluate demand for a radically new electric car (Urban et al 1997). In that study, respondents read a series of newspaper/magazine articles from the future and then assessed vehicle details by interacting with a multimedia program that provided a full array of verbal, pictorial, video, and text material. By guiding participants through this learning process, researchers can reduce uncertainty over the context and then more accurately model choices and decisions.

This reduction in uncertainty has important implications for strategy research where some of the greatest empirical challenges are to present core concepts such as capability based research in ways that ensure high levels precision. Ambiguity in terminology and capability measurement often creates terminology haze with severe implications for operational measurement (Winter 2000). Information acceleration provides a common context, where greater precision over construct domains can be achieved to enhance content validity.

ILLUSTRATIVE EMPIRICAL APPLICATION

To illustrate the advantages of our method, we turn our attention to a common tension that managers face regarding the need to 'engage in sufficient exploitation to ensure current viability and, at the same time, devote enough energy to exploration to ensure future viability' March (1991: 105). Exploration is rooted in variance increasing capabilities: search, discovery, experimentation, and learning-by-doing. Exploitation is rooted in variance decreasing capabilities: efficiency, control, increasing productivity and disciplined problem solving (Benner and Tushman, 2002; March, 1991; Rosenkopf and Nerkar, 2001; Smith and Tushman, 2005). The competing logics of exploration and exploitation represent a considerable tension as the mindsets and resource allocations needed for exploration differ from those required for exploitation.

Early work on the capabilities required to manage these tensions highlighted the importance of ambidexterity (Gibson and Birkinshaw, 2004; Raisch and Birkinshaw, 2008). However, this work has assumed that managers can 'optimally' arrange an array of people, resources, and technologies across a span of internal business units and external partners to achieve competing and contradictory goals. In other words, they assume that what is 'optimal' for the organization can be achieved by the managers. Closer attention to the micro-foundations of strategy suggests this cannot be assumed. The cognitive burden placed on the managers, and the decision rules that they have for incorporating complexity require a direct assessment of the micro role of manager as the 'middleman' between what is structurally optimal and organizationally and humanly possible.

The domain used to illustrate the method was the Asia Pacific management team of a major multinational logistics firm which included representation from Australia, New Zealand, Singapore, China, Hong Kong, India, Japan, South Korea and Taiwan. Sixty-two managers responsible for designing tender responses for major customers across the Asia-Pacific region completed the discrete choice experiment. These tenders amount to the hundreds of millions of dollars of revenue per year.

We defined two macro scenarios that information accelerations provided information on. Each scenario presented a different competitive context. Alpha corporation faces a context consistent with an exploration strategy. Beta corporation's context, however, is more consistent with an exploitation strategy. These two separate customer service feature scenarios provide the independent manipulation of customer preferences between the pursuit of exploration and exploitation in the manager DCE.

In order to make the empirical illustration as realistic as possible, we proffer the following two research hypotheses for the ensuing analysis.

H1: Research attributes (i.e., continuous business improvement and creative solutions capabilities) will be strategically important to managers.

H2: Contextual features in the information acceleration will impact the strategic importance of the research attributes.

RESULTS
BRIDGING MICRO AND MACRO THROUGH EXPERIMENTAL INFORMATION ACCELERATION

The regression model that was used to analyze our DCE data is a variant of the conditional logit model developed by McFadden (1986). The model represents an extension to the multinomial logit model that allows for the inclusion of explanatory variables related to the choice set options. The capabilities and their associated levels act as the independent variables in the model with the dependent variable being the best and worst choice distinction made with respect to likelihood of the tender response being successful. Similar to a partial ranking task, the selection of the best and worst alternatives is treated as a sequential choice process, where the selection of the best option is equivalent to a first choice and coded as '+1'. The worst alternative is then considered the first choice out of the remaining alternatives, where the choice probabilities are negatively related to the utilities of those alternatives. The fact that the second choice is not the second best but the worst is indicated by a code of '-1' which reverses the choice probabilities. The remaining two choice options were coded as '0'. The DCE results in Table 1 provide output of the aggregate and separate models for the Alpha and Beta contexts.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Aggregate Beta</th>
<th>z-value</th>
<th>Alpha (exploration) Beta</th>
<th>z-value</th>
<th>Beta (exploitation) Beta</th>
<th>z-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active engagement</td>
<td>0.50</td>
<td>6.22</td>
<td>0.46</td>
<td>3.50</td>
<td>0.43</td>
<td>3.88</td>
</tr>
<tr>
<td>Cross functional coord.</td>
<td>0.20</td>
<td>2.49</td>
<td>-0.21</td>
<td>-1.60</td>
<td>0.37</td>
<td>3.42</td>
</tr>
<tr>
<td>Creative solutions</td>
<td>0.59</td>
<td>7.28</td>
<td>0.68</td>
<td>5.06</td>
<td>0.49</td>
<td>4.54</td>
</tr>
<tr>
<td>Continuous improvement</td>
<td>0.67</td>
<td>8.24</td>
<td>0.36</td>
<td>2.81</td>
<td>0.80</td>
<td>7.20</td>
</tr>
<tr>
<td>IT infrastructure</td>
<td>0.14</td>
<td>1.72</td>
<td>-0.25</td>
<td>-1.97</td>
<td>0.37</td>
<td>3.40</td>
</tr>
<tr>
<td>Professional delivery</td>
<td>0.32</td>
<td>4.08</td>
<td>0.18</td>
<td>1.40</td>
<td>0.37</td>
<td>3.44</td>
</tr>
<tr>
<td>R(0)^2</td>
<td>0.31</td>
<td>0.47</td>
<td>0.25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-2LL</td>
<td>817.49</td>
<td>671.69</td>
<td>971.60</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**H1: The micro impact of research attributes**

Our results provided support for the first hypothesis and the expectation that capabilities in the area of continuous improvement would be most important to managers concerned with delivering exploitation outcomes. Although this attribute was observed to be significant across both groups, it was the strongest predictor in the exploitation scenario, contributing almost three times as much to the variance explained in the architectures proposed for the exploitation scenario vis-à-vis the exploration scenario. This difference is reflected in a high Wald statistic (67.93, p<0.001).

Likewise, our findings also supported the second hypothesis that creative solutions would be most important in the exploration scenario. Although this attribute was once again found to be important in both scenarios, it was observed to be more important in case of the exploration scenario. The associated Wald statistic (52.99, p<0.001) for this capability was observed to be the strongest predictor in the selection of a set of capabilities in the exploration scenario.

In the exploration scenario managers identified only three variables as positively associated with bid success, while in contrast when faced with the exploitation scenario all six capabilities were associated significantly with the design of an attractive bid architecture. A paired sample t-test suggested this was of borderline statistical significance (p=0.076, 5 df). Given the conservative nature of the test this result is positive.

**H2: The impact of macro context**
BRIDGING MICRO AND MACRO THROUGH EXPERIMENTAL INFORMATION ACCELERATION

The impact of context was assessed by the set of hierarchical tests as outlined by Swait and Louviere (1993). The evaluation of model equivalence is done by estimating one model relative to the other across a range of scale factors using the likelihood ratio test statistic using the following formula:

$$\lambda_1 = -2[L_0 - (L_1 + L_2)]$$

where \(L_0\) corresponds to the joint log likelihood value associated with the point estimate of the scale factor ratio (\(\hat{f}\)). \(L_1\) and \(L_2\) correspond to the log likelihood estimates for the separate models (i.e., exploration and exploitation). The test statistic is asymptotically \(\chi^2\) distributed with \((K+1)\) degrees of freedom, where \(K\) is the number of parameters in the model. Here this produced a test statistic of 57.47 for \(\lambda_1\) is rejected (it exceeds the critical value of 24.32).

Consideration of the separate context-level models highlights the importance of multi group analysis in revealing effects that can often be masked by single aggregate level analysis. In terms of the segment level models, the exploitation scenario was linked strongly with the capability of IT infrastructure whereas this capability added little to the prospects of bid success in the exploration context.

CONCLUSIONS AND DIRECTIONS

The results reveal important differences over how managers constructed value in the two macro competitive contexts. As expected, the exploration context was focused on applying creative solutions capabilities, while exploitation context relied primarily on continuous improvement. An important methodological implication of this work is that experimental approaches, like DCE, rely on the formative definition of macro features. In recent years, there has been considerable debate about formative and reflective measurement and the blind adherence by scholars to reflective measurement as prescribed by Churchill (1979). It has been argued that scholars place greater emphasis on content validity and the experimental approach described in this study is ideally placed to isolate specific aspects of a macro context and define constructs around them. Moreover, experimental research, such as the DCE approach, provides an important supplement to cross-sectional surveys, formal modeling and simulation. The power of experimental approaches to measure both micro and macro features provides a more complete picture than cross-sectional analysis. Survey data identifies outcomes and simulation and formal modeling allows us to understand the dynamics of relationships. Experimental work is important because it can confirm the paths that are followed and how these processes are enacted by managers (McKelvey, 2000). We urge researchers to continue to explore new experimental approaches that allow scholars to unpack processes and capabilities in controlled ways.

REFERENCES


Churchill GA. 1979. A paradigm for developing better measures of marketing constructs Journal of Marketing Research; 16(2):64-73.
BRIDGING MICRO AND MACRO THROUGH EXPERIMENTAL INFORMATION ACCELERATION


