ORGANIZATIONAL SLACK AND IT INNOVATION ADOPTION IN SMEs

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ABSTRACT

This study explores the relevance of different types of organizational slack in small and medium enterprises (SMEs), as well as the relationship between these types of slack and the adoption of information technology (IT) innovations. Using recent data from a representative sample of 2,307 non-retail U.S. SMEs, we find that the slack-innovation relationships previously described in larger firms do not hold well for SMEs. Our results show that, depending on the type of innovation and the type of slack, the linearity and direction of the relationship changes. We discuss implications regarding environmental, technological, and organizational conditions that promote innovation adoption within SMEs.

Keywords: technology adoption, small and medium enterprises, SMEs, organizational slack, innovation.

INTRODUCTION

Organizations must strike a balance between stability and innovation –i.e., between exploitation of their current business model and processes and exploration and adoption of alternative solutions [11]. Accordingly, understanding the processes by which organizations adjust their propensity to innovate, as well as the conditions most likely to foster innovation in a firm, is an important endeavor that has motivated a large innovation literature in management (e.g. [7]).

Prior theory predicting innovation rates highlights the role of organizational slack as an important condition that facilitates exploration and, thus, contributes to a firm's innovativeness [6][9]. However, slack is also argued to be related to inefficiencies in the use of resources [3] and to less disciplined investment, which may actually be detrimental to innovation. Nohria and Gulati [12] argued for an inverted U-shaped relationship between slack and innovation. Findings from their study supported this proposition and suggest that greater levels of slack increase the rate of adopting technical and administrative innovations, but only up to a point. Beyond this point, excess slack is counterproductive and actually reduces innovation.

Subsequent research by Geiger and Cashen [8] extended Nohria & Gulati's [12] work by examining the impact of different types of slack on innovation. Prior studies had distinguished among available slack, recoverable slack, and potential slack [4][5]. Geiger & Cashen [8] investigated these different dimensions of slack and found available and recoverable slack to have a curvilinear, inverted-U shaped relationship with innovation, while potential slack had a linear positive relationship to innovation.

A limitation of prior research on organizational slack is that it has overwhelmingly focused on large, publicly traded firms. There are fundamental differences between SMEs and large businesses [14]. In particular, SMEs are severely resource constrained [1] and necessarily less willing to take risks. As a result, the levels and types of slack, as well as the mechanisms by which slack influences innovation, may vary in the context of these firms. For instance, we believe that recoverable slack is not consequential to SMEs (see full paper for discussion).

The purpose of the present research is to extend prior slack-innovation studies (i.e., [8][12]) by developing the concept and dimensions of organizational slack in the context of SMEs, and investigating how different types of slack relate to innovation adoption within these firms. In an attempt to explore how characteristics of the innovation itself may moderate the slack-innovation relationship, we study SME's adoption of two specific information technologies that represent opposite minimum requirements in terms of their capital intensity and complexity: e-commerce and computerized core process technologies.

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Available Slack

Past studies of larger firms have argued and found support for an inverted U-shaped relationship between available slack and innovation [8][12]. Despite a tighter resource environment as well as differences in management processes and types of innovations that will be pursued, we expect a similar relationship in the SME context. At low levels of available slack it is unlikely that there are resources for innovation adoption. As financial reserves increase, we expect adoption of e-commerce and computerized core processes to increase. However, at very high levels of cash reserves, which suggest a very successful business model, we expect greater inertial pressure and a lesser willingness to innovate. This leads us to our first set of hypotheses:

H1: Adoption of e-commerce exhibits a curvilinear inverted U-shaped relationship with the amount of available slack.

H2: Adoption of computerized core exhibits a curvilinear inverted U-shaped relationship with the amount of available slack.

Potential Slack

Geiger and Cashen [8] argue that, unlike available and (for larger firms) recoverable slack, potential slack is unlikely to display an inverse U-shaped relationship with innovation. A high level of potential slack simply represents little or no debt rather than current resources and would not encourage inefficiencies in the use of such resources. The authors demonstrate a positive linear relationship between potential slack and innovation [8].

We believe that specific characteristics of the innovation being considered may have an impact on how the adoption decision is affected by potential slack. In particular, the capital-intensity of minimum investment requirements to adopt IT innovations relative to the minimum investment required for alternative processes will determine the role of potential slack. In the case of e-

commerce, this innovation offers a low-investment, low-cost alternative to business expansion via traditional means such as hiring additional sales personnel and/or opening new locations. Thus, we expect firms that are more credit constrained to be drawn to this innovation. Indeed, for these firms e-commerce might be regarded as a form of *bricolage*, or utilizing 'what is at hand' [1] in order to be able to grow the business. Therefore, we expect that firms with lower potential slack will be more likely to adopt e-commerce:

H3: Adoption of e-commerce exhibits a negative linear relationship with the amount of potential slack.

Conversely, process-enhancing technological innovations such as computerizing core activities are likely to require substantial capital investment over and above the no-adoption alternative. Some of this investment may be derived from available slack but this type of innovation is likely to require additional financial resources. Hence, adoption of computerized core innovations is more likely to be pursued by financially healthier companies with greater potential slack. This leads to our final hypothesis:

H4: Adoption of computerized core exhibits a positive linear relationship with the amount of potential slack.

DATA and MEASURES

Data

The data used for this study were obtained from the recently released 2003 Survey of Small Business Finances (SSBF). The survey was administered between June 2004 and January 2005 and gathered data from a nationally representative sample of 4,240 private, nonfinancial, nonfarm firms with fewer than 500 employees. Screening resulted in a final sample of 2,307 firms that could be used for our analyses.

Variables

e-Commerce adoption. Respondents were asked if their firm used the computer "to sell business products and services via the internet".
Computerized core. Respondents were asked if their firm used computers "to directly contribute to the firm's primary business activity".
Available slack. We use working capital over total assets as our final measure, since it has been used in prior research as a measure of slack, and it was found to relate to the effectiveness of innovation adoption [10].
Potential slack. Given recent technological developments in banking leading to broad adoption of automated underwriting technologies (i.e., credit scoring) for small business loans [2], we used the firm's credit score as an indicator of its access to credit. Our measure is derived from the Dun &Bradstreet Commercial Credit Score Percentile, as provided in SSBF.
Control variables. Table 1 provides a categorized list of control variables. Categories controlled for include *Owner's Characteristics*, *Firm's Characteristics*, and *Environmental Factors*.

METHODS and RESULTS

Statistical Analysis

To test our hypotheses regarding the effects of different types of financial slack on adoption of different IT applications we ran maximum-likelihood logistic regression analyses of our dependent variables. In each case, we fitted a reduced model, first, with control variables only, followed by the full model that added the financial slack variables of interest and their quadratic terms. Although we did not hypothesize quadratic effects for potential slack, we nonetheless included the quadratic term for this variable as well, so as to provide a complete test of our hypothesis. In order to facilitate interpretation of the quadratic equations, slack variables were mean-centered –i.e., expressed as deviations from their means. To produce appropriate population estimates of regression parameters we used the SURVEYLOGISTIC procedure in SAS 9.1, which takes into account the stratified sample design and corrects for the sampling weight of each observation. Therefore, our regression coefficient estimates provide evidence regarding the effect of a change in independent variables on the likelihood of e-commerce (or computerized core processes) adoption by non-retail, non-wholesale U.S.-based SMEs.

Results

Table 1 provides the results of the logistic regression analyses. The columns labeled Model 1 and Model 3 present results for the reduced regression equations that include only control variables, for e-commerce and computerized-core adoption respectively. Both regression equations are strongly significant, due in large part to very strong industry effects. Most interesting, the likelihood of e-commerce adoption was found to increase for younger and less asset-intensive firms, while the opposite was true for adopters of computerized core processes.

Hypothesis 1 predicts an inverted U-shape relationship between available slack and the likelihood of e-commerce adoption. We expected to find a negative coefficient for the quadratic available slack term. The evidence in Table 1 (Model 2) does not support this hypothesis. We find no evidence that available slack is related to e-commerce adoption.

Hypothesis 2 predicts an inverted U-shape relationship between available slack and the likelihood of computerized-core adoption. The regression coefficient for the quadratic available slack term in Table 1 (Model 4) was negative (β = –.215; p=.0067), suggesting that indeed the relationship between available slack and computerized-core adoption dwindles or becomes more strongly negative as available slack increases. However, we also found evidence of a negative and significant linear effect of available slack (β = –.688; p=.0037), indicating an overall negative trend in the curvilinear relationship. In other words, we did not find support for a symmetric U-shaped relationship. Further analysis allowed us to conclude that the relationship between available slack and the likelihood of computerized-core adoption is negative from the beginning and becomes more strongly negative as the level of slack increases. Although we found evidence of a non-linear effect of available slack, Hypothesis 2 is rejected.

Hypothesis 3 predicts an inverse relationship between potential slack and the likelihood of e-commerce adoption. Consistent with this, the regression coefficient for potential slack in Table 1

TABLE 1
Results of Logistic Regression Models Predicting the Likelihood of Innovation Adoption

	E-commerce adoption				Computerized-core adoption			
Variables	**Model 1**		**Model 2**		**Model 3**		**Model 4**	
Owners' characteristics:								
Average age of owner group	-0.010	(0.008)	-0.009	(0.008)	-0.006	(0.012)	-0.004	(0.013)
Average education of owner group	0.024	(0.039)	0.026	(0.039)	0.095	(0.063)	0.091	(0.062)
Average mgmt. experience of owner(s)	0.003	(0.010)	0.003	(0.010)	-0.013	(0.014)	-0.015	(0.015)
Firm's characteristics:								
Firm age	-0.017 †	(0.009)	-0.013	(0.009)	0.024 *	(0.012)	0.020 †	(0.012)
Number of employees (ln)	0.161 *	(0.068)	0.179 **	(0.068)	0.124	(0.100)	0.072	(0.104)
Number of sites	0.087	(0.101)	0.087	(0.101)	0.099	(0.187)	0.095	(0.181)
Ownership share of primary owner	-0.002	(0.003)	-0.002	(0.003)	0.000	(0.004)	-0.001	(0.004)
Growth in sales	-0.096	(0.110)	-0.119	(0.111)	0.036	(0.141)	0.081	(0.141)
Growth in profits	-0.045	(0.113)	-0.042	(0.114)	-0.067	(0.139)	-0.061	(0.142)
Corporation	0.319	(0.226)	0.373	(0.231)	0.372	(0.315)	0.278	(0.316)
S_Corporation	0.199	(0.170)	0.264	(0.174)	0.275	(0.269)	0.172	(0.273)
Partnerhip	-0.076	(0.279)	-0.044	(0.276)	-0.129	(0.445)	-0.272	(0.477)
Professionally managed firm	-0.033	(0.346)	-0.073	(0.335)	-0.353	(0.489)	-0.349	(0.512)
Fixed asset intensity	-0.126 †	(0.072)	-0.099	(0.075)	0.295 **	(0.098)	0.209 †	(0.110)
Environmental factors:								
Urban location	0.170	(0.179)	0.172	(0.179)	0.209	(0.291)	0.208	(0.293)
Local banking market concentration	-0.087	(0.113)	-0.071	(0.115)	0.087	(0.178)	0.072	(0.182)
Industry: 2-digit SIC code dummies	included ***		included ***		included ***		included ***	
Financial Slack:								
Available slack (working capital/assets)			0.205	(0.148)			-0.688 **	(0.237)
Available slack squared			0.026	(0.024)			-0.215 **	(0.079)
Potential slack (D&B credit rating)			-0.153 **	(0.051)			0.195 **	(0.069)
Potential slack squared			-0.044	(0.031)			0.068	(0.042)
Intercept	0.472	(0.599)	0.348	(0.607)	-3.328 **	(1.114)	-3.102 **	(1.151)
Wald χ^2	227.33 ***		235.38 ***		21,056.22 ***		19,873.66 ***	
d.f.	38		42		38		42	

n= 2,307. Coefficient estimates and their standard errors are adjusted for sampling weights and stratification of the survey design. Standard errors are in parentheses.
Detailed industry dummy estimates are not reported. † p < .10, * p < .05, ** p < .01, *** p < .001

(Model 2) was negative and significant (β = –.153; p=.0026). Hence, Hypothesis 3 is strongly supported. Similarly, hypothesis 4 predicts a direct relationship between potential slack and the likelihood of adoption of computerized core processes. As expected, the regression coefficient for potential slack in Table 1 (Model 4) was positive and significant (β = .195; p=.0048). This result provides strong support for Hypothesis 4.

DISCUSSION

This study sheds light on the relevance of different types of financial slack in SMEs, as well as on the relationships between slack and adoption of different types of IT applications. Our first contribution relates to our characterization of organizational slack in the context of SMEs. We have argued that available and potential slack will be the most salient sources of financial slack in the case of SMEs, while absorbed or recoverable slack will tend to be immaterial and, thus, play a negligible role as a driver of innovation. In contrast to larger and well-established firms, SMEs are unlikely to experience lengthy surpluses in returns and cash-flows, and are unlikely to absorb those surpluses in the form of redundant or underutilized firm assets. Rather, SMEs tend to be characterized as operating under severe resource constraints (e.g., [13]). Furthermore, we argue that the salient dimension of potential slack for SMEs is not the financial leverage capacity implicit in their capital structure (and measured by the debt-to-equity ratio) as professed for larger firms, but rather their ability to access external debt in the first place. Access to

commercial credit or other sources of external financing (like venture capital) are not a given and, rather, tend to be the exception for these firms (e.g., [1]).

Our second contribution stems from the characterization of some forms of innovation as "bricolage" [1] or as alternative business models that seek to economize resources. Virtually all prior research investigating the relationship between slack and innovation has been built on the premise that innovation is germane to greater resource expenditures.

Most importantly, this is the first study to test and find support for relationships between slack resources and innovation adoption by SMEs. Drawing from the prior literature, we argued for an inverted U-shaped relationship between available slack and innovation adoption in SMEs. Conforming to prior studies of larger firms, we posited that available slack would increase innovation adoption in SMEs up to an optimal point, beyond which greater amounts of slack would provide disincentives to innovation. By contrast, and also based on the prior literature, we argued for a linear relationship between potential slack and adoption, which would be moderated by the capital requirements associated with implementing the innovation relative to the no-innovation scenario. We hypothesized that e-commerce is a form of bricolage (or "make do with what's at hand") that requires less investment than alternative forms of distribution and, thus, would tend to be pursued by those that are under-capitalized. By contrast, we argued that computerized-core applications will tend to be more capital intensive than the alternatives and, thus, will tend to be pursued by those with greater potential slack (i.e., greater access to credit). Our test of these hypotheses with a representative sample of non-retail and non-wholesale SMEs in the U.S. produced mixed support for our theoretical model.

[This version represents a significant shortening of the original paper. The full paper is available from the authors.]

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