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A reexamination of the organizational slack and innovation relationship

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ABSTRACT

In this study a configurational approach was used to examine the organizational slack and innovation relationship. Utilizing a sample of 437 manufacturing firms and multiple measures of firm innovation we identified distinct configurations of slack and found significant innovation differences between them. The results from our analyses demonstrate that configurations with moderately high combined levels of internal slack (available and recoverable slack) and moderately high levels of potential slack produced higher levels of innovation. Conversely, configurations with low to moderately low levels of each type of slack produced the lowest levels of innovation. Our findings also indicate that alternative configurations of slack can result in similar levels of innovation suggesting the existence of equifinality in this relationship. Overall, our findings suggest that the slack and innovation relationship is more complex than has been accounted for in previous research. The implications of these findings are discussed.

1. Introduction

Organizational slack and its impact on firm innovation is an important area of research within the strategic management literature. Organizational slack has been studied because the accumulation and expenditure of resources impacts competitive ability and firm outcomes (Chen, Yang, & Lin, 2013; Cheng & Kesner, 1997; Daniel, Lohrke, Fornaciari, & Turner, 2004). Innovation has been studied because it plays a large role in a firm's ability to create competitive advantages via adaptation and new product development (Alessandri & Pattit, 2014; Herold, Jayaraman, & Narayanaswamy, 2006). Overall, the research findings on the relationship between organizational slack and innovation remain largely equivocal.

Like many other areas of research, most studies examining the slack and innovation relationship have tested for linear relationships. For example, slack is argued to be a benefit for firms because it serves as a buffer from shortages of funds and can increase the potential for firm innovation (Bourgeois, 1981; Cyert & March, 1963). However, it is also argued that organizational slack is inefficient and accrues because of self-serving managers (Jensen & Meckling, 1976; Nohria & Gulati, 1996; Simon, 1957). Other researchers have argued for contingency (Geiger & Makri, 2006) or nonlinear (Herold et al., 2006; Nohria & Gulati, 1996) relationships and thus expand beyond the good or bad arguments for slack. Most prior research has also examined slack uniformly from a theoretical perspective even though slack is recognized as being a multidimensional concept (e.g., Bromiley, 1991; Singh, 1986; Voss, Sirdeshmukh, & Voss, 2008) and the relationship between slack and innovation can vary depending on these different dimensions (Geiger & Cashen, 2002).

The above highlights two important factors: (1) there is inconsistency in prior findings and (2) there is still much to be learned regarding the relationship between organizational slack and innovation. Given this, we believe the literature can be advanced in two ways. First, while prior research has examined the relationship between individual components of slack and innovation, no known studies have examined the joint impact of multiple types of slack on firm innovation. As such, we extend prior research by building on the theoretical arguments of both behavioral theorists (Cyert & March, 1963) and agency theorists (Jensen & Meckling, 1976) and then examining how firms bundle slack resources and how these bundles impact firm innovation. This is accomplished through the use of a configurational approach (Gruber, Heinemann, Brettel, & Hungeling, 2010; Short, Payne, & Ketchen, 2008) which to date has not been used when examining this relationship even though slack has been recognized as a multidimensional concept. Using such an approach provides insights that are either out of the scope of or unattainable by research focusing on the impacts of individual organizational elements (Miller, 1981).

Second, no known studies have considered the combined effect of the different types of slack or whether the different types of slack resources, when uniquely bundled together, result in differing or similar firm level outcomes. Because slack is multidimensional, different unique combinations or configurations of slack resources may result in equifinality in the slack and innovation relationship. As described by Gresov and Drazin (1997) and Katz and Kahn (1978) equifinality exists when a system can reach the same final state from different initial

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conditions and by a variety of different paths. Since no prior studies have examined this relationship using a configurational approach, it is not known if there are multiple ways to bundle slack resources that result in similar levels of firm innovation. Thus, this study provides a first step in determining if certain slack bundles result in higher levels of innovation and if there are multiple ways of bundling slack resources that result in similar innovation outcomes.

In the following section we provide a review of the slack and innovation literature and develop testable hypotheses. Following this, we describe the data, research methodology and the results of our empirical analyses. Finally, we provide a discussion of the results that includes both managerial and theoretical implications as well as future research directions.

2. Theory and hypotheses

2.1. Types of slack and slack configurations

Based on prior definitions, slack can be thought of as a bundle of resources within or available to an organization above the minimum needed to create a given level of output (Geiger & Cashen, 2002). Previous research has identified multiple components of slack (Bourgeois, 1981; Bourgeois & Singh, 1983; Geiger & Cashen, 2002; Singh, 1986). These components have been most commonly categorized as available, recoverable, and potential slack (Bourgeois, 1981; Bourgeois & Singh, 1983) absorbed and unabsorbed slack (Singh, 1986), or internal and external slack (Geiger & Cashen, 2002). These categories are similar in that internal slack is within the firm and either readily available and unabsorbed, or already absorbed and considered recoverable while external slack is not within the firm and is considered potential or unabsorbed. Since these frameworks are consistent we use available, recoverable, and potential slack as it is the most fine-grained approach in the literature.

Concerning slack's relationship with firm outcomes, varying arguments have been presented on its benefits (Bourgeois, 1981; Love & Nohria, 2005). Moreover, prior research suggests that the relationship between slack and firm outcomes can vary depending on the component or type of slack being examined (Geiger & Cashen, 2002; Singh, 1986). Overall, the literature has conceptualized slack as a multidimensional concept (i.e., Bourgeois, 1981; Bourgeois & Singh, 1983; Bromiley, 1991; Singh, 1986; Voss et al., 2008). However, individual studies have typically failed to make varying theoretical arguments regarding the relationship between slack and firm outcomes based on the different slack dimensions. Also, prior research has yet to examine the combined or simultaneous effects of the different slack dimensions on firm outcomes such as innovation. As such, the use of a multidimensional approach such as a configurational approach should improve our understanding of this relationship.

Within the overall body of management research configurational relationships are often examined. Configurational approaches are used because they allow researchers to examine sets of firms that share common profiles across a variety of key variables (Gruber et al., 2010; Short et al., 2008), and they demonstrate differences in outcomes among the groups of firms studied (Ketchen, Thomas, & Snow, 1993; Ketchen et al., 1997). Thus, when studying slack and innovation, a configurational approach allows for the testing of how multiple components of slack are bundled and how these bundles, or configurations, are associated with different levels of firm innovation. Surprisingly, despite the equivocal findings related to slack and innovation outcomes using other methods, configurational studies that specifically examine the slack and innovation relationship do not exist. This is unfortunate as prior slack research (e.g., Bourgeois, 1981; Bromiley, 1991; Singh, 1986; Voss et al., 2008) has recognized the multidimensional nature of slack and the need for additional research (Daniel et al., 2004: Geiger & Cashen, 2002).

2.2. Slack and innovation

It important to note that firm innovation involves both important inputs into the innovation process such as R&D expenditures and important outputs of a firm's innovative activities such as patents. In this study we examine both types of innovative activities and thus our theoretical arguments are based on how firm behavior will impact both innovation inputs and outputs. Within the literature slack has been argued to have positive, negative, and curvilinear influences on firm innovation (Bourgeois, 1981; Herold et al., 2006; Nohria & Gulati, 1996). The positive outcomes of slack are often tied to the arguments of behavioral theorists that slack buffers an organization from environmental uncertainty and provides extra resources that allow for scientific research and experimentation (Tan & Peng, 2003). This results in innovative cultures and experimental projects being more likely to develop (Bourgeois, 1981; Nohria & Gulati, 1996). Under this scenario managers are less likely to worry about the risk of failure because excess resources exist to buffer against any losses. In this sense slack can also serve to facilitate strategic behavior which allows firms to create new strategies and new products (Bourgeois, 1981; Thompson, 1967). Overall, slack is acknowledged to have costs, but its benefits are thought to outweigh these costs (Tan & Peng, 2003). Conversely, according to agency theorists slack has negative effects on firm outcomes because managers are self-serving and wasteful (Jensen & Meckling, 1976). Following this line of reasoning, managers may not have the incentive to act in the best interest of the firm and the firm's owners may lack the information needed to monitor managerial behavior. Thus, managers may pursue personal projects, engage in empire building, or simply inefficiently utilize resources, all of which could reduce firm outcomes such as innovation (Geiger & Cashen, 2002). However, the relationship between slack and innovation may vary based on the type of slack and thus these relationships are discussed separately below.

Available slack identifies the amount of resources that are unutilized and readily available to the firm. Typically used measures of available slack include liquidity measures such as the current ratio or quick ratio (Bromiley, 1991; Cheng & Kesner, 1997; Palmer & Wiseman, 1999). Available slack is internal, flexible, highly deployable and provides firms with a buffer to the ebb and flow in firm innovative outcomes (Bourgeois, 1981). A benefit of available slack is that firms can experiment knowing that resources will still remain even if the experimentation fails. When viewed in this way available slack within the firm allows managers the ability to take on many initiatives, including innovative efforts, knowing that a safety net exists if a given initiative is unsuccessful. Thus, the existence of available slack should positively impact firm innovative efforts (Thompson, 1967). Conversely, it can also be argued that at a certain point controls used in selecting or terminating projects may become relaxed due to excessive available slack (Jensen, 1993). In other words, because available slack is flexible and readily available to managers they may pursue or continue with projects that otherwise would be avoided or terminated if little or no available slack existed. This can result in a suboptimal level of innovation becoming acceptable to managers because of available slack in the firm and thus as available slack increases innovation may actually suffer. Therefore, on balance and consistent with the arguments of Nohria and Gulati (1996) and Tan and Peng (2003) both too much and too little available slack can be detrimental to innovation.

Recoverable slack has typically been operationalized using selling and general administrative expenses divided by sales (Bromiley, 1991; Palmer & Wiseman, 1999). This measure identifies the amount of excess costs embedded within a firm that could be reduced and thus recovered during financially difficult times (Bourgeois & Singh, 1983). While recoverable slack is different from available slack discussed above, it is also a form of internal slack and thus much of the same logic applies to its relationship with innovation. For example, some firms retain more employees than needed to endure the ebb and flow of demand and general business activity. This increases expenses but also provides

a buffer to ensure effectiveness if demand increases (Cyert & March, 1963) and provides the embedded resources that allow for experimentation and innovative projects to be born (Nohria & Gulati, 1996). As such, following this line of reasoning recoverable slack is argued to have a positive impact on firm innovation. However, it can also be argued that excessive recoverable slack resources will cease to improve innovation. Agency theorists suggest that managers can become self-serving and wasteful (Jensen & Meckling, 1976) and that in the presence of recoverable slack resources loose organizational controls and poor resource decisions are more likely to be made. This can take place because information asymmetry exists between principals and agents and thus specific to recoverable slack, managers can pad budgets and accumulate resources in a way that is difficult for agents to detect. Moreover, it is argued that recoverable slack in the form of excessive personnel or capital embedded in overhead can be difficult to recoup (Love & Nohria, 2005) and forces such as power and politics can negatively impact the recovery of this type of slack (Herold et al., 2006). This is quite different than is the case with available slack, however, this logic also suggests a similar relationship in that innovation should increase in the presence of recoverable slack but at some point the benefits of recoverable slack will be diminished or eliminated altogether. Given the conflicting arguments in the literature, on balance both too much and too little recoverable slack should also be detrimental to innovation (Geiger & Cashen, 2002).

Lastly, potential slack has been operationalized using financial leverage variables such as a firm's debt to equity ratio (Bourgeois & Singh, 1983; Bromiley, 1991; Palmer & Wiseman, 1999). This slack component is external in nature because it represents the ability of a firm to secure resources with debt financing. It is argued that innovation is encouraged because the risks of experimentation are buffered when the potential for accessing outside resources exists suggesting a positive relationship between potential slack and innovation (Geiger & Cashen, 2002). However, unlike available and recoverable slack the existence of potential slack should not by its very nature lead to issues of misuse because this component of slack consists of resources that are only potentially available to the firm and currently not utilized (Herold et al., 2006). Moreover, the incurrence of debt financing implies future outflows in the form of interest expense and likely involves a high amount of scrutiny from principals and agents no matter the level that exists (Geiger & Cashen, 2002; Herold et al., 2006). For example, the issuance of long term debt may impact bond ratings and involve board approval. Thus, at high levels of potential slack the principal-agent problem of monitoring and control (Love & Nohria, 2005) is likely not a factor as is this case with available and recoverable slack. Based on these arguments, a positive relationship is expected between potential slack and innovation.

2.3. Slack configurations and innovation

The above review and extension of prior research provides a framework within which to predict levels of slack that will be associated with higher and lower levels of firm innovation. These arguments, however, do not take into account the combined effects of the different types of slack. With an understanding that different firms will bundle resources in different ways, it is expected that different configurations of slack will exist among firms. Further, given the different types of slack and prior research findings it seems likely that different configurations of slack will result in different innovation outcomes. Firms with overall low slack will have few excess resources to take risks, will be restricted in the ability to absorb any internal or external shocks to the organization, and will have limited embedded resources that might induce innovation within the firm (Cyert & March, 1963; Thompson, 1967). This suggests that firms with low levels of each type of slack will have less opportunity to encourage innovation, absorb failures in experimentation, or secure external funding for innovative projects. While prior research findings support these arguments (Geiger & Cashen, 2002; Nohria & Gulati, 1996) no previous studies have examined this relationship while considering the different types of slack simultaneously as a bundle of resources. Thus, we propose the following hypothesis.

Hypothesis 1. *Configurations exhibiting low levels of each type of slack (available, recoverable, and potential) will experience low levels of innovation.*

High levels of available and recoverable slack are also expected to negatively impact innovation (Nohria & Gulati, 1996) although for slightly different reasons. For example, it is argued that the existence of available slack will cause managers to relax controls when selecting or terminating projects which in turn could lead to fruitless projects and result in the potential opportunity cost of reduced innovation (Herold et al., 2006). Recoverable slack on the other hand could come in the form of excess personnel and/or padded budgets. The presence of recoverable slack can lead to loose organizational controls because managers can use these resources in a way that is difficult for principals to detect and thus could involve suboptimal utilization of resources. Moreover, in the case of personnel, embedded slack resources are difficult to eliminate, recover, and in turn redeploy in innovation efforts (Herold et al., 2006). With regard to potential slack, the literature suggests that the above arguments do not hold because potential slack is not currently available, the use of it involves future interest expense, and it requires a great deal of scrutiny from principals and agents (Geiger & Cashen, 2002; Herold et al., 2006). Prior research has found that high levels of potential slack do not negatively impact innovation (Geiger & Cashen, 2002). Thus, it can be expected that firms displaying high levels of available and recoverable slack combined with a low level of potential slack will have low levels of innovation. Formally stated:

Hypothesis 2. *Configurations exhibiting high levels of available and recoverable slack and a low level of potential slack will experience low levels of innovation.*

Concerning higher innovation configurations, the relationship between internal slack (available and recoverable) and innovation has been argued to follow a curvilinear relationship such that at both lower and higher levels of slack innovation is reduced (Geiger & Cashen, 2002). In other words moderate levels of available and recoverable slack should lead to higher levels of innovation. Again these arguments do not take into account the combined effects of the different types of slack. Given the expected relationships between both types of internal slack (available and recoverable) and innovation it seems reasonable to assume that the combined level of available and recoverable slack should be moderate since as discussed previously both low and high levels of available and recoverable slack can hurt innovation. Overall moderate levels of internal slack can be achieved in multiple ways such as high available slack combined with low recoverable slack, low available slack combined with high recoverable slack, and moderate available slack combined with moderate recoverable slack to name a few. Thus, to maximize innovation firms should avoid having high or low levels of both available and recoverable slack.

With regard to potential slack, prior research suggests that the slack and innovation relationship is positive and remains positive even at higher levels of slack (Geiger & Cashen, 2002). Unlike internal slack, it is not expected that potential slack will suffer from the same agency issues such as information asymmetry among principals and agents because a great deal of scrutiny is expected when the use of potential slack is considered (Geiger & Cashen, 2002). Given this, it is expected that high levels of potential slack will be beneficial to firm innovation independent of available and recoverable slack. These arguments provide a framework to hypothesize which slack configurations will lead to higher levels of innovation such that to maximize innovation the combined level of internal slack (available and recoverable) should at least be moderate but not too high so as to negatively impact innovation,

while potential slack should be moderate to high to provide a buffer for the firm and foster innovation. This leads to our final hypothesis.

Hypothesis 3. *Configurations exhibiting moderate combined levels of available and recoverable slack and a moderate to high level of potential slack with experience higher levels of innovation.*

3. Methods

3.1. Sample

Our study sample was drawn from the S&P 500, Mid-cap 400, and Small-cap 600 indices for the year 2010. Since levels of slack and innovation can be expected to vary widely across broader industry groupings we chose to only examine manufacturing firms (identified as those competing in the 2000 through 3999 SIC code industries) in this study. The year 2010 was chosen since it was at the time of data collection the most recent year which would allow for complete data to be collected. These choices resulted in an initial sample of 579 firms.

3.2. Slack measures

We utilized a total of seven variables to capture available, recoverable, and potential slack (Bourgeois & Singh, 1983). The measures chosen are consistent with prior research (Bergh & Lawless, 1998; Bourgeois & Singh, 1983; Bromiley, 1991; Cheng & Kesner, 1997; Geiger & Cashen, 2002; Palmer & Wiseman, 1999). In addition, to help in the determination of causality we used a one year time lag with slack measured in 2009 and innovation measured in 2010. Available slack was operationalized using three measures: current ratio (current assets divided by current liabilities), quick ratio (current assets minus inventories divided by current liabilities), and working capital (current assets minus current liabilities divided by sales). Potential slack was operationalized using three measures: debt to equity, debt to sales, and debt to assets. Finally, recoverable slack was operationalized using a single measure: selling, general, and administrative expenses divided by sales.

3.3. Innovation

We chose three measures of innovation for this study: R&D expenditures, patent applications and patents granted. This allowed us to capture both important inputs into the innovation process and important outputs of a firm's innovative activities. Since a firm's patent activities can vary significantly from year to year and often takes several years to develop and come to fruition we used a three year average (2010–2012) in these calculations. Finally, since the use of ratio measures can be problematic (Wiseman, 2009) we chose not to adjust these measures for firm size which is a commonly used approach in the literature (Geiger & Cashen, 2002; Hitt, Hoskisson, Johnson, & Moesel, 1996). Instead we used the actual levels of R&D expenditures, patent applications and patents granted and as described below we included firm sales as a control measure. It is worth noting that we replicated our analyses using innovation measures adjusted for firm sales and found very similar results.

3.4. Control measures

Innovation may be impacted by other organizational variables and thus firm size, product diversification, geographic diversification, financial performance, and industry innovation levels were used as controls. Rumelt's (1974) relatedness ratio was used to capture product diversification. Geographic diversification was operationalized using the percentage of foreign sales relative to total sales. Return on assets was used to measure financial performance. Firm sales was used to control for firm size. Finally, since industry setting is likely to affect firm innovation it was important to control for industry effects. Consistent with Hitt et al. (1996) this was accomplished by grouping all firms in the sample into primary 2-digit SIC code industry groups, calculating average innovations levels, and using these averages as controls.

3.5. Analyses

To identify configurations we cluster analyzed the slack measures. Since cluster analysis can be sensitive to outliers we trimmed all slack measures at three standard deviations from the mean. In addition, since the outcome of interest was firm innovation we removed from the sample firms not actively spending money on R&D. These choices reduced the size of our sample from 579 to 437 manufacturing firms. Because of the likelihood of multicollinearity among the slack measures and the severe problems it can pose with cluster analysis (Ketchen & Shook, 1996), we first factor analyzed the slack measures using principal components analysis with varimax rotation and used the uncorrelated factor scores as the basis for clustering.

We then preprocessed the data using SAS's ACECLUS procedure and used the Ward's minimum variance clustering method. The identification of optimal cluster solutions was based on visual inspection of the tree-plots along with the following decision criteria: (1) the clusters explain at least 65% of the overall variance, (2) with an additional cluster increasing the overall fit by less than 5%, (3) with a local peak in the Cubic Clustering Criterion, (4) with a local peak in the pseudo F statistic combined, and (5) with a small value of the pseudo t^2 statistic and a larger pseudo t^2 statistic for the next cluster fusion. When discrepancies existed across these decision criteria, we relied on visual inspection of the tree-plots and prioritized our use of each decision criteria in the order in which they are listed above. These decision criteria are consistent with those used in prior configurational research (i.e., Fiegenbaum & Thomas, 1990; Marlin, Ritchie, & Geiger, 2009; Ketchen et al., 1993) and with clustering stopping rules recommended by the SAS Manual (SAS Institute, 2003) and by the SAS Technical Report A-108 (SAS Institute, 1983).

Once our cluster analysis was complete, we ran ANOVAs to determine whether the clusters differed on the underlying slack measures and whether the results of our cluster analysis produced different slack configurations. We then ran pair-wise means comparisons on each slack measure to determine where the configurations differed. Next, we used ANCOVA to test for between configuration differences in innovation. Finally, least-squares means (i.e., means adjusted for our controls) comparisons were utilized to test for and identify specific innovation differences between the identified slack configurations.

4. Results

Table 1 reports descriptive statistics and correlations for all variables used in the study. The descriptive statistics show that the firms varied in innovation as well as the slack and control variables examined. The cluster analysis of 437 firms produced clusters representing six slack configurations. Table 2 reports the results of ANOVAs and pairwise tests for configuration differences along the slack measures. Significant differences were found across configurations with all slack measures suggesting the existence of distinct slack configurations. Table 3 provides a summary of each configuration based on level and type of slack (and innovation which will be discussed later). Below we highlight and provide a brief interpretation of the configurations to facilitate the discussion of our results.

4.1. Configuration 1: constrained borrowers

Configuration 1 was labeled *constrained borrowers*. The main characteristics of this configuration included moderately low available, potential, and recoverable slack. Specifically, relative to other configurations this group had the second lowest available and recoverable slack and

Table 1
Descriptive statistics.

Variable	Mean	sd	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Current ratio	3.042	1.895													
2 Quick ratio	2.333	1.683	.962												
3 Working capital	.403	.337	.837	.845											
4 Debt/equity[a]	.534	.957	−.272	−.273	−.268										
5 Debt/sales[a]	.211	.197	−.285	−.277	−.211	.427									
6 Debt/assets[a]	.166	.137	−.415	−.423	−.401	.618	.853								
7 SGA expenses	.288	.160	.364	.435	.526	−.164	−.007	−.202							
8 Relatedness ratio	.902	.170	.202	.207	.203	−.066	−.116	−.131	.210						
9 Foreign sales	.441	.269	.048	.067	.172	−.049	−.022	−.086	.093	.053					
10 Return on assets	.076	.068	.055	.071	.028	.016	−.131	−.102	.063	.113	.087				
11 Firm sales	7.499	1.565	−.549	−.511	−.495	.274	.292	.360	−.374	−.228	.110	.083			
12 R&D expenditures	301.265	907.443	−.113	−.069	−.020	.050	.128	.008	.103	−.054	.124	.070	.463		
13 Patents granted	196.030	533.778	−.099	−.049	−.026	.023	.036	−.033	.002	−.110	.218	.110	.446	.533	
14 Patent applications	103.430	315.260	−.060	−.018	.013	−.003	.044	−.031	.020	−.104	.187	.076	.343	.330	.747

N = 437.
If correlation > |.083| p < .05.
If correlation > |.110| p < .01.
If correlation > |.142| p < .001.
[a] Higher values indicate lower slack.

was slightly below average for potential slack. Thus, this configuration was constrained with overall low internal slack but utilized a moderately high level of debt financing and thus was limited in the area of potential slack.

4.2. Configuration 2: spenders/borrowers

Configuration 4 was characterized by having high recoverable slack, moderate available slack, and low potential slack. Labeled as *spenders/borrowers*, this group embedded slack into the firm by spending firm resources on things such as employees, marketing, and administration that could later be reduced if necessary. However, this configuration was similar to configuration 1 in that it utilized a high level of debt financing and thus was also limited in the area of potential slack. Spenders/borrowers ranked the highest in recoverable slack, the third highest in available slack and the second lowest in potential slack.

4.3. Configuration 3: hoarders

Configuration 3 was labeled *hoarders*. This group ranked the highest in available and potential slack and ranked third in recoverable slack. Thus, the main characteristic of this group was the significant amount of readily available resources stashed away for use at a later time as well as the low level of borrowing utilized. Relative to other configurations this group had a moderate level of recoverable slack spending less than configurations 2 and 4.

4.4. Configuration 4: moderate accumulators

Configuration 4 which was labeled *moderate accumulators* exhibited the second highest level of each type of slack and was closest to configuration 3 in the area of potential slack but higher with regard to recoverable slack. This group uses little debt and strikes a balance between accumulating available resources and spending resources which creates recoverable slack. Thus, they have moderately high levels of available, potential and recoverable slack.

4.5. Configuration 5: refrainers

Configuration 5 ranked fourth in available and recoverable slack and third in potential slack. Labeled *refrainers*, this group was similar to configuration 1 in that it had moderately low levels of available resources. However, this group had moderate levels of spending and refrained from utilizing significant levels of debt. Thus, this group had moderately low levels of available slack, moderate recoverable slack, and retained moderately high levels of potential slack.

4.6. Configuration 6: depleters

This the smallest configuration was labeled *depleters*. This group had the lowest levels of all three types of slack. Thus, these firms had little available slack, few embedded resources and thus little recoverable slack, and finally a depleted availability of potential slack from external sources due to high levels of debt financing. Overall, this group had a depleted level of all resources and as such had low overall slack.

Table 2
Configuration means and results of tests for significant differences.

	Configuration							Mean
Variable	1	2	3	4	5	6	F	comparisons*
Current ratio	2.186	2.737	7.231	3.974	2.201	1.656	238.13***	3 > 4 > 2 > 5,1 > 6
Quick ratio	1.491	2.193	5.904	3.291	1.641	1.120	209.97***	3 > 4 > 2 > 5,1 > 6; 5 > 6
Working capital	.244	.430	.990	.669	.253	.143	123.81***	3 > 4 > 2 > 5,1 > 6
Debt/equity[a]	.705	.783	.050	.099	.182	4.185	184.66***	6 > 2 > 1 > 5,4,3
Debt/sales[a]	.316	.531	.062	.105	.080	.484	129.00***	2,6 > 1 > 4,5,3
Debt/assets[a]	.265	.310	.035	.062	.082	.423	199.02***	6 > 2 > 1 > 5,4,3; 5 > 3
SGA expenses	.197	.515	.355	.413	.261	.180	56.47***	2 > 4 > 3 > 5 > 1,6
N	150	32	49	65	124	17	437	

[a] Higher values indicate lower slack.
* p < 05.
*** p < .001.

Table 3
Configuration summary based on level and type of slack.

	Type of slack[c,d]		
Level of slack[a]	Available[b]	Potential[b]	Recoverable
High	**3**	–	**2**
Moderate/high	**4**	**3 4** *5*	**4**
Moderate	**2**	–	**3** *5*
Low/moderate	*1 5 6*	*1*	*1 6*
Low	–	**2** *6*	–

[a] Moderate equals the mean and each category is within +/− half of a standard deviation.
[b] Based on an average of the three measures used for this type of slack.
[c] Numbers in **bold** indicate higher innovation configurations.
[d] Numbers in *italics* indicate lower innovation configurations.

4.7. Innovation results

In Table 4 we report ANCOVA tests of innovation differences across the identified slack configurations. In these analyses we controlled for the effects of firm size, product diversification, geographic diversification, financial performance, and industry levels of innovation. All multivariate and univariate tests were significant ($p < .01$ to $p < .001$) for innovation differences between the identified configurations. These results suggest an overall effect of cluster membership and thus slack configurations on firm innovation. Finally, with regards to our control variables, firm size and industry were significantly related ($p < .01$ to $p < .001$) to all three innovation measures and foreign sales was significantly related ($p < .10$ to $p < .05$) to patents granted and patent applications.

Table 5 presents least squares means comparisons which tested for innovation differences between slack configurations while again controlling for firm size, product diversification, geographic diversification, financial performance, and industry levels of innovation. The pairwise comparisons revealed significant innovation differences ($p < .05$) between the identified configurations using all three innovation measures. It is worth noting that spenders/borrowers (configuration 2), hoarders (configuration 3), and moderate accumulators (configuration 4) are higher slack configurations while constrained borrowers (configuration 1), refrainers (configuration 5), and depleters (configuration 6) are lower slack configurations.

Concerning our hypotheses, moderate support was found for Hypothesis 1 which predicted that configurations exhibiting low levels of each type of slack would experience low levels of innovation. Constrained borrowers (configuration 1) and depleters (configuration 6) had low or moderately low levels of each type of slack and produced the lowest levels of innovation. Hypothesis 2 which predicted that configurations exhibiting overall high levels of available and recoverable slack and a low level of potential slack would experience low levels of innovation was not supported. Our analyses did not produce any configurations with high levels of both available and recoverable slack combined with a low level of potential slack. The configuration which came closest to this slack profile was that of spenders/borrowers (configuration 2) which had moderate available, high recoverable and low potential slack and produced higher levels of innovation. Finally, Hypothesis 3 which predicted that configurations exhibiting moderate combined levels of available and recoverable slack and a moderate to high level of potential slack would experience higher levels of innovation received some support. More specifically, hoarders (configurations 3) and moderate accumulators (configuration 4) both had moderately high combined levels of internal slack (available and recoverable slack) and moderately high levels of potential slack and produced high levels of innovation. Finally, and as mentioned above spenders/borrowers (configuration 2) also had moderately high combined levels of internal slack (available and recoverable slack) but had a low level of potential slack and generally produced high levels of innovation.

4.8. Reliability and validity

Following procedures recommended by Ketchen and Shook (1996), we conducted an assessment of the reliability and validity of our cluster analyses and of our results. This consisted of two main assessment areas: (1) multicollinearity among our slack measures, and (2) the stability and consistency of our cluster results. Concerning multicollinearity our rotated factor pattern supported the existence of three components of slack (i.e., available, potential, and recoverable) with all factor loadings above .75 and the highest cross-loading being .321. Further, Cronbach's alphas on the three available and three potential slack measures were both above .83. These analyses support our use of factor analysis and the resulting uncorrelated factor scores as the basis for clustering. To further examine the reliability and validity of our results we performed multiple cluster analyses changing the approach we used to measure slack and thus control for multicollinearity. The agreement in cluster assignments across all approaches used ranged from 68% to 73%. More importantly, the results of each of these additional analyses were nearly identical to those reported above. Additional analyses were then performed concerning and more specific to the stability and validity of our cluster results. This involved using two additional clustering approaches. The agreement in cluster assignments across all approaches ranged from 68% to 79% and produced cluster and innovation results nearly identical to those reported above. Further details about these analyses are available from the authors.

5. Discussion

The findings of this study show that different configurations of slack resources are associated with differences in firm innovation. The configurations associated with a combined level of moderate/high internal slack (available and recoverable slack) had the highest levels of innovation. Specifically, moderate accumulators (configuration 4) were among the highest level of innovators for all three innovation measures and demonstrated moderate/high levels of all three types of slack. Hoarders (configuration 3) were among the highest level of innovators for two of the three innovation measures and demonstrated high available slack, moderate recoverable slack, and moderate/high potential slack. Spenders/borrowers (configuration 2) were among the highest level of innovators for one of the three innovation measures and demonstrated a high level of recoverable slack, moderate available slack, and low potential slack. Conversely, constrained borrowers (configuration 1), refrainers (configuration 5), and depleters (configuration 6) had lower levels of innovation for all three innovation measures used and demonstrated

Table 4
Multivariate and univariate innovation results.

Variable	Firm sales	Relatedness ratio	Foreign sales	Return on assets	Industry innovation	Configuration	Overall F
R&D Expenditures	157.86***	0.06	1.19	0.81	21.81***	14.33***	24.58***
Patents granted	130.26***	1.17	3.98*	0.06	17.86***	6.09***	19.83***
Patent applications	62.54***	1.89	3.49+	0.01	7.96**	3.70**	10.57***

+ $p < .10$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 5
Least squares innovation means across configurations and results of means comparisons.

	Configuration						
Variable	1	2	3	4	5	6	Means comparisons*
R&D expenditures	−65.05	946.77	619.73	624.76	303.86	144.65	2,4,3 > 5,6,1; 2 > 4; 5 > 1
Patents granted	62.41	252.26	349.76	430.45	180.58	42.48	4,3 > 5,1,6; 2,5 > 1
Patent applications	48.54	170.30	155.31	222.46	83.41	3.29	4 > 5,1,6; 2 > 1,6; 3 > 1

* $p < .05$.

lower levels of internal slack (available and recoverable) and varying levels of potential slack. Overall, these findings suggest that at moderately high levels, internal slack (available and recoverable) has a positive impact on a firm innovation. Moreover, these results suggest that while a positive relationship tends to exist between potential slack and innovation this may be tempered by the level of available or recoverable slack within the firm. For example, spenders/borrowers and constrained borrowers had slightly different potential and available slack, but spenders/borrowers had much higher recoverable slack and benefited from a much higher level of innovation than constrained borrowers for all three measures of innovation. Overall, these findings provide support for the behavioral argument that slack provides a positive impact on organizational outcomes such as innovation. However, none of the configurations in this study had high levels of all types of slack and thus it is difficult to determine if high overall slack would negatively impact innovation. As such, the negative impacts of slack that are argued from an agency theory perspective cannot be completely dismissed.

This study contributes to prior slack research by utilizing a configurational approach and considering the combined effects of different types of slack on innovative outcomes. Our results suggest that different types or bundles of slack resources result in different or varying levels of firm innovative activities. This study provides a richer description of how multiple types and levels of slack are related to a firm's innovative activities by identifying bundles or configurations of slack resources. Overall, the results of this study suggest that slack is positively related to innovation. However, this differs somewhat from prior research which suggests an inverted U shaped relationship between slack and innovation (Nohria & Gulati, 1996) and between some types of slack and innovation (Geiger & Cashen, 2002). These prior studies failed to account for either multiple slack measures (Nohria & Gulati, 1996) or how firms configure or bundle multiple types of slack resources (Geiger & Cashen, 2002). Thus, an important contribution of this study is that while level of slack may be important, how the various types of slack are bundled also serves as an important factor in firm outcomes and should be examined by future researchers. The current study neither supports nor runs counter to prior slack research in that no other studies have examined the simultaneous impact of slack bundles on innovation. In general, this study does support the view that the presence of slack is positively related to firm innovation. Future research will be needed to determine if, and the degree to which, high overall slack profiles exhibit the negative influences on innovation as argued by agency theorists.

The results indicate multiple ways of bundling slack resources that can lead to similar innovation outcomes suggesting that equifinality (Katz & Kahn, 1978; Gresov & Drazin, 1997) exists among some configurations. The three configurations that had the highest levels of innovation had significantly different slack profiles yet statistically similar levels of innovation. For example, hoarders (configuration 3) and moderate accumulators (configuration 4) enjoyed a statistically equal high level of innovation for two of the three innovation measures but had different slack profiles for two of the three slack dimensions. This result suggests equally effective ways to manage slack resources to achieve innovative outcomes and adds to prior research that has found that equifinality exists with regards to firm outcomes in service industries (Jennings, Rajaratnam, & Lawrence, 2003), in different compensation systems (Eisenhardt, 1988), among strategic groups (Marlin, Ketchen, & Lamont, 2007), between organizational configurations (Payne, 2006), among configurations of contextual factors (Ganter & Hecker, 2014), and between configurations or different bundles of sales and distribution resources (Gruber et al., 2010). The evidence of equifinality found in this study provides a significant extension to the literature on slack and innovation.

The results of this study also have important practical implications. Our findings suggest that slack impacts innovation and it may do so in ways not yet considered. More specifically, our results suggest that managers can achieve similar levels of innovation inputs and outputs using different patterns of slack resources. This is good news for managers as it provides for alternative pathways to the same end in that they can use the approach that best fits their organization and its resources. Thus, attention should be paid to identifying appropriate levels for each type of slack as part of an appropriate slack profile and how this slack profile could impact a critical firm outcome such as innovation.

Our study also has limitations that provide opportunities for future research. First, it must be recognized that we examined the slack and innovation relationship using cross-sectional data and only with U.S. manufacturing firms. As such, different slack configurations and innovation results could be found using other industries or time frames. Also, the measures used in this study are not necessarily appropriate indicators of slack resources or of innovation in other settings. For example, our measures of innovation would clearly not be appropriate for the examination of firms in the retail industry. Future research should consider examining the slack and innovation relationship using a configurational approach in other industry settings and using longitudinal data. Overall, this study provides a unique contribution to the slack and innovation literature and should provide a framework for future research utilizing alternative methods for investigating this and other relationships. We also hope that our findings will provide managers with useful insight when making slack resource decisions.

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