Organizational Slack And Performance: The Impact Of Outliers

Andrew J. Wefald, Kansas State University, USA
Jeffrey P. Katz, Kansas State University, USA
Ronald G. Downey, Kansas State University, USA
Kathleen G. Rust, Elmhurst College, USA

ABSTRACT

Extending initial theory development and empirical studies conducted in the early 1980s, the investigation of the relationship between slack resources and the performance of the firm has experienced renewed attention. Over the past 25 years enough empirical research has been conducted that researchers have begun to question the frequently found ambiguous results. We assess the impact statistical outliers may have on the relationship between organizational slack and firm performance trying to determine whether the positive, curvilinear, or ambiguous results that have been reported are impacted by the presence of outliers. We found that the measures of organizational slack were highly variable due to five general factors. When the outliers, extreme values, were statistically identified and removed, the relationship between organizational slack (Available Slack) and performance (ROA) became non-linear and consistent over years. Implications suggest that future research should consider the potential impact that non-normal distributed data could have on the validity of findings, particularly when employing data from archival sources. Suggestions for future research in the slack-performance relationship are offered.

Keywords: organizational slack, performance, outliers

INTRODUCTION

Over the past 25 years more than 65 studies have been conducted that seek to examine how the existence of slack resources impacts firm performance (Daniel, Lohrke, Fornaciari & Turner, 2004 Management scholars have devoted so much attention to this relationship because maintaining resources serves as a buffer for the future needs of the firm. It is argued that maintaining a organizational slack displays skillful management of the firm in situations where the competitive environment is uncertain (Sharfman & Dean, 1997). Conversely, slack resources that would otherwise be available to add value to the firm are seen as a potential problem (Ghemawat, 2006).These concerns have resulted in the belief that organizational slack resources and performance will have a curvilinear relationship; too little slack will leave the firm with inadequate resources while too much slack will limit performance (Bansal, 2003).

Much of what is known about slack and its relationship with performance is based on the use of archival data sources and the assumption that it is normally distributed or at least approximates normality. This research seeks to investigate the normality of archival data sources using the slack-performance relationship as a background and the effects on the slack-performance relationships.

The following sections will define of organizational slackand a review of past research on organizational slack. We will also provide a review of some of the data problems associated with the slack research and outline an approach to investigate the consequences of these data problems.

The conceptual discussion of organizational slack can be traced to organizational theorists such as Barnard (1938) and Thompson (1967) who argued that protecting the core of the organization from rapid changes in the

firm's external environment through the use of slack resources is an important managerial role. That is, maintaining slack resources was considered a method to buffer the core of the firm from environmental variation thereby reducing the need to make substantial changes to the operating core of the firm (Pfeffer & Salancik, 1978). However, a discussion of the concept of slack, and understanding its originations in the organization has lasted for over a quarter century (see the discussion of the interaction between slack and environmental adaptation found in Aldrich (1980) and Perrow (1986)).

Several studies (Bourgeois & Singh, 1983; Cheng & Kesner, 1997; Hambrick & D'Aveni, 1988; Iqbal & Shetty, 1994; Singh, 1986) measured slack using primarily financial indicators (ratios). Singh (1986) measured slack using two dimensions: absorbed and unabsorbed slack. Unabsorbed (or available) slack, is measured using the current ratio. Hambrick and D'Aveni (1988) used working capital as a percent of sales as a measure of unabsorbed slack. This type of slack can be measured using the equity-to-debt ratio; an indicator of a firm's unused borrowing capacity. Absorbed slack, defined as slack absorbed in salaries, overhead expense, and various other administrative costs, has been measured as the ratio of general and administrative expenses to sales (Singh, 1986).

Beginning with conceptual work by Bourgeois (1981), and continuing by George (2005), researchers have reported various relationships between slack resources and firm performance that include positive, negative, linear, and curvilinear directions and forms (Daniel, et al., 2004). Investigating changes relating to particular types of organizational slack can help executives pinpoint precisely what organizational slack should be removed or acquired to attain peak performance levels. According to Singh (1986), "…an a priori theory about the differential effects of the two slack components [unabsorbed slack and absorbed slack] is lacking" (p. 567). Figure 1 displays the antecedents and direct effects between organizational slack and firm performance as presented in the related literature. In addition to firm financial performance, slack has been examined in relation to firm innovation (Geiger & Cashen, 2002), internal efficiency (Kerschbamer & Tournas, 2003), organizational structure (Riahi-Belkaoui, 1998), and risk taking behaviors (Moses, 1992).

In the ongoing global movement, it is critical to understand the true impact that slack resources may have on the performance of a firm. Thus, how firms define slack resources and what action is taken to match available resources with the strategic needs of the firm, becomes critical to the long-term success of the firm (Nohria & Gulati, 1996). Specifically, it has been suggested that the strategic management of available resources plays a critical role in the performance of any organization (Cascio, Young & Morris, 1997).

The discussion of slack appears to converge on several key issues. First, organizations must adapt to changes in their industry to be viable in the long term (McKelvey & Aldrich, 1983). Second, slack and the organization's ability to adapt, or innovate, appears to be a curvilinear relationship. That is, too much or too little slack tends to handicap organizations from adequately adapting to environmental opportunities (Nohria & Gulati, 1996). And finally, the definition of slack and its antecedents are issues that are subject to multiple interpretations (Sharfman, Wolf, Chase & Tansik, 1988). Knowing the optimal level of slack necessary for strong company performance provides useful information for executives contemplating workforce changes (Lawson, 2001). This information can aid decisions on how to best use their staff for optimal performance.

Perhaps the first attempt to define slack and its relationship with performance was Bourgeois' (1981) proposal that there is a curvilinear relationship between slack and organizational performance such that increasing levels of slack are associated with improved performance up to a point, but beyond that point performance declines. Cheng and Kesner's (1997) findings among airlines suggest that different types of financial slack play different roles with respect to resource allocation patterns. While helping to unravel the apparent puzzle between slack and performance, the authors encourage research that identifies and specifies the roles different kinds of organizational slack play in organizational effectiveness. Nohria and Gulati (1996) found that slack has an inverted U-shaped effect on innovation, suggesting that intermediate levels of slack have an optimal effect on innovation. Others suggest an optimal level of slack exists for any given firm and if organizational slack falls below that level, organization performance will decline (Sharfman, et al., 1988).

However, in the empirical studies reporting relationships between organizational slack and outcome measures of interest including firm performance, there seems to be increasing evidence of statistical non-normality

among the measures used to assess slack resources and performance of the firm. For example, Singh (1986) reports measures of slack and performance having standard deviations significantly greater that the reported means for the same measures. More recently, George (2005) in studying slack resources among privately-owned firms, reports the mean for "high discretion slack" of 41.10 with a corresponding standard deviation of 305.30, indicating a significant level of variance within the measure. In this paper we explore the relationship between organizational slack and firm performance in an effort to better understand the true relationship between these variables.

OUTLIERS IN SLACK DATA

Recent research on organizational slack has neglected to discuss the apparently high standard deviations for the main variables that comprise the measures employed (George, 2005; Tan, 2003). High standard deviations are potential indicators that the data may be non-normal (Chatterjee & Price, 1991). If these high standard deviations represent non-normal data, then using non-normal data to identify curvilinear relationships is problematic because the influence and leverage of the outliers potentially masks the true nature of the relationships.

Outliers are generally considered data points that are far outside the norm for a variable or population (Osborne & Overbay, 2004). Barnett & Lewis (1994) define outliers as, "…an observation (or subset of observations) that appears to be inconsistent with the remainder of that set of data" (p. 7). Outliers can influence the analysis of data. In this regard, it is important to assure conclusions are not based on one or more extreme observations (Chatterjee & Price, 1991). The existence and inclusion of one or more outliers can seriously jeopardize the results and conclusions of a regression analysis (Cohen, Cohen, West, & Aiken, 2003).

According to Osborne & Overbay (2004), outliers can have deleterious effects on statistical analyses. First, they generally serve to increase error variance and reduce the power of statistical tests. Second, if non-randomly distributed they can decrease normality and in multivariate analyses, violate assumptions of sphericity and multivariate normality. Outliers can alter the odds of making both Type I and Type II errors. Third, they can seriously bias or influence estimates that may be of substantive interest (for more information on these issues, see Rasmussen, 1988; Schwager & Margolin, 1982; Zimmerman, 1994).

Outliers typically come from two sources: 1) errors in the data, and 2) inherent variability in the data (Osborne & Overbay, 2004). However, not all outliers are illegitimate contaminants and sometimes illegitimate scores are not outliers. Outliers may lead to inflated error rates and distortions of parametric or statistic estimates for both parametric and non-parametric tests (Osborne & Overbay, 2004). This latter point was supported empirically by Osborne, Christiansen, and Gunter (2001) in an empirical study on how often statistical assumptions (including information on outliers) were tested and reported by researchers and found this rarely happens. In their study, only eight percent of the researchers took this important step.

There is also variability (and disagreement) in how researchers detect and address outliers (Orr, Sackett, & Dubois, 1991). One common approach for detecting outliers is the examination of data points or the number of observations that are two or more standard deviations from the mean (Wilcox, 2003 & Chatterjee & Price, 1991). Osborne & Overbay (2004) report other methods for detecting outliers, including Mahalanobis' distance and Cook's *D* to detect influence, leverage, or distance and standardized residuals in regressions. Arsham (1994) reports that any value 2.5 standard deviations from the mean should be further investigated as a potential outlier. This step is important whether the approach is to use 2, 2.5, or 3 standard deviations – those values should be investigated to determine if they are valid and accurate data points. Chatterjee & Price (1991) suggest that rejecting outliers based on a rule such as data beyond two or more standard deviations should be applied with caution. Transforming the data, or in some other way accommodating outliers also involves consequences. Lovie (1986) suggests the decision to reject, ignore, or in some way accommodate outliers depends on why and how the data were collected, what analyses will be conducted, and why the deviant values arose. Hawkins (1980) argues that rejecting outliers is a viable method because doing so results in estimators that are both robust and efficient. Hawkins also notes that when there are numerous outliers, rejection is a relatively easy solution compared to other treatments of the data with possibly similar results. Cohen et al. (2003) report that deletion of outliers is the simplest method and in many cases will provide robust estimates of the regression coefficients similar to more complex regression techniques. They also note that researchers typically base their conclusions on the regression equations with the outliers deleted

and that the nature of the outliers and their treatment should be reported.

A review of recently published literature involving the measurement of organizational slack suggests there could be potential problems with the underlying data in many studies. For example, out of ten articles published using organizational slack as a variable of interest, three did not report means and standard deviations (see Table 1). Of seven articles reporting means and standard deviations, four indicate evidence of irregularly large standard deviations in relation to the reported means suggesting the data should have been investigated to assess normality or exclude other potential problems with the data (for e.g., Martinez & Artz, 2006). Some authors reported the means and standard deviations, but did so in a way that assessing normality was not possible, for example Greenley & Oktemgil (1998). Interestingly, consistent with the findings reported by Osborne, Christiansen, & Gunter (2001), only two articles mentioned evaluation of data normality (Tan, 2003 & Tan & Peng, 2003). For example, Tan (2003) reported the means and standard deviations and checked for normality and purportedly found it. However, the means and standard deviations he reported showed signs of non-normal data (see Table 1). The findings from our limited review of the literature provides evidence that the data may be non-normal and potential outliers may be skewing the results and creating potential problems in the research conducted on organizational slack.

Given the increasing level of interest in organizational slack as a partial explanation for company performance, greater attention needs to focus on its measurement. The consistent finding has been that slack measures appear to lack a normal distribution. This study examines the underlying reasons for this non-normality and the impact of non-normality on the relationship between slack and performance. We focus our attention on two measures of slack and two measures of performance. Previous research has found a curvilinear relationship between organizational slack and performance. We examined both the linear and curvilinear relationships.

METHOD

Following the procedure outlined by Nohria & Gulati (1997) and Daniel et al., (2004), various measures of company performance for an eight-year period (1991 to 1998) were collected from the Research Insight database of domestic firms. We chose those years because it was a stable period in the domestic economy and preceded the period of significant market turbulence as technology-related companies exited the market in great numbers. A total of 769 U.S. companies were identified.

Two measures of slack were collected using the following formulas: *Absorbed Slack*, a rather slow to change form of organizational slack characterized by administrative overhead, was defined as general and administrative expenses divided by total sales. *Available Slack*, a measure reflecting more readily available slack generated through unit sales, was defined as gross profit less net profit divided by total sales. These ratios are used following what is commonly used in the research on slack (Bourgeois, 1981; Bourgeois & Singh, 1983; Cheng & Kesner, 1997; Hambrick & D'Aveni, 1988; Iqbal & Shetty, 1994; Singh, 1986). There are inherent problems with using ratios, however, this is the common method used so we followed this precedentThe two measures of performance used were return on assets (ROA) and return on equity (ROE). The data were further screened for missing data in the Absorbed Slack variable and a list-wise deletion of records was made. The final data contained 635 records when the data were screened based on Available Slack and 554 records when the data were screened based on Absorbed Slack.

The slack measures were each scanned for outliers using the following procedures. First, means and standard deviations were calculated for Available Slack and any company with an Available Slack greater than or less than three standard deviations were removed from the data set, i.e. data were trimmed from both ends of the distribution.. The means and standard deviations were recalculated for Available Slack for the remaining companies and, again, any company with an Available Slack greater than or less than three standard deviations were removed from the data set. The means and standard deviations stabilized at this point. This process was repeated with the remaining records and another 25 records were identified as outliers. The final data set used for the analyses of Available Slack with the outliers removed contained 436 firms. Starting with the original date set, the process was repeated using Absorbed Slack. A total of 526 firms were identified.

Given the past examples of potentially non-normal data in the literature and the identification of extremely non-normal data in our own data set, further investigation into the normality or non-normality of the data was conducted. In this study, we used a generous cut-off of three standard deviations and removed the data beyond that point. Also, following the suggestions from Chatterjee & Price (1991), Arsham (1994), and Osborne & Overbay (2004) we conducted a thorough investigation of the data beyond three standard deviations. Chatterjee and Price (1991) state that when observations represent a special situation and have too much influence on the regression results they may be removed. In the present study, the option of transforming the data was not utilized because there were too many outliers in this data set and the nature of the outliers suggested that removal was the best and most efficient option.

To better understand why data sets contain significant numbers of outliers, an analysis of a random sample of 50 companies that were identified as outliers was conducted. The company records were reviewed to identify why the slack measures were aberrant. Using a random number generator, a random sample of 50 companies from the group of 359 (common companies identified after removing the outliers between available and absorbed slack) companies was selected. Companies were categorized using information from their 10-K reports. EDGAR was used (www.sec.gov) to search for companies by their stock ticker, and then limited the search further by searching for only 10-K reports. The reports from 1998 and earlier were isolated to identify major business practices. The companies were then grouped into six categories; 1) Changes in Accounting Procedures, 2) Changes in Business Model, 3) Market Changes, 4) Litigation, 5) Mergers, Acquisitions, and Restructuring, and 6) Other Conditions. We then tabulated a count and percentage for each category. Microsoft Excel was used to count each time a company was in a category and the percentage for each classification. This analysis led to the categorization of the random sample into six groups. A company could and were placed in more than one category type. A second analysis and categorization was performed on those companies left in the data (remaining) using the same procedures.

A series of hierarchical regressions were performed for each year. The slack measures were used to predict performance. First slack was entered into the equation as a predictor followed by the slack measure squared as a predictor. The squared values were used to identify any non-linear contributions.

RESULTS

Table 2 provides the means and standard deviations for the Available Slack, Absorbed Slack, ROA, and ROE measures for years 1991 to 1998 for the 635 companies with missing values removed. In all cases, the Available Slack standard deviations greatly exceeded the corresponding means for all eight years (by a factor of seven or greater). For the other variables (Absorbed Slack, ROA and ROE) in Table 2 for the file with missing values removed suggested non-normal data for many of the years. Inspection of the kurtosis values suggested very flat distributions. Table 2 also provides the means and standard deviations for the Available Slack, ROA and ROE measures for years 1991 to 1998 for the 436 companies with outliers removed based on Available Slack. In no case did Available Slack standard deviations exceed the corresponding means for all eight years by a factor of two. Inspection of the kurtosis values suggested normal distributions after removal of outliers. The values for Absorbed Slack and ROA also suggested normal distributions. However, the ROE values still indicated a non-normal distribution.

The same analyses for the Absorbed Slack data set are shown in Table 3. For the 554 companies without missing data for Absorbed Slack, the results were similar to those found for Available Slack. However, the non-normality was not as extreme for years 1991 to 1994. Table 3 also provides the means and standard deviations for the Available Slack, ROA and ROE measures for years 1991 to 1998 for the 526 companies with outliers removed based on Absorbed Slack. In no case did the Absorbed Slack standard deviations exceed the corresponding means for all eight years. Inspection of the kurtosis values (not shown) now suggested normal distributions. The values for Available Slack and ROA also suggested normal distributions. However, once again, the ROE values standard deviations still indicated a non-normal distribution.

The analysis of the sample of 50 companies removed from the 173 companies identified as outliers revealed a consistent set of problems that could be categorized into six groups. Each company could be identified with more than one category so the final N = 111. The first category was a change in accounting procedures; 19

companies or 17.1 percent were placed in this category. The second category was a change in the business model; 22 companies or 19.8 percent were placed in this category. The third category was a change in market conditions; 18 companies or 16.2 percent were placed in this category. The fourth category was litigation; 11 companies or 9.9 percent were placed in this category. The fifth category was mergers/acquisitions and restructuring which accounted for the majority of the outliers with 39 companies or 35.1 percent of those in this category. The final category included a variety of issues that we labeled as other; 2 companies or 1.8 percent were placed in this category. Some companies were placed in more than one category, so there were 69 responses for the 50 companies. Table 4 provides a more detailed description of the six categories and a breakdown of the random sample of companies left in the analyzed data (remaining).

The analyses of the two sets of 50 randomly chosen companies from both the data that was removed and the data that remained suggested there were differences between those companies that were identified as abnormal (and that were removed from the data set) and those companies remaining in the data (see Table 4). Approximately the same numbers of identifications (108 and 111) were made for each sample. A 2 (outlier or remaining) by 6 (categories) chi-square was conduced. The two groups were significantly different, χ^2 (5) = 34.63, p<.001. Of the 50 companies remaining in the data 41 experienced "Changes in Market Conditions" while only 18 of the 50 companies identified as outliers were in that category. Another difference was that none of the remaining companies in the sample experienced "accounting changes" while 19 in the outlier group did. Both the outliers and remaining had large numbers of mergers, acquisitions, and restructurings (42 & 39 respectively). Nine companies identified as outliers experienced both accounting changes and changes in market conditions.

Tables 5 and 6 provide the hierarchal regression analyses using Available Slack and Available Slack squared as the predictors. Separate regressions were done for each year and for the missing (Table 5) and outliers (Table 6) removed files. For both data files (missing and outliers removed) averages were computed for the slack, ROA and ROE values and these were also entered into the type of regression.

The results for the missing data removed file are shown in Tables 5. Available Slack was a significant predictor of ROA in three of the eight years and accounted for two to four percent of the variance. Available Slack squared (the non-linear component) was a significant predictor of ROA in four of the eight years and accounted for one to three percent of the variance. For the average over-years variables, Available Slack accounted for 20 percent of the variance and Available Slack squared accounted for 44 percent of the variance in predicting ROA. Neither Available Slack nor Available Slack squared predicted ROE in any of the years or the average over years.

The results for the data with outliers removed based on Available Slack are shown in Table 6. Available Slack was a significant predictor of ROA in seven of the eight years and accounted for two to seven percent of the variance. Available Slack squared (the non-linear component) was a significant predictor of ROA in all eight years and accounted for three to nine percent of the variance. For the average over-years variables, Available Slack accounted for four percent of the variance and Available Slack squared accounted for one percent of the variance. Available Slack was a significant predictor of ROE in one of the eight years and accounted for one percent of the variance. Available Slack squared (the non-linear component) was a significant predictor of ROE in four out of the eight years and accounted for one to two percent of the variance. For the average over-years variables, Available Slack and Available Slack squared were not significant predictors.

The results for the data with missing removed based on Absorbed Slack are shown in Table 7. Based on missing data, Absorbed Slack was a significant predictor of ROA in six of the eight years and accounted for one to 95 percent of the variance. Absorbed Slack squared (the non-linear component) was a significant predictor of ROA in all eight years and accounted for one to 10 percent of the variance. For the average over years variables, Absorbed Slack accounted for 60 percent of the variance and Absorbed Slack squared accounted for 14 percent of the variance in predicting ROA. Absorbed Slack was a significant predictor of ROE in one of the eight years and accounted for two percent of the variance. Absorbed Slack squared (the non-linear component) was a significant predictor of ROE in two out of the eight years and accounted for one percent of the variance. For the average over-years variables, Absorbed Slack and Absorbed Slack squared were not significant predictors.

An obvious outlier was discovered in the Absorbed Slack missing removed data set. That outlier was the Coleman Company and it was removed from the data set and the regressions were re-run. These results appear in Table 8. Absorbed Slack was a significant predictor of ROA in five of the eight years and accounted for one to three percent of the variance. Absorbed Slack squared (the non-linear component) was a significant predictor of ROA in all eight years and accounted for one to eight percent of the variance. For the average over the years examined, Absorbed Slack was a significant predictor of average ROA and accounted for three percent of the variance. The average Absorbed Slack squared was also a significant predictor and accounted for two percent of the variance. Absorbed Slack was a significant predictor of ROE in one of the eight years and accounted for one percent of the variance. Absorbed Slack squared was a significant predictor of ROE in two of the eight years and accounted for one percent of the variance. For the average over years, neither Absorbed Slack nor Absorbed Slack squared were significant predictors of ROE.

The results for the outliers removed data for Absorbed Slack file are shown in Table 9. Absorbed Slack was a significant predictor of ROA in six of the eight years and accounted for one to seven percent of the variance. Absorbed Slack squared (the non-linear component) was a significant predictor of ROA in none of the eight years. For the average over years variables, Absorbed Slack accounted for six percent of the variance and Absorbed Slack squared was not significant. Absorbed Slack was a significant predictor of ROE in three of the eight years and accounted for one to two percent of the variance. Absorbed Slack squared (the non-linear component) was a significant predictor of ROE in two out of the eight years and accounted for one to two percent of the variance. For the average-over-years variables, Absorbed Slack and Absorbed Slack squared were not significant predictors of ROE.

DISCUSSION

The analysis of the data used in this study clearly demonstrates the high probability of finding outliers in archival databases. This research focused on the impact of outliers in archival data for a line of research that has been ongoing for 25 years. Our work indicates the common measures used to examine organizational slack are no exception. However, given the history of contradictory findings in the relationship between organizational slack and firm performance, we sought to more clearly examine the inconsistencies in what past research data sets have shown (Daniel et al., 2004; Geiger & Cashen, 2002). Previous research has also provided evidence for non-normal archival data (see George, 2005 and Tan, 2003). This evidence along with our own data gives strong reason for managers and researchers to closely examine the data and possibly trim the outliers. The outliers in our data were beyond three standard deviations from the mean, which suggests a closer examination of the data was needed. These outliers have potentially high leverage and influence on reported relationships. For these reasons we made the decision to trim the data and kept those data that were within three standard deviations of the mean.

What is also clear from our study is that outliers were the result of naturally occurring changes in the business practices and conditions of organizations that are typically studied. In fact, a simple inspection of a scatter-plot was what alerted us to the potential outlier problem. Cohen et al. (2003) provides a comprehensive discussion of detecting outliers in multiple regression analysis procedures. The analyses of the 50 randomly chosen companies both in and out of the data set showed interesting results that highlight the need for researchers using archival data to carefully examine their data. We found a similarity between the two groups for experiencing mergers, acquisitions, and restructurings and this finding combined with the results from the changes in accounting procedures category support the idea that it is not mergers, acquisitions, and restructurings that are causing the companies to be identified as either very high or low performing companies. The fact that a large group of companies identified as outliers experienced accounting changes is interesting. If they were experiencing very high or low performance, that, in and of itself, should not lead a company to alter its accounting procedures. Also, nine companies identified as outliers experienced both marketing changes and accounting changes. This is also interesting because market changes should not, in and of themselves, lead a company to change their accounting procedures. It may be coincidence.

Given the differences between data determined to be abnormal and data determined to be relatively normal and our other results, these findings suggest that future researchers closely examine archival data for abnormalities to avoid skewing any analyses or results. The statistical use of archival data without properly checking the distributional properties of the numbers can result in tremendously misleading results. Failing to closely examine

archival data is a mistake. This research supports this conclusion and any future research involving the statistical use of archival data should include some method of accounting for abnormal data. Given our use of ratios for measures of slack we are unable to identify what is causing the very high and low values. However, that is the common practice for measuring slack and we followed that precedent. A manager of a specific company would be in a position to identify what is driving his or her levels of slack. Given our findings, it is important for managers to carefully examine their data and carefully measure slack and to understand how different measures of slack and performance can drive the results.

The outliers identified in the dataset underlying our work represent what Cohen et al. would consider "unusual cases" (p.391). A random sample of the companies we removed as outliers showed that those companies all represented "unusual cases" and were experiencing one of five general problems (see Table 4). What makes this a particularly difficult problem is that the unusual cases in this study represented 31.3 percent of the data. The problem was not as acute for Absorbed Slack where only 5.1 percent of the data were removed as outliers. The use of large archival data sets certainly contributed to researchers overlooking these problems. Without a close inspection of the data points in the archival data when anomalies occur, it is easy to draw erroneous conclusions from any resulting analyses of the data. In fact, outliers distorting the data occurred based on one set of data points associated with one company where the regression of Available Slack on ROA produced an R^2 of .97.

The potential for outliers to distort any regression analysis was also shown in the changes in the inter-correlations between and among the slack and performance measures before and after the outliers were removed. When the regressions were performed on the data before and after outliers were removed, the findings and conclusions one would draw from the results were very different. The hypothesized curvilinear relationship between slack and performance (Bansal, 2003) received only partial support with the unadjusted data; however, it received much stronger and consistent support when outliers were removed. These conclusions only held for Available Slack and ROA but not Available Slack and ROE where there was weak and inconsistent support. Very different results occurred for Absorbed Slack when outliers were removed. There was inconsistent support for a linear relationship between Absorbed Slack and both measures of performance.

These patterns suggest that when outliers are removed, the strength, consistency, and nature of the relationship between slack and performance varied by how slack and performance were measured. When slack was measured in terms of a more stable measure (secondary cost drivers or Available Slack), it demonstrated a consistent curvilinear relationship with performance as measured by ROA. The average R^2 for over the eight years between squared Available Slack and ROA was .058. This contrasts with an average R^2 for the four years where the results were significant between squared Available Slack and ROE of .013. For Absorbed Slack (outliers removed), none of the squared (non-linear) terms were significant for ROA and only two for ROE. In six of the eight years, the linear contribution of Absorbed Slack was significant in predicting ROA and only three of the eight years for predicting ROE.

Thus, the hypothesized curvilinear relationship between slack and performance suggested by Bansal (2003) is supported when slack is measured in terms of sales (Available Slack) and performance in terms of return on assets. It needs to be noted that Net Profit is a common factor in Available Slack, ROA, and ROE. However, if this common factor was driving the relationship found between Available Slack and ROA, it would also be expected for other performance measures such as ROE, which did not occur.

The overall difference between the results with the missing data removed and the outliers removed depends on the measure of slack used. For available slack, removing the outliers clearly improves the prediction of performance. Both ROA and ROE are predicted in more years and have higher R^2 values. For absorbed slack, removing the outliers results in a decrease in the prediction of performance both in the number of years where absorbed slack can predict performance and in the R^2 values. However, the real issue with both measures of slack is identifying what produces the clearest picture of the relationship between slack and performance. It is out contention that removing the extreme data presents a clearer picture of the relationship between slack and performance regardless of whether prediction improves or decreases. With either measure there are consequences with the dubious measurement procedures related to including extreme values on either end of the distribution. This can result in a distorted picture of the nature of the relationship between slack and performance.

The findings related to outliers in the data and the measures used for organizational slack and performance suggested the need to closely examine findings from past research. As was demonstrated in our results, support for or against a curvilinear relationship is dependent on these factors. If there were outliers in the data (for example, the case of the Coleman Company shown in Tables 10 and 11), they can dramatically alter the regressions. Further, outliers can either understate or overstate the relationship and change the direction of the relationship. Given the values used to calculate slack and performance, major changes in a company's condition (e.g., mergers, acquisitions, and/or restructuring) can significantly alter the meaning of the slack and return values. Finally, if there is no common metric for measuring slack and performance, different outcomes are likely. An unknown outcome may be that many researchers studying slack may have failed to find the hypothesized curvilinear relationship and therefore the study was not reported. This is a common problem found in conducting meta-analyses (Daniel et al., 2004). The key point of our findings is that the careful measurement of slack is important to managers because of the preceding reasons. Much of the previous research on slack has ignored outliers. Managers should pay attention to their data and the presences of outliers. It is also clear that managers need to understand that major changes in the organizations marketing and accounting practices can alter how slack and performance are measured. Finally, while not explicitly studied here, the results suggest the importance of conducting longitudinal studies. The average inter-correlations among slack and return variables suggest that the stability of the measures varies over time and is different for different measures of slack. The same was found for variables measuring performance. Greater efforts need to be directed at this issue.

CONCLUSIONS AND FURTHER RESEARCH

The results from this study make it clear that future research on the relationship between slack and performance must deal with the issue of outliers. A failure to do so runs the high risk of failing to accurately represent the relationship. It is also clear that the specific measures of slack and performance used in the research can make a significant difference in the results. Changing how performance is measured also affects the relationship between slack and firm performance. It is also likely, given the prevalence of non-normal appearing data that past studies of the slack/performance relationship should be re-assessed. Our analysis suggests that the slack-performance relationship changed as the outliers were removed. The relationship also changed as slack and performance were measured differently. Without "cleaning up" the data, any results must be interpreted cautiously.

Finally, this work has reinforced past concerns about the quality and accuracy of archival data acquired from large databases. Accepting data from these sources, without closely examining the underlying data, can easily lead to erroneous conclusions. The outlier problem identified in our study is one of several problems that could occur. The key message from our work is to carefully examine all aspects of the data prior to charging forward with analytic procedures. Additionally, it is very important to clarify how variables are measured because their measurement and the quality of the underlying observations may significantly impact the nature of the relationships reported between the variables.

ACKNOWLEDGEMENTS

Special thanks to Mike Haag and Brandon Solt for their efforts on this research.

AUTHOR INFORMATION

Andrew Wefald is an Assistant Professor in the School of Leadership Studies at Kansas State University. His research covers job attitudes, leadership, and other organizational issues.

Jeff Katz is a Professor of Management and the Edgerley Family Endowed Chair in the Management at Kansas State University. He is currently the Associate Dean in the College of Business Administration at K-State.

Ron Downey is a Professor of Psychology at Kansas State University and his research covers job burnout, job engagement, work-family issues, and part-time employment.

Kathleen Rust is the Director of Intercultural Studies, the Director of Intercultural Education and an Associate Professor of Management at Elmhurst College, Elmhurst Illinois.

NOTE

References, tables, and figures are available upon request (wefald@ksu.edu)

NOTES