

Osteryoung, Jerome S.; Pace, R. Daniel; Constand, Richard L.

Article

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Journal of Small Business Finance

Provided in Cooperation with:

The Academy of Entrepreneurial Finance (AEF), Los Angeles, CA, USA

Suggested Citation: Osteryoung, Jerome S.; Pace, R. Daniel; Constand, Richard L. (1995) : An Empirical Investigation into the Size of Small Businesses, Journal of Small Business Finance, ISSN 1057-2287, JAI Press, Greenwich, CT, Vol. 4, Iss. 1, pp. 75-86

This Version is available at:

<http://hdl.handle.net/10419/114683>

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An Empirical Investigation into the Size of Small Businesses

Jerome S. Osteryoung
R. Daniel Pace
Richard L. Constand

A fundamental understanding of small businesses begins with an adequate definition of what constitutes a small business. Often the definition of a small business incorporates the definitions employed by the Small Business Administration (SBA) which, in part, uses the number of employees as the definitive measure. This paper examines the SBA's definitions of a small business which use the number of employees as the standard. We find little evidence that supports the use of SBA definitions or any definition that relies on the number of employees.

I. INTRODUCTION

A fundamental understanding of small businesses begins with an adequate definition of what constitutes a small business. Often the definition of a small business incorporates the definitions employed by the Small Business Administration (SBA) which, in part, uses the number of employees as the definitive measure. Depending upon the type of business, the SBA defines a business as small if it has under 100 to under 1,000 employees, depending upon industry classification. The SBA and the United States Government use this definition in policy formation and implementation. Any characterization of firms, such as defining certain firms as small firms, implies that the firms are reasonably similar in their needs and behavior and that firms in different size classification have different fundamental characteristics. An adequate and appropriate definition of small business is critical both for government policy formation and for small firm research. In this study we

Jerome S. Osteryoung • Florida State University, Department of Finance, College of Business, Tallahassee, Florida 32306; **R. Daniel Pace** • Valparaiso University, College of Business Administration, Valparaiso, Indiana 46383; **Richard L. Constand** • Department of Financial Economics and Institutions, College of Business, Honolulu, Hawaii 96822.

test the robustness of the current Small Business Administration's definition of small business, specifically those definitions using the number of employees as the standard.

While no consensus definition of small business exists, several definitions have been forwarded. Megginson, Scott, and Megginson (1991), state that "The best definition of small business is the one used by Congress in the Small Business Act of 1953 which states that a small business is one that is independently owned and operated and is not dominant in its field of operation" (Megginson, Scott, & Megginson, 1991). Osteryoung and Newman argue that a small business is defined as having two major criteria; first, a small business is one that has no public common stock, and second, the owner(s) of a small business must personally guarantee any existing or planned financing. (Osteryoung & Newman, 1992).

Currently the SBA uses several definitions of small business to determine which businesses are eligible for government assistance. The basic definitions that are employee-size based are in the areas of manufacturing and wholesaling. Manufacturing firms are considered small if the total number of employees averaged 500 or less during the preceding 12 months. However, there are alternative size standards for selected industries and for owners that meet certain veteran, disability, and ethnic criteria. These standards can expand the range up to 1,000 employees.¹ In this paper, we test the use of the number of employees as definitive of small business. Specifically, we test the SBA's standard of 500 employees for manufacturing firms, the standard of 100 employees for wholesaling firms, and the validity of using the number of employees as a measure of size.

Data

The data source is Standard and Poor's Compustat PC Plus database. For each firm we examine the number of employees, Standard Industrial Classification (SIC), and 11 financial, performance, and operating ratios in the years 1983 to 1992.² All firms that have the required financial data available are included in the analysis. Manufacturing firms and wholesaling firms are further classified by the number of employees. For manufacturing firms, "small" firms are segmented into groups defined by the number of employees; 0 to 25, 26 to 50, 51 to 75, 76 to 100, 101 to 200, 201 to 300, 301 to 400, and 401 to 500. "Large" manufacturing firms are those with over 500 employees. For wholesaling firms, the "small" firms are segmented into groups of 0 to 25, 26 to 50, 51 to 75, and 76 to 100, with "large" firms having over 100 employees. The number of firms in each classification is shown on Table 1.

Table 1
Sample Sizes

	<i>Manufacturing Only</i>	<i>Wholesaling Only</i>
Totals	917	91
0 < Employees ≤ 25	23	5
26 < Employees ≤ 50	41	4
51 < Employees ≤ 75	33	4
76 < Employees ≤ 100	28	4
101 < Employees ≤ 200	86	For wholesaling firms the relevant cutoff point to test is at 100 employees
201 < Employees ≤ 300	68	
301 < Employees ≤ 400	52	
401 < Employees ≤ 500	47	

II. METHODOLOGY

In this study we examine both a sample of manufacturing firms and a sample of wholesaling firms in order to determine if definitions of “small” and “large” firms used by the SBA are consistent with significant differences in the financial and operating structure of different sized firms. We focus on manufacturing and wholesaling firms because the SBA has used the number of employees as the determining factor in these industries. For manufacturing firms, a firm with less than 500 employees is defined as small while for wholesaling firms, a firm with less than 100 employees is considered small. The analysis applied to these two samples are designed to determine if the SBA size criteria reflect actual differences observed in firms of different sizes.

There are three formal hypotheses that are related to this size-definition issue. The first hypotheses addresses the issue of whether or not the number of firm employees has any relation to the underlying financial and operating structure of the firm. Formally;

H_0 : The number of employees is insignificant in explaining financial, operating, and performance ratios.

H_A : The number of employees is significant in explaining financial, operating, and performance ratios.

The second hypotheses addresses the issue of whether or not the current criteria used by the SBA actually reflects significant differences in firms

of different sizes. Stated another way, the hypotheses examines whether the existing small/large firm size cutoff actually separates firms into two groups that have different characteristics. Formally;

H_O : The employee based small firm/large firm cutoff levels *FAIL TO* partition the population of firms into two groups that have different operating characteristics.

H_A : The cutoffs *DO* successfully partition the firms into two groups with significant differences.

The third hypothesis addresses the issue of whether there is another employee-based size definition that may be better than the existing size definition in differentiating between firms with different operating and financial characteristics. Formally;

H_O : No other (employees) sized-based categorization has greater explanatory power to separate firms into groups with significantly different operating and financial characteristics than the existing SBA categorizations .

H_A : There are other size cutoffs that outperform the current SBA employee size cutoffs.

In order to address the first hypothesis a set of regressions in which the number of employees is regressed against each of the ratios are performed. If the employee number is a good proxy for size, there should be systematic relationships between the size of the ratios and the number of employees in the firm. The regressions are of the form:

$$\text{Ratio} = \alpha + \beta(\text{Number of employees}) + \varepsilon \quad (1)$$

In order to examine the second and third hypothesis a series of multiple regressions are performed on both a sample of manufacturing firms and a sample of wholesaling firms.³ In these regressions, dummy variables are created in order to allow examination of differences between financial ratios of small and large firms when the size cutoff is set at different levels. The dummy variables are defined for manufacturing firms as follows:

$$MSIZE25 = 1 \text{ if } 0 < \text{number of employees} \leq 25$$

$$MSIZE50 = 1 \text{ if } 26 < \text{number of employees} \leq 50$$

$MSIZE75 = 1$ if $51 < \text{number of employees} \leq 75$

$MSIZE100 = 1$ if $76 < \text{number of employees} \leq 100$

$MSIZE200 = 1$ if $101 < \text{number of employees} \leq 200$

$MSIZE300 = 1$ if $201 < \text{number of employees} \leq 300$

$MSIZE400 = 1$ if $301 < \text{number of employees} \leq 400$

$MSIZE500 = 1$ if $401 < \text{number of employees} \leq 500$

Wholesaling firms are classified in a similar fashion but the classes only range to 100 employees.⁴ Each of the small firms is assigned to one of these distinct, non-overlapping groups. Firms are then given a value of one for that particular size dummy variable. Large firms have zeros given for all small size variables. This allows each individual size group to be compared against the set of large firms.

In order to determine if the differences in firm characteristics are related to differences in firm size (when size is defined by the number of employees), a series of regressions are performed. The regressions are of the form:

$$\begin{aligned} SIZE\ DUMMY = & \beta_0 + \beta_1(Current\ Ratio) + \beta_2(Inventory\ Turnover) \\ & + \beta_3(Receivables\ Turnover) + \beta_4(Net\ Profit\ Margin) \\ & + \beta_5(Return\ on\ Assets) + \beta_6(Return\ on\ Equity) \\ & + \beta_7(Debt\ Asset\ Ratio) \end{aligned} \quad (2)$$

and are repeated for each of the different size categories. For example, for manufacturing firms, the MSIZE25 regression, firms with 1-25 employees and firms with 500 employees are included in the analysis. Firms with 26 to 500 employees are excluded. This analysis allows us to determine the strength of the relationship between firm characteristics and the ability to discriminate between large firms and firms in the MSIZE25 group.⁵

As the analysis is repeated with groups of firms with successively larger numbers of employees, the changes in the power of the regressions can be observed to see if the differences in financial characteristics becomes more or less pronounced.

If the 500 employee cutoff is appropriate, the regression for each and every small firm size group should be highly significant and should exhibit similar patterns of significant coefficients. That is, the differences between a "small" 25 employee firm and a large (over 500 employee) firm should be the same as the differences between a "small" 450 employee firm and a large(over 500 employee) firm if the 500 employee size cutoff is valid. How-

ever, if the ability to discriminate between small and large firms weakens as we increase the size of our "small" firm cutoff group, this will provide evidence that a more restrictive definition of a small firm than those in place might be more meaningful.

If the 500-employee-size cutoff specified by the SBA is valid, all of the small firm size dummy regressions should be highly significant with a high degree of explanatory power. If it is, we cannot reject the second hypothesis that the SBA definition is meaningless. If the results indicate that another size dummy variable does have greater explanatory power than the 500 (or 100) cutoff, we can reject the third hypothesis that no other employee-based size categorizations outperforms the current SBA definition.

III. RESULTS

Table 1 reports the size (number of firms) of the various size subsamples examined in each of the size categories. Table 2 presents the sample statistics for the observations in the two samples (wholesaling and manufacturing) used for the analysis. Since there are 10 annual observations for each firm the number of observations is ten times the size of the firm counts presented in Table 1.⁶

Table 3 presents the results of the series of regressions represented by equation (1) that examine the strength of the relationships between the number of employees and various financial and operating ratios.

The results for the regressions for manufacturing firms are presented on the left side of the table. While a number of the individual regressions are statistically significant (as indicated by their calculated *F* values), none of the regression models indicate that the number of employees can explain more than two percent of the variation in the firm characteristics. In fact, in seven of the eight regressions, the number of employees cannot explain even one-half of one percent of the variation in the financial ratios. Only in the current ratio regression representing liquidity is there the slightest evidence that the number of employees might be related to differences in liquidity across small and large firms. On the right side of the table the results of the wholesaling regressions are presented. For the wholesaling firms, the only evidence of a relationship between the number of employees and a firm's financial characteristics appear in the receivables and total asset turnover ratios. Both regression models are significant (at the 0.01 level) and the regression models do explain a large part of the variance in the dependent variables as indicated by the adjusted R-squares of 18.6 percent for the receivables turnover ratio and 12.5 percent for the total asset

Table 2

<i>Ratio</i>	<i>N</i>	<i>Mean</i>	<i>Standard Deviation</i>	<i>Minimum</i>	<i>Maximum</i>
<i>Panel A</i>					
<i>Industrial Firm Ratio Sample Statistics</i>					
Current	11964	2.77	2.68	0.00	83.54
Inventory Turnover	11815	5.79	23.96	0.00	1959.00
Receivables Turnover	11894	7.08	6.78	-0.07	254.60
Total Asset Turnover	11900	1.37	0.55	-0.01	6.06
Net Profit Margin	11930	-2.01	102.86	-8740.00	1680.39
Return on Assets	11951	2.64	14.17	-333.70	96.20
Return on Equity	11950	8.08	775.88	-32478.00	63000.00
Debt to Asset	11956	24.53	22.97	0.00	571.39
<i>Panel B</i>					
<i>Wholesale Firm Ratio Sample Statistics</i>					
Current	1008	2.27	2.22	0.01	41.75
Inventory Turnover	970	9.29	14.73	0.45	207.15
Receivables Turnover	986	12.30	13.86	0.00	179.43
Total Asset Turnover	998	2.54	1.51	0.00	9.18
Net Profit Margin	1003	-13.94	208.57	-4482.19	375.35
Return on Assets	1006	-2.20	68.30	-1899.60	28.50
Return on Equity	1006	16.21	248.33	-2157.20	5391.40
Debt to Asset	1008	32.04	30.31	0.00	338.17

Notes: N = the number of firm-year observations used in each regression.

turnover. The combined results indicate that the receivables turn over results are most likely driving the total asset turnover results. None of the other financial characteristics appear to be related to the number of employees in the firm.

Table 4 presents the results of the eight regressions performed on the various size-based dummy variables for the manufacturing firms. When reviewing the overall pattern of coefficient significance, a few points become clear. First, liquidity, total asset turnover, profitability, and leverage, all seem to be statistically different for large and small firms regardless of the particular small firm segment we examine. This statistical significance, however, must be interpreted in the light of the results in Table 3 that showed little explanatory power for each ratio. Second, both the adjusted *R*-square values and the *F*-values decrease as the segments representing the larger of the "small firms" are compared with the larger,

Table 3
Regression Analysis of Firm Characteristics and Number of Employees
Dependent Variable = $\beta_0 + \beta_1(\text{Number of Employees}) + \varepsilon$

<i>Dependent Variable</i>	<i>Manufacturing Firms</i>			<i>Wholesaling Firms</i>		
	β_0 (<i>t-value</i>)	β_1 (<i>t-value</i>)	<i>Adj. R²</i> (<i>F-value</i>)	β_0 (<i>t-value</i>)	β_1 (<i>t-value</i>)	<i>Adj. R²</i> (<i>F-value</i>)
Current Ratio	2.377 (30.00)†	-0.000 (-2.357)†	0.0060 (7.061)†	2.377 (30.00)†	-0.000 (-2.357)†	0.0060 (7.061)†
Inventory Turnover Ratio	9.170 (16.97)†	0.000 (0.48)8	-0.000 (0.239)	9.170 (16.97)†	0.000 (0.488)	-0.000 (0.239)
Receivables Turnover Ratio	9.118 (20.218)†	0.001 (15.043)†	0.1862 (226.29)†	9.118 (20.218)†	0.001 (15.043)†	0.1862 (226.29)†
Total Asset Turnover Ratio	2.257 (44.255)†	0.000 (11.955)†	0.1246 (142.92)†	2.257 (44.255)†	0.000 (11.955)†	0.1246 (142.92)†
Net Profit Margin	-18.56 (-2.481)†	0.001 (1.300)	0.0007 (1.689)	-18.56 (-2.481)†	0.001 (1.300)	0.0007 (1.689)
Return on Assets	-4.343 (-1.778)	0.007 (1.846)	0.0024 (3.408)†	-4.343 (-1.778)	0.007 (1.846)	0.0024 (3.408)†
Return of Equity	16.27 (1.829)	-0.000 (-0.016)	-0.000 (0.000)	16.27 (1.829)	-0.000 (-0.016)	-0.000 (0.000)
Debt/Asset Ratio	33.39 (30.86)†	-0.000 (-2.626)†	0.0058 (6.894)†	33.39 (30.86)†	-0.000 (-2.626)†	0.0058 (6.894)†

Notes: † Significant at the one percent level.

over 500 employee, firms. There is a very noticeable drop in explanatory power of the models once firms with more than 50 employees are compared to firms with more than 500 employees. This can be seen by the drop from an adjusted *R*-square of 15 percent at the 50 employees cutoff to an *R*-square of only seven percent for the 51 to 75 employee size group. By the time we compare firms with 401 to 500 employees with firms with over 500 employees, the explanatory power has dropped to only two percent, indicating that the set of financial characteristics represented by the financial ratios has little, if any, ability to discriminate between firms in these two size categories.

These results provide strong evidence that the 500 employee cutoff used by the SBA for separating "small" firms from "large" firms in the manufacturing industry is meaningless and of no value in making a distinction between firms with different characteristics. If an employee number based

Table 4
Regression Results of Firm Classification and Firm Characteristics
(Manufacturing Firms Only)

$$SIZE\ DUMMY = \beta_0 + \beta_1(Current\ Ratio) + \beta_2(Inventory\ Turnover) + \beta_3(Receivables\ Turnover) + \beta_4(Net\ Profit\ Margin) + \beta_5(Return\ on\ Assets) + \beta_6(Return\ on\ Equity) + \beta_7(Debt\ Asset\ Ratio)$$

	0-25	26-50	51-75	76-100	101-200	201-300	301-400	401-500
Intercept	3.68 (0.68)	-97.00 (-11.47)*	-35.95 (-4.30)†	67.58 (-8.43)†	-83.52 (-6.67)†	-93.19 (-7.91)†	-81.14 (-7.22)†	-46.40 (-4.30)†
Current	14.56 (22.29)†	40.92 (27.68)†	22.14 (15.92)†	26.84 (19.47)†	43.35 (20.83)†	43.45 (21.35)†	33.31 (16.18)†	22.67 (11.22)†
Inventory Turnover	0.35 (1.68)	0.41 (1.13)	-0.04 (-0.13)	0.68 (2.20)*	0.63 (5.14)†	1.07 (5.55)†	-0.25 (-0.56)	-0.75 (-1.77)
Receivables Turnover	0.83 (3.68)†	0.23 (0.68)	0.23 (0.71)	0.20 (0.69)	0.20 (0.45)	1.28 (3.01)†	-0.51 (-1.24)	-0.24 (-0.60)
Total Asset Turnover	-7.27 (-2.54)†	22.89 (5.41)†	12.03 (2.93)†	19.19 (5.08)†	57.44 (9.42)†	36.35 (6.47)†	38.85 (7.42)†	34.94 (7.01)†
Net Profit Margin	-0.58 (-14.80)†	-0.10 (-4.89)†	-0.87 (-6.19)†	-0.53 (-5.28)†	0.02 (0.20)	-1.44 (-3.22)†	0.97 (1.72)	0.88 (1.98)*
Return on Assets	-2.56 (-15.30)†	-5.14 (-24.49)†	-3.27 (-11.94)†	-2.70 (-10.71)†	-5.99 (-16.79)†	-3.34 (-6.11)†	-3.12 (-5.23)†	-2.46 (-4.76)†
Return on Equity	0.00 (1.09)	0.01 (3.49)†	0.00 (0.22)	0.00 (0.96)	0.01 (2.94)†	-0.00 (-0.94)	0.00 (1.52)	0.00 (0.20)
Debt to Assets	-0.31 (-3.67)†	0.97 (8.94)†	0.66 (5.52)†	0.55 (7.76)†	0.30 (1.68)	0.52 (3.00)†	0.75 (4.82)†	0.28 (1.86)
Adjusted R ²	0.179	0.152	0.076	0.064	0.076	0.065	0.036	0.020
F Value	231.55†	194.68†	90.34†	74.80†	95.48†	78.66†	42.94†	23.81†

Notes: 1. Firms are classified by number of employees and compared to firms with over 500 employees. For example, firms with 26-50 employees are assigned a one, firms over 500 employees are assigned a zero and all other firms are dropped.
 2. All parameter values have been multiplied by 1,000 for presentation.
 3. T-statistics are in parentheses.
 4. * significant at the five percent level; † are significant at the one percent level.

Table 5
Regression Results of Firm Classification and Firm Characteristics
 (Wholesaling Firms Only)

$$\begin{aligned}
 \text{SIZE DUMMY} = & \beta_0 + \beta_1(\text{Current Ratio}) + \beta_2(\text{Inventory Turnover}) \\
 & + \beta_3(\text{Receivables Turnover}) + \beta_4(\text{Net Profit Margin}) \\
 & + \beta_5(\text{Return on Assets}) + \beta_6(\text{Return on Equity}) \\
 & + \beta_7(\text{Debt Asset Ratio})
 \end{aligned}$$

	0-25	26-50	51-75	76-100
Intercept	-13.89 (-0.60)	69.45 (2.75)†	91.72 (3.33)†	117.94 (4.53)†
Current	15.80 (3.01)†	26.87 (5.45)†	16.14 (3.18)†	3.35 (0.63)
Inventory Turnover	-0.00 (-0.01)	0.76 (1.72)	0.56 (1.15)	0.94 (2.28)*
Receivables Turnover	1.94 (3.65)†	0.69 (1.32)	0.62 (1.06)	0.67 (1.21)
Total Asset Turnover	-28.69 (-5.30)†	-20.05 (-3.71)†	-25.08 (-4.19)†	-28.12 (-5.01)†
Net Profit Margin	-1.47 (-8.19)†	-0.48 (-0.19)	-0.63 (-0.23)	-1.26 (-0.49)
Return on Assets	-1.24 (-1.56)	-2.19 (-1.60)	-1.18 (-0.78)	-2.20 (-1.99)
Return on Equity	0.07 (3.51)†	0.00 (0.11)	-0.00 (-0.02)	-0.00 (-0.26)
Debt to Assets	2.29 (8.62)†	-1.68 (-4.34)†	-0.98 (-2.25)*	-0.79 (-2.08)*
Adjusted R2	0.270	0.092	0.044	0.080
F Value	41.10†	11.96†	6.05†	10.69†

- Notes:*
1. Firms are classified by number of employees and compared to firms with over 100 employees. For example, firms with 26-50 employees are assigned a one, firms over 100 employees are assigned a zero and all other firms are dropped.
 2. All parameter values have been multiplied by 1,000 for presentation.
 3. T-statistics are in parentheses.
 4. * significant at the five percent level; † significant at the one percent level.

distinction between small and large firms must be made, a cutoff at either 25 or 50 employees would be preferred to the current 500 employee cutoff.

It should also be noted that the signs of the coefficients change for the debt ratio when the size definition is increased to the 26 to 50 size category. This change of sign suggests that there are major differences in the leverage positions of firms with less than 25 employees and firms with 26 to 50 employees providing more evidence that employee number is an imperfect manner in which to define firm size.

The results of the various regressions performed on the wholesaling firms samples appear in Table 5. Examining the individual coefficients suggests a number of interesting findings.

1. Liquidity appears to differ between large and small wholesaling firms when small firms are identified as those having less than 75 employees. The current definition based on 100 employees does not seem to be adequate in making the distinction between firms with 76 to 100 employees and those with over 100 employees.
2. The total asset turnover proxy is significant for each of the small firm samples with the pattern of significance indicating that no other employee based cutoff is better than the existing one.
3. When the leverage is considered, the sign of the coefficients changes for the under 25 employee firms and the over 25 employee firms. None of the other financial ratios appear to be related to the number of employees of the firm.

When the power of the different regressions are considered, the results indicate that the 25 employee regression allows the explanatory variables to explain over 25 percent of the difference between the small firms and the larger firms. As the results for the other regressions are considered, it is clear that none of the other cutoffs segment the firms into size categories as well as the 25 employee cutoff.

The results of all these wholesaling regressions, when taken together, indicate that the number of employees does not seem to be a meaningful method of distinguishing between large and small firms for most of the financial characteristics examined. Furthermore, for those financial ratios that do seem to be related to number of employees, the relationship suggests another employee size cutoff might be better than the existing 100 cutoff level.

IV. CONCLUSIONS AND CAVEATS

This paper examines the SBA's small business definitions that use the number of employees as the standard. We find no evidence that supports the use of 500 or less employees a definitive standard. The results suggest that if the number of employees must be used, that 100 or less is more appropriate. However, given our results, any definition that relies on the number of employees is suspect.

Two caveats should be stated. The first is that our study used firms that were publicly traded. Almost all definitions of small business would agree

that a publicly traded firm would not be considered small. The second caveat is that it is likely and possibly appropriate that the SBA defines businesses for policy considerations rather than economic considerations. If this is the case, scholarly studies of the small businesses should clearly separate the politic from the economic.

NOTES

1. The SBA uses a preceding three-year average receipts definition for business in the fields of retailing (\$3.5 million or less, though some businesses have alternative standards of \$13.5 million or less), services(\$2.5 million or less, alternatively \$14.5 million or less), and construction (\$7 million or less, alternatively \$17 million or less).
2. These ratios are: Current Ratio, Quick Ratio, Inventory Turnover Ratio, Receivables Turnover Ratio, Total Asset Turnover Ratio, Percentage Profit Margin, Net Profit Margin, Return on Assets, Return on Equity, Interest Coverage Before Taxes, and the Debt/Asset Ratio. However due to multicollinearity-related problems, our final analysis omits the Quick Ratio, the Percentage Profit Margin, and the Interest Coverage Before Taxes.
3. All tests were conducted for a sample of all firms that are publicly traded. These results are available upon request. Our findings were similar to those findings for the manufacturing and wholesaling samples.
4. The dummy variables are defined for manufacturing firms as follows: $WSIZE25 = 1$ if $0 < \text{number of employees} \leq 25$; $WSIZE50 = 1$ if $26 < \text{number of employees} \leq 50$; $WSIZE75 = 1$ if $51 < \text{number of employees} \leq 75$; $WSIZE100 = 1$ if $76 < \text{number of employees} \leq 100$.
5. Multiple regression with a 1/0 dummy dependent variable is equivalent to a multiple discriminate analysis. The resulting regression equation can be interpreted as a discriminate function with the power of the function provided by the adjusted R^2 .
6. In this paper results of the pooled time-series analysis are presented. With this approach each year's calculated ratios for each firm are treated as a separate observation. The analyses have also been performed on ten year, five year, and three year average ratios for each firm. The results for these other analyses are almost identical to the results reported here.

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