Are Defense Contractors Rewarded for Risk, Innovation, and Influence?

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This study investigates the factors that lead to a diversity of profitability among defense contractors, a topic largely ignored by prior studies. We use regression analysis to test whether the profitability of defense contractors is significantly associated with factors that are hypothesized to cause the diversity of profitability among defense contractors. We find that defense contractors assuming higher risks, being more innovation-oriented, and being more influential could earn higher profitability from their defense business than other defense contractors, but defense business in general seems to be less profitable than commercial business. Our evidence suggests that the profitability of defense contractors is reasonable with respect to rewarding risk and innovation. This study provides new light on the reasonableness of defense contractors' profitability and also provides useful evidence to evaluate the effectiveness of the Department of Defense in implementing its stated profit policy.

Introduction

The profitability of defense contractors has been investigated by many academic studies (Weidenbaum, 1968; Agapos and Galloway, 1970; Stigler and Friedland, 1971; Bohi, 1973; Rogerson, 1989; Lichtenberg, 1992; and McGowan and Vendrzyk, 2002). These studies mainly compare the profitability of segments or companies that had defense sales with the profitability of their commercial counterparts to determine whether defense contractors earn excessive profitability from defense business. The prior studies largely ignore the diversity of profitability among defense contractors. According to the Department of Defense (DOD), however, profits (markup) of defense contracts should depend on the risk assumed by a contractor, the difficulty of the task, the amount of contract cost, the source of resources, contractor past performance, and other factors (DFAIR, 1985, V-1). This objective suggests that the DOD makes a deliberate decision to vary the profitability

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of defense contracts. The decision may aid the DOD in achieving its desired purpose, a balance of protecting the interest of the taxpayer and enabling U.S. industry to achieve an equitable return for its involvement in defense business (DFAIR, 1985, E-1).

The purpose of this study is to investigate the factors that lead to diversity of profitability among defense contractors. A comparison of the average profitability of defense contracting firms (segments) with their commercial counterparts may not provide sufficient evidence for the reasonableness of defense contractors' profitability because defense business may be riskier (Weidenbaum, 1968; Stigler and Friedland, 1971) and/or more innovative (Rogerson, 1989) than commercial business. By investigating major factors that determine the profitability of defense contractors, this study can provide new light on the reasonableness of defense contractors' profitability. By examining whether the profitability of defense contractors is consistent with the intended objectives stated by the DOD, this study also provides useful evidence to evaluate the effectiveness of the DOD in implementing its stated profit policy.

This study uses a new method (relative to the prior research) to investigate the profitability of defense contractors. The percentage of defense sales to a firm's total sales is used as a main-effect variable for profitability of defense contractors while the factors that are hypothesized to cause the diversity of profitability among defense contractors are used as moderating variables. Such a method allows us to provide evidence on both the effect of defense sales on firms' profitability in a general sense and the incremental effects of the hypothesized factors on the diversity of profitability among the firms. Our results suggest that defense contractors assuming higher risks, being more innovation-oriented, and being more influential, can earn higher profitability from their defense business than other defense contractors, but that defense business in general seem to be less profitable than commercial business. The evidence implies that the profitability of defense contractors was reasonable with respects of rewarding risk and innovation. The DOD seems to have effectively implemented its stated profit policy.

Literature Review

Many studies have investigated the profitability of defense contractors. A study by the Logistics Management Institute for the DOD (1969) found that profitability of defense contracts was too low relative to that of commercial business. The study uses information voluntarily provided by defense contractors, which makes their results subject to self-selection bias, as the defense contractors with high profitability might choose not to participate. A study by the U.S. General Accounting Office (GAO, 1971) examines profitability of defense contracts for 74 large defense contractors. The study concludes that return on equity is generally not significantly different for defense contracts than for commercial business. The Defense Financial and

Investment Review (DFAIR), completed by the Department of Defense in June 1985, finds that the average profitability of defense contracts, measured by either return on assets or return on sales, is similar to that of comparable manufacturers of selected durable goods over the period of 1970 to 1979. Over the period of 1980 to 1983, the profits of defense contracts are similar or even lower than the comparable commercial business for all product groups, except for two groups (aircraft and shipbuilding). The U.S. General Accounting Office (GAO), using different measurements for profitability, however, concludes that defense contractors earn higher return on assets from defense contracts than from comparable commercial business (GAO, 1986). The evidence from these studies suggests that profitability of defense contracts relative to commercial business varies for different periods and for different product groups.

While the studies by both the DOD and the GAO primarily focus on profitability of defense contracts, academic studies have investigated the profitability of segments or the whole company for a defense contractor (Weidenbaum, 1968; Bohi, 1973; Lichtenberg, 1992; and McGowan and Vendrzyk, 2002). These academic studies contend that the profits of defense and commercial sales of a segment or a company are inseparable due to the existence of externalities (Bohi, 1973) and cost shifting (Lichtenberg, 1992). Thus, focusing only on the profits of defense sales may understate the profitability of defense contractors (Lichtenberg, 1992). The academic studies mainly have investigated the profitability of segments or companies with defense sales and of those with only commercial sales, without much consideration of the diversity of profitability among defense contractors.

Weidenbaum (1968) finds that large defense contractors, during 1962 to 1965, earn a lower return on sales but a higher rate of capital turnover than comparable commercially-oriented firms. The higher turnover rates of the defense contractors overcompensate the lower returns on sales, which results in higher returns on stockholders' investment. Bohi (1973) finds that returns on equity of defense firms are not significantly different from that of commercial firms for the period of 1960 to 1969. Similarly, Agapos and Galloway (1970) also conclude that aerospace defense firms could not earn excessive profits from defense sales. Stigler and Friedland (1971) find that investments in defense firms could earn higher stock returns than weighted returns of all NYSE stocks in the 1950s but not in the 1960s. They also suggest that defense firms were riskier than commercial firms.

Lichtenberg (1992) finds that return on assets is substantially higher for the segments with defense sales than for the segments without any defense sales. Lichtenberg (1992) interprets the results as the evidence to suggest that excessive profitability of defense contractors could be, at least partially, attributed to cost shifting. McGowan and Vendrzyk (2002), however, provide an alternative explanation for excessive profitability of defense contractors during 1980s. They find that pure government segments had significantly higher profitability than mixed and pure

commercial segments, while the latter two did not differ in profitability. They interpreted the results as evidence to suggest that excessive profitability of defense contractors is caused by high profitability of defense contracts rather than cost shifting.

Hypothesis Development

The DOD believes that it is important to keep a balance of protecting the interest of the taxpayer and enabling U.S. industry to achieve an equitable return for its involvement in defense business (DFAIR, 1985, E-1). To keep the balance, the DOD states that profits (markup) of defense contracts should depend on the risk assumed by a contractor, the difficulty of the task, the amount of contract cost, the source of resources, contractor past performance, and other factors (DFAIR, 1985, V-1). The profit policy stated by the DOD indicates that risk should be an important factor affecting profitability of defense sales. Appropriate profit rewarding for risks assumed by defense contractors is critical to attract and/or maintain high quality defense suppliers, especially when the demand for defense products is high. If defense contractors are undercompensated for the risks they assume, they may choose to exit the defense business in the future or try to provide lower-quality products to the DOD. If potential defense suppliers perceive defense business will earn low profits relative to the risks to be assumed, they may avoid the defense area. Thus, insufficient profit rewarding for risks results in low supply or low quality for defense products, which potentially threatens the national security. Consistent with this contention, prior academic studies also suggest risk as an important factor in determining the profitability of defense sales (Weidenbaum, 1968; Agapos and Galloway, 1970; Stigler and Friedland, 1971). Thus, our hypothesis 1 is:

H1: *Ceteris paribus*, profitability earned by defense contractors from defense sales is positively associated with risks assumed for engaging in the defense business.

The DOD's stated profit policy also indicates that the difficulty of the task should be a factor in determining the profitability of defense sales. Innovative work is generally more difficult than producing established products. Thus, the extent of innovation should be positively correlated with the profit rates earned by defense contractors. Keeping an innovative lead in developing advanced defense products is a critical strategy for the U.S. to maintain defense advantages over the enemy (Rogerson, 1989). According to Rogerson (1989), the optimal strategy for the DOD to motivate defense contractors' efforts in innovations is to allow them to earn positive economic profits because the level of efforts by a firm in the innovative process and the quality of an innovation are difficult to monitor. Thus, our hypothesis 2 is:

H2: *Ceteris paribus*, profitability earned by defense contractors from defense sales is positively associated with the extent of innovation involved in the defense business.

According to the profit policy stated by DOD, the source of resources should be another factor that determines the profitability of defense sales. When the sources available to the DOD for procurement of one defense product are limited, the individual defense suppliers of the products become more influential because the DOD has fewer alternatives suppliers to pursue; consequently, the DOD is more dependent on these suppliers. Thus, the influence of defense suppliers should be positively associated with rate of profits.

In addition, captured regulator theory in prior studies also suggests a positive association between the influence of defense suppliers and the profits earned by them (Leitzel, 1992; Karpoff et al., 1999). The two studies suggest that the DOD is a captured regulator working for the best interest of influential defense contractors. Karpoff et al. (1999) find that the DOD's fraud oversight system benefits influential defense contractors (firms with Top 100 defense awards) at the cost of non-influential contractors (unranked defense firms with smaller awards) by imposing much larger punishments on the frauds of non-influential contractors. McGowan and Vendrzyk (2002) also provide evidence that pure government segments of influential defense contractors were more profitable during the period of 1994 to 1998 than those of firms with smaller awards. Thus, our hypothesis 3 is:

H3: *Ceteris paribus*, profitability earned by defense contractors from defense sales is positively associated with the influence of the defense contractors in the defense market.

Method

Sample

Our sample period is from 1984 to 1998. Prior to 1984, not many firms reported segment sales to the government. After 1998, most firms stopped reporting segment sales to the government and instead started reporting segment sales to major customers due to the change in disclosure requirements on segment reporting by the SEC in January1999 (SEC Final Rule 33-7620). Our initial sample is all the firms with non-zero segment sales to the government included in the 1984-1998 Compustat segment files.[1] The initial sample includes 11,867 firm-year observations. Our data at firm level were collected from Research Insight database; thus we eliminate 670 firm-year

[1]We treat all the firms with sales to the government as defense contractors because defense sales account for the majority portion of all the sales to the U.S. government (Lichtenberg, 1992; McGowan and Vendrzyk, 2002).

observations with missing values in Research Insight database.[2] Following Lichtenberg (1992), we also remove 146 firm-year observations with return on average assets greater than 1 or less than –1. The final sample includes 11,051 firm-year observations.

Tests of Hypotheses

The general approach for testing hypotheses is to examine the effect of risk, innovation, and influence on the correlation between the percentage of a firm's defense sales to its total sales and the firm's rate of profits. Due to the existence of externalities (Bohi, 1973) and cost shifting (Lichtenberg, 1992), the profits of government sales and commercial sales are not separable. Thus, we examine the profitability at the firm level, rather than at the level of defense contracts or segments with defense sales. The effect of defense sales on a firm's profitability is measured by the correlation between percentage of defense sales to a firm's total sales and the firm's rate of profits. Risk of defense business, innovation involved in defense work, and influence of defense contractor are considered as moderating variables for the correlation. We employ OLS regression to test the null hypotheses that the correlation between percentage of defense sales to a firm's total sales and the firm's rate of profits does not vary with the hypothesized factor variables.

The dependent variable for the hypotheses is the rate of profits for firms with defense sales. We use R&D-adjusted return on average assets (AdROA) to measure rate of profits. R&D-adjusted return on average assets is calculated as income before extraordinary items and discontinued operations plus R&D expenses, then divided by the average of the current year's and the prior year's total assets. We add R&D expenses to a firm's reported income in the calculation of returns because U.S. GAAP adopts a conservative rule for R&D expenditures. The rule requires, with a few exceptions, all R&D expenditures to be immediately expensed, although most R&D expenditures help to produce sales for future periods. This causes a mismatching of revenues and expenses and potentially results in understatement of profitability for firms with high R&D expenditures during the period (Lev and Sougiannis, 1996).

[2]We did not eliminate firm-year observations that had missing values for research and development (R&D) expenses and intangible assets. A zero was assigned instead to these missing values. According to Research Insight, the major reason for the missing values is that firms do not report information on certain items or they combine two or more items into one item. We assume that firms do this because they do not have these items or the amounts of the items are immaterial. A large percentage of our sample firms (more than 50 percent) have missing values for R&D expenses and/or intangible assets. Exclusion of firm-year observations with these missing values, which substantially reduces sample size, yields qualitatively similar results.

The main-effect independent variable is the percentage of a firm's defense sales to its total sales (TGSPSAL). We measure this variable as the sum of each segment's defense sales of a firm (TGVSAL) divided by the firm's total sales (SALE). The correlation between the percentage of a firm's total sales from defense sales and the firm's rate of profits indicates the effect of defense business on the firm's profitability. A significant positive correlation suggests that defense business, in general, earns higher rates of profits than does commercial business.

The moderating independent variables are the factor variables, i.e., risk of defense business, innovation involved in the defense business task, and influence of defense contractors. The risk assumed by a firm for engaging in specific defense business is a type of operating risk. There is no measure available in prior research to measure it directly. We use capital intensity as a proxy for operating risk. The more capital assets committed by a firm, the higher operating risk is assumed by the firm for engaging in the defense business. High capital intensity is associated with a high level of fixed cost relative to total cost. When the demand for defense products drops due to political changes or the end of a war, the declines in defense sales tend to have a greater damaging effect on profits of defense contractors with higher capital intensity. Capital intensity is defined as the sum of net property, plant, and equipment with intangible assets, scaled by total sales. The use of this proxy is consistent with DOD's profit policy. The DOD profit policy considers facilities capital investment, which refers to net book value of tangible and intangible capital assets subject to amortization, as a major risk factor for defense contractors (DFAIR, 1985, VI).

Innovation involves a change in production resulting from a new or improved product, process, technique, or method (Johnston, 1966). Following prior research (e.g., Hitt et al., 1996; Lev and Sougiannis, 1996), we use R&D intensity as a proxy for innovation, which is generally measured as reported R&D expenses divided by total sales of a firm.

Following Karpoff et al. (1999) and McGowan and Vendrzyk (2002), influence in this study refers to the market and/or political power of a defense contractor. These two studies use whether or not defense contractors are included in the annual DOD report, *100 Companies Receiving the Largest Dollar Volume of Prime Contract Awards*, as a way to gauge influence of defense contractors. The firms on the 100 ranking list are considered as influential contractors, and the firms not on the list are considered non-influential.

We measure the influence of a defense firm directly with the magnitude of the firm's annual sales to the government.[3] We do not use the ranking as a measure

[3]The measure for influence appears to be another proxy for size in addition to total sales. But it is different from the proxy for firm size (total sales) because firms with large total sales do not necessarily have large government sales, while firms with relatively large government sales do not necessarily have large total sales. Take Lockheed Martin and GE as examples. While

because ranked contractors with data publicly available consist of only a small percentage of our sample (sample size = 11,051). Our measure should be consistent with the measure used by the two prior studies because the amount of a firm's defense sales should be highly positively correlated with dollar volume of prime contract awards received by the firm. A large volume of prime contract awards results in a large amount of sales to the DOD in the awarding and/or the following years.

Similar with Lichtenberg (1992) and McGowan and Vendrzyk (2002), we include industry and year to control for industry and year effect. The industry variable takes one of 58 values corresponding to the first two digits of the firm's primary Compustat SIC code. Year variable takes one of 15 values for each of the years from 1984 to 1998. We also include sales as a variable to control for size effect as suggested by prior research (Core et al., 1999). The following regression model was estimated for our sample firms:

$$\begin{aligned} AdROA_{it} = {} & \beta_0 + \beta_1 TGSPSAL_{it} + \beta_2 TGSPSAL_{it} * Risk_{it} \\ & + \beta_3 TGSPSAL_{it} * Innovation_{it} + \beta_4 TGSPSAL_{it} * Influence_{it} \\ & + \beta_5 Risk_{it} + \beta_6 Innovation_{it} + \beta_7 Influence_{it} + \beta_8 Industry_{it} \\ & + \beta_9 Year_{it} + \beta_{10} Size_{it} + \varepsilon_{it} \end{aligned} \quad (1)$$

where ε_{it} is a random error term. Table 1 defines the variables.

Table 1—Variable Definitions

Variable	Definition
$AdROA_{it}$:	Adjusted return on assets, measured as income before extraordinary items and discontinued operation plus R&D expenses, then divided by average of total assets for year t and year t-1 of firm i. This is then multiplied by 100
$TGSPSAL_{it}$:	The percentage of total sales from sales to the domestic government for firm i and year t
Risk:	Proxy for risk, measured as the sum of net property, plant, and equipment, and intangible assets, scaled by total sales for firm i and year t
$Innovation_{it}$:	Proxy for innovation, measured by R&D expenses scaled by total sales for firm i and year t
$Influence_{it}$:	Proxy for influence, measured by the value of sales to the domestic government for firm i and year t
$Industry_{it}$:	Control variable for the industry effect, which assumes one of 58 values corresponding to the first two digits of the SIC code for firm i and year t
$Year_{it}$:	Control variable for the year effect, which assumes one of 15 values corresponding to each year of 1984-1998 for firm i and year t
$Size_{it}$:	Control variable for the size effect, measured by total sales for firm i and year t

Model:

$$\begin{aligned} AdROA_{it} = {} & \beta_0 + \beta_1 TGSPSAL_{it} + \beta_2 TGSPSAL_{it} * Risk_{it} + \beta_3 TGSPSAL_{it} * Innovation_{it} \\ & + \beta_4 TGSPSAL_{it} * Influence_{it} + \beta_5 Risk_{it} + \beta_6 Innovation_{it} + \beta_7 Influence_{it} + \beta_8 Industry_{it} \\ & + \beta_9 Year_{it} + \beta_{10} Size_{it} + \varepsilon_{it} \end{aligned}$$

Lockheed Martin is much smaller than GE in total sales, it reported much greater amounts of sales to the government than GE did during the period from 1993 to 1998.

The coefficient of β_1 indicates the effect of the share of total sales from defense sales on a firm's profitability. Our major coefficients of research interest are β_2, β_3, and β_4. A positive β_2, β_3, and β_4 support hypothesis 1 (the effect of risk on the correlation between the share of total sales from defense sales and a firm's profitability), hypothesis 2 (the effect of innovation on the correlation), and hypothesis 3 (the effect of influence on the correlation).

Empirical Results

Descriptive statistics for the variables in the regression model are reported in Table 2. Extreme values exist for the variables such as R&D-adjusted returns and R&D intensity. To mitigate the potentially undue influence of these extreme values on the coefficients estimated from the regressions, we trim the data based on Cook's D and standardized residuals. More specifically, we exclude the firm-year observations with Cook's D larger than 2k/n (k is the number of regressors in the model; n is the total number of firm-year observations), and observations with the absolute value of the standardized residuals larger than 3 (Besley et al., 1980).

Table 2—Descriptive Statistics of Variables (n = 11,051)

Variable	Mean	Standard Deviation	Min.	1st Quarter	Median	3rd Quarter	Max.
AdROA	3.35	16.35	-98.05	0.70	4.83	9.90	427.22
TGSPSAL	0.30	0.28	0.00	0.07	0.19	0.47	1.00
Risk	0.78	5.48	0.00	0.14	0.28	0.68	452.09
Innovation	0.45	17.38	0.00	0.00	0.00	0.05	1639.00
Influence	206.50	867.12	0.00	3.45	15.97	74.00	18714.00
Size	1066.10	4314.90	0.01	18.98	90.78	545.41	218399.00

Variables are defined as:

AdROA = (100* (Income + R&D expenses)/average assets)
TGSPSAL = (total government sales/total sales)
Risk = ((PP&E + Intangible assets)/total sales)
Innovation = (R&D expense/total sales)
Influence = (total government sales)
Size = (total sales)

The results of OLS regression to test the hypotheses are reported in Table 3. The negative coefficient for $TGSPSAL_{it}$ ($\beta_1 = -3.4756$, $t = -7.15$, $p < 0.01$) indicates that, controlling for other factors, a higher percentage of total sales from defense sales is related to a lower return on assets for a firm, which suggests that defense sales generally are less profitable than commercial sales. The positive coefficients for the interaction terms,

$TGSPSAL_{it}$*$Risk_{it}$ ($\beta_2 = 1.0608$, $t = 4.63$, $p < 0.01$),
$TGSPSAL_{it}$**$Innovation_{it}$ ($\beta_3 = 0.3997$, $t = 2.72$, $p < 0.01$), and
$TGSPSAL_{it}$**$Influence_{it}$ ($\beta_4 = 0.0017$, $t = 2.24$, $p < 0.05$),

Table 3— Regression Results for Hypotheses Testing (n = 10,770)

	Dependent Variable: $AdROA_{it}$		
Independent Variables	Pred.	Coef.	t-stat.
CONSTANT		8.8330	
$TGSPSAL_{it}$	?	-3.4756	-7.15**
$TGSPSAL_{it}$ * $Risk_{it}$	+	1.0608	4.63**
$TGSPSAL_{it}$ *$Innovation_{it}$	+	0.3997	2.72**
$TGSPSAL_{it}$ *$Influence_{it}$	+	0.0017	2.24*
$Risk_{it}$	?	-1.6631	-10.86**
$Innovation_{it}$	?	-0.2687	-2.00*
$Influence_{it}$	?	-0.0004	-0.75
$Size_{it}$	+	0.0003	3.40**
$Year_{it}$		Yes	Yes
$Industry_{it}$		Yes	Yes
Adjusted R^2		0.0308	
F-Value		35.27**	

** Significant at the 0.01 level
* Significance at the 0.05 level

The observations with extreme values and/or undue influence are identified based on Cook's D and standardized residual. We exclude from the regressions all the observations with Cook'D > 2k/n (k is the number if regressors in the regression model; n is the total number of firm-year observations) and observations with |standardized residual| > 3

suggests that defense contractors assuming higher operating risks, being more innovation-oriented, and being more influential, could earn relatively high profitability from defense business than other defense contractors. The results are consistent with our hypotheses.

Sensitivity Analysis

We use R&D-adjusted return on average assets (AdROA) as the dependent variable for the regression model in Table 3. In calculating R&D-adjusted return on average assets, we assumed all R&D expenditures being capitalized in the period of occurrence, and added back 100 percent of R&D expense to the income. Like other capital assets such as property, plant, and equipment and intangible assets, a portion of the capitalized R&D may need to be amortized (expensed) during the period. Therefore, we calculate three alternative measures of the dependent variable by assuming amortization of 10 percent, 20 percent, or 30 percent of capitalized R&D. Using the three alternative measures as the dependent variable, we re-run the OLS regressions of equation (1). The results, as reported in Table 4, remain qualitatively unchanged.

In the primary analysis, we calculate the risk proxy, capital intensity, as the sum of net property, plant, and equipment with intangible assets, scaled by total sales. Some intangible assets such as goodwill may not be considered as valid facilities capital investments by the DOD. Thus, we exclude intangible assets in the calculation of an alternative measure for capital intensity. Using the alternative measure for

Table 4—Regression Results for Hypotheses Testing

		Dependent Variable		
		AdROA1 (n = 10,761) Coef.	AdROA2 (n = 10,758) Coef.	AdROA3 (n = 10,750) Coef.
Independent Variables	Pred.	(t-stat.)	(t-stat.)	(t-stat.)
CONSTANT		8.0346**	7 7.3476**	6.6190**
		-3.0928**	-2.8650**	-2.5631**
$TGSPSAL_{it}$	?	(-6.42)	(-6.00)	(-5.39)
		0.9782**	0.8132**	0.6575**
$TGSPSAL_{it}$ * $Risk_{it}$	+	(3.69)	(3.11)	(2.51)
		0.4832*	0.6036**	0.7975**
$TGSPSAL_{it}$ *$Innovation_{it}$	+	(2.39)	(2.99)	(3.97)
		0.0017*	0.0017*	0.0017*
$TGSPSAL_{it}$ *$Influence_{it}$	+	(2.27)	(2.26)	(2.26)
		-1.4351**	-1.2207**	-1.0384**
$Risk_{it}$	?	(-9.42)	(-8.26)	(-6.94)
		-0.5441**	-0.7476**	-0.9938**
$Innovation_{it}$	?	(-4.03)	(-5.51)	(-7.35)
		-0.0004	-0.0004	-0.0005
$Influence_{it}$	?	(-0.77)	(-0.78)	(-0.83)
		0.0003**	0.0003**	0.0003**
$Size_{it}$	+	(3.58)	(3.72)	(3.92)
$Year_{it}$		Yes	Yes	Yes
$Industry_{it}$		Yes	Yes	Yes
Adjusted R^2		0.0293	0.0293	0.0297
F-Value		33.48**	33.48**	33.94**

** Significant at the 0.01 level

* Significance at the 0.05 level

The observations with extreme values and/or undue influence are identified based on Cook's D and standardized residual. We exclude from the regressions all the observations with Cook'D > 2k/n (k is the number of regressors in the regression model; n is the total number of firm-year observations) and observations with |standardized residual| > 3

AdROA1: R&D-adjusted return on assets with 10 percent of R&D expenditures being expensed in the year of occurrence

AdROA2: R&D-adjusted return on assets with 20 percent of R&D expenditures being expensed in the year of occurrence

AdROA3: R&D-adjusted return on assets with 30 percent of R&D expenditures being expensed in the year of occurrence

capital intensity, we re-estimate the regression models in Table 3 and Table 4. The results (not reported) remain qualitatively similar with those presented.

We use alternative measures to control for the industry effect. The industry variable takes a value corresponding to the first one digit or three digits of the firm's primary Compustat SIC code. Our sample period is from 1984 to 1998. Thus, we also use sales in constant 1998 dollars rather than sales in dollars of each year to control the size effect. The results (not reported) remain qualitatively the same.

We use an alternative measure for the influence variable. We replace total government sales variable in the regressions with an indicator variable based on ranking of total government sales for each year. The indicator variable is coded 1 if a firm is

among the 100 firms with the largest government sales for a sample year and 0 otherwise. The results (not reported) remain similar to those reported.

Conclusions

This study investigates whether defense contractors are rewarded for the risk assumed for engaging in the defense business, for the extent of innovation involved in the task, and for their market or political influence. Our empirical evidence indicates that risk, innovation, and influence are positively associated with rate of profits earned by defense contractors from defense sales. The evidence suggests that the profitability of defense contractors seems reasonable in respect to rewarding risk and innovations.

The implication of the positive association between influence and rate of profits is less clear. It may suggest that the DOD was a regulator captured by influential defense contractors, but it also may merely reflect the reasonable extra reward due to limited procurement sources available to the DOD. The discrimination of the two explanations is a topic of future research. In addition, this study suggests the DOD seems to have effectively implemented its stated profit policy.

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