



## Profitability of Defense Companies in the US and Europe

Jean Belin & Mahdi Fawaz

To cite this article: Jean Belin & Mahdi Fawaz (2024) Profitability of Defense Companies in the US and Europe, Defence and Peace Economics, 35:4, 415-426, DOI: [10.1080/10242694.2024.2329865](https://doi.org/10.1080/10242694.2024.2329865)

To link to this article: <https://doi.org/10.1080/10242694.2024.2329865>



Published online: 13 Mar 2024.



Submit your article to this journal [↗](#)



Article views: 417



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 3 View citing articles [↗](#)



# Profitability of Defense Companies in the US and Europe

Jean Belin<sup>a</sup> and Mahdi Fawaz<sup>b</sup> 

<sup>a</sup>BSE, University of Bordeaux, Bordeaux, France; <sup>b</sup>CEPN, Sorbonne Paris Nord University, Paris, France

## ABSTRACT

The profitability (ROA) of US and European defense companies are influenced by past profitability, debt policy, company size, and defense specialization. Taking into account the effect of these variables, individual company characteristics and time specificities, the profitability of US defense companies remains higher than that of European companies. Moreover, US defense firms are more profitable when specialized in defense, while European companies are more dependent on the civilian market and its evolution. The position of a company in the SIPRI ranking has a negative impact on American companies' profitability, while it positively influences European companies' profitability. These results could be due to excessive fragmentation (of orders and industries) on the European market and high concentration on the US market.

## ARTICLE HISTORY

Received 3 July 2023  
Accepted 9 March 2024

## KEYWORDS

Profitability (ROA); defense companies; GMM system estimator; SIPRI

## JEL CLASSIFICATION

D53; C20; H56; F59

## Introduction

One way to spend better if we spend more is to build a successful European defense industry. The European Union (EU) has recently put in place a series of initiatives aimed at improving the performance of the defense market<sup>1</sup> and reducing its splitting (CARD,<sup>2</sup> EDF<sup>3</sup>). In the United States, the performance of companies (Gutiérrez and Philippon 2018) – particularly, defense companies (Department of Defense report 2022) – is also becoming an important issue: their current performance could be a sign of too much market concentration.

Performance is the result obtained in a given field. Economists measure performance using various indicators. In a market, performance can be analyzed from the supply or demand side using quantitative or qualitative<sup>4</sup> performance indicators.

On the demand side, performance will be measured by customer satisfaction and loyalty (Smith and Wright 2004), price, quality, lead times, innovation or product and service performance (Department of Defense report 2022). On the supply side, much of the economic literature focuses on the determinants of firm performance. Firm performance is measured in various ways (see Siepel and Dejjardin 2020): firm survival, sales, market share, productivity, R&D or innovation, export rates (see Hartley, White, and Chaundy 1997), debt (King and Santor 2008) or financial performance. For listed firms, some of the literature focuses on stock market performance (Göktepe and Satyanath 2013), but financial performance is most often measured by ROA<sup>5</sup> (Callado-Muñoz et al. 2020; Chaundy 1997; Harper 1999; Hartley, White).

In this study, we focus on financial performance and analyze the profitability (ROA) of EU and US companies. Profitability is the ratio of a result (profit) to the capital required to achieve it. This result depends on both the environment in which the company operates and its choices. In industrial economics, the traditional structure – conduct – performance approach (Mason 1939) studies the links between the structure of a market, the conduct of firms in that market or industry, and the firms'

economic performance. The characteristics and composition of an economy's markets (e.g. concentration, economies of scale, and barriers to entry and exit) are important determinants of performance. In a business strategy, the role of the company's internal resources (production factors, financing, technological choices, reputation, etc.) is decisive. Organizational structures, management practices, and resource allocation are thus the main sources of heterogeneity in company performance.

These theories have mainly been used to study the determinants of profitability and to analyze abnormal profits or the persistence of corporate profits.<sup>6</sup> They have given rise to a great deal of empirical work that has made it possible to highlight both the specificities and characteristics of the country, market, or company being analyzed. The profitability of defense companies has been studied, but there are few recent studies, particularly in the case of Europe, and none of them compare Europe and the United States.<sup>7</sup> At a time when Europe is seeking to develop its defense industrial policy, it is important to have research results that include European companies. If corporate profitability is too high, legitimate debates will arise regarding the resources allocated to this sector. If it is too low, companies will not be encouraged to invest in these activities, which will have a significant impact on prices or product quality. Therefore, a trade-off must be made between protecting the interests of taxpayers and allowing defense companies to maintain their activities in a strategic sector. For these reasons, we analyze the determinants of profitability (ROA) of defense companies in the United States and Europe based on the Top 100 of the SIPRI's ranking from 2006 to 2020.

In the first part of this paper, we present the results of studies on the profitability of companies and then recall the specificities of defense companies in the United States and Europe. In the second part, we present our empirical strategy. Finally, in the third part, we discuss our results.

## Literature Review

Several studies have analyzed the profitability of defense companies, but none have compared the United States and the EU in the field of defense. Defense companies in the United States and Europe, however, have different characteristics and operate in different environments.

Profitability is the ratio between profit and the capital needed to achieve it. It is a measure of business performance. It is influenced by prices, quantities sold, and the various costs incurred by the company. It can be distributed to shareholders as a reward for their investments, or it can be used to increase the company's equity. It thus partly reflects the sharing of the fruits of economic activity between customers, employees, the state, the subcontracting chain, and capital providers. It encourages innovation by making it possible, on the one hand, to release resources to finance new investments and research, but future profitability, in particular, is also an incentive for innovation that pushes the industry to offer better technical solutions. On the other hand, too high performance can be a sign of insufficient competition and have consequences for costs, quality, or innovation. For these reasons, many studies have analyzed the determinants of profitability through the characteristics of the company and its environment (market structure, effect of regulation, etc.), the reasons for abnormal profits,<sup>8</sup> or the persistence of these profits. These studies usually focus on a country or group of countries. Other researchers have taken a more sectoral approach and analyzed the determinants of profits for a particular sector or market.<sup>9</sup> The profitability of companies in a sector is indeed an important issue, especially since the latter is controlled by the state.

Pepall and Shapiro (1991) analyze the determinants of the profit of 160 Canadian defense firms from 1980 to 1985. Alongside the individual characteristics of the companies (size, debt, etc.), they also introduce the proportion of defense contracts. They find no connection between the rate of profit and the proportion of defense contracts, exports, or public funding. Lichtenberg (1992) is not specifically interested in defense but analyzes the influence of public orders obtained on corporate profits from 1984 to 1989. He finds a positive and significant effect of having public orders. McGowan and Vendrzyk (2002), using a similar method over the periods 1984-1989 and 1994-1998, find higher profits for companies receiving public contracts only in the first period. The first period would be

characterized by little competition, while competition would be greater in the second period and associated with a decline in public demand. Zhong and Gribbin (2009) show, over the period 1984–1998, that US defense contractors that took the most risk were more profitable than other defense companies. This result is consistent with DOD policy, which makes company margins dependent on this criterion. They also find that market power (a company's market share) has a positive effect on the profitability of US defense companies. To measure risk, they integrate the ratio of tangible (and intangible) assets to sales. Companies with heavy investments are more at risk from variations in earnings. Wang and San Miguel (2012) find that US defense companies made larger profits between 1950 and 2010 using different measures of profitability.<sup>10</sup> Callado-Muñoz et al. (2020) analyze the performance of Spanish defense companies following regulatory reforms. Their econometric study shows a decrease in profitability (ROA) of all defense companies following the reforms (this impact is as important for major defense companies as it is for other defense companies) and an increase in the productivity of major contractors and large companies. In this way, they demonstrate the influence of public authorities and steering policies on the performance of defense contractors. Callado-Muñoz et al. (2023) analyze the influence of civil, dual, and purely defense research and development (R&D) on the performance of Spanish defense companies over the period 2011–2018. They find that R&D expenditure exerts a positive and significant effect on the ROA of Spanish defense companies and that this effect is more marked for certain types of R&D. Thus, the effect of dual R&D is more pronounced than that of defense R&D, which, in turn, is more pronounced than that of civil R&D. To the best of our knowledge, no study has compared the defense profitability of several countries, and in particular, compared the United States and the EU.

## Defense Markets and Companies in the United States and Europe

Defense markets are highly specific in terms of both structure and conduct. Despite the rapprochement of the US and EU markets in the 1990s, their environment and company characteristics remain highly specific.

The defense goods and services market has a unique structure. There are few suppliers (Fonfria and Correa-Burrows 2010) and, concurrently, governments tightly control trade in defense goods (Sandler and Hartley 1995). On the one hand, more often than not, only one or two national companies per domain can provide equipment in line with the country's strategic choices. Therefore, they can have significant bargaining power and higher profits (McGowan and Vendrzyk 2002; Pepall and Shapiro 1991). On the other hand, there is tight control of the market by public authorities. The state alone determines the level of national and international demand. At the national level, the state is the sole buyer. At the international level, companies are subject to obtaining export permits issued by the state. In addition, exports are most often due to political and diplomatic factors that are determined by the state. Public authorities have other means of influencing defense companies, notably through financing decisions (R&D or presence in the capital of defense companies).

Defense markets in the United States and Europe share the same characteristics as those described above but differ both in terms of order size and market fragmentation. Defense spending in the United States was previously projected to reach 686 billion euros by 2021, compared to 214 billion euros for the 26 EDA member states (European Defence Agency 2022). In addition, orders addressed to European defense companies are very fragmented (178 different weapons systems in Europe/30 in the United States). The structure of the defense market will determine the market power of buyers and sellers and influence the profits made by defense companies.

Nevertheless, measuring market power in defense markets remains difficult. Some authors study defense market concentration (Dunne and Smith 2016) using the SIPRI ranking. Each company's market share is calculated by dividing its defense sales by the sum of the sales of the 100 companies in the ranking. We have tried to include this information in our equations, but this variable has no significant influence. This does not mean, however, that market concentration does not influence profitability. Indeed, as Dunne and Smith (2016) point out, this measure of market concentration is

imperfect both theoretically and empirically.<sup>11</sup> Theoretically, with this measure, the defense market is then considered, at global level, as unique yet the defense market at global level is far from unified, there are both national sub-markets and/or by product type. Secondly, empirically, this assumes that the sum of sales figures is a measure of market size. This is a very strong assumption, as many defense companies and activities do not appear in this ranking. In economic literature outside the defense sector, this problem is frequently encountered with individual data. The individual data available (in this case, the defense sales of the 100 SIPRI companies) do not reflect market concentration. The authors therefore prefer to use aggregate indicators (see Fungáčová, Shamshur, and Weill 2017; or; Rexhäuser and Rammer 2014). In defense this type of indicator is not available because defense is not a sector in the sense of national accounting.

As far as defense companies are concerned, despite the common developments that have taken place in Europe and the United States, they also retain strong specificities. DIB models in the United States and Europe have become closer to one another since the 1990s (see Belin 2019; Dunne 1995; Hartley and Sandler and Hartley 1995). Defense companies have been gradually privatized and restructured to form large industrial groups. The use of private financing in the defense sector has increased, and the influence of financial markets has intensified. They have become internationalized, and competition has increased with the emergence of new players such as China. The intensification of research efforts, particularly on civilians, has made the innovation process more complex by mobilizing more knowledge and actors. Purchasing policies have also been redefined to reduce costs, increase potential competition, and share risk with private investors (Hartley 2003). The United States is the most striking example of these changes, but a similar strategy has been followed by the United Kingdom and other EU governments. Nevertheless, strong specificities remain between American and European defense companies.

Fragmentation also affects industry, with a very fragmented European industry<sup>12</sup> that has experienced or is experiencing consolidations, but which are not comparable to those observed in the United States. European defense companies must therefore be more diversified and less dependent on the national defense market. They have high export rates and are more dual. US defense companies operate in a unified market, where orders are very high and they are less dependent on exports. The shareholding and financing of European companies also distinguishes them from American companies. Public authorities are often shareholders in these companies, even if they are listed on the markets (Belin, Fawaz, and Masson 2019). In the United States, the weight of institutional investors is dominant in their shareholding, often in the position of reference shareholders.

The differences in environments and individual characteristics could lead to differences in profitability. Harper (1998) points out that American defense companies could be more profitable than European ones because of their different modes of governance. Descriptive statistics (Table 1) also show that the ROA of US defense companies is significantly higher than that of European defense companies (5% vs. 3%). The econometric work will allow us to know if American and European defense companies present a different profitability once the individual characteristics of the companies and time dummies are considered.

## Data and Empirical Strategy

To identify defense companies, we use the SIPRI Top 100 ranking from 2006 to 2020 (company name, rank in the ranking, and defense turnover). We then keep the companies for which we have economic and financial information (balance sheets and income statements) in the Orbis database (Bureau Van Djick). We restrict our sample to American and European companies. We use a dynamic relationship in which the explained variable is lagged by a period existing in the explanatory variables. Other studies (Mairesse, Mulkay, and Hall 2001; Van Reenen 1999) have shown that results obtained from dynamic relationships turn out to be more consistent. The estimated econometric model establishes a linear relationship between the rate of return of assets rated ROA, its lagged value over a period, and a set of control explanatory variables X:

**Table 1.** Descriptive statistics.

	All firms		US firms		European firms	
	<i>Obs</i>	<i>Mean</i>	<i>Obs</i>	<i>Mean</i>	<i>Obs</i>	<i>Mean</i>
ROA*	503	.04	330	.05	173	.03
Turn. Growth	503	.06	330	.05	173	.07
		.14		.13		.15
Def. Turn. Growth	460	.06	292	.06	168	.06
		.17		.14		.2
Civ. Turn. Growth	460	.03	292	0	168	.07
		.73		.77		.64
Debts*	503	.13	330	.15	173	.09
		.17		.19		.12
Total assets (ln)	503	15.9	330	15.89	173	15.92
		1.46		1.54		1.31
Employees (ln)*	315	54267.2	202	60183.8	113	43690.6
		58715.1		68341		33276.8
% from Def*	503	.39	330	.43	173	.33
		.36		.38		.31
Rank	462	39.22	292	37.19	170	42.71
		29.53		30.24		28

$$ROA_{i,t} = \beta_1 ROA_{i,t-1} + \beta_2 X_{i,t} + u_i + v_t + e_{i,t} \quad (1)$$

where  $u$  is the individual-specific effect,  $v$  is the specific temporal effect, and  $e$  is the error term. Our specification is very close to those of Gedajlovic and Shapiro (2002) and Estrin, Poukliakova, and Shapiro (2009). The return on assets (ROA) profitability ratio is defined as the ratio of profits or losses to total assets. This method of calculating profitability is widely used in the literature (Callado-Muñoz et al. 2020; Gschwandtner and Hirsch 2018; Lichtenberg 1992; McGowan and Vendrzyk 2002; Patel and Tsionas 2022; Tchuigoua and Nekhili 2012) and has the merit of being one of the most appreciated measures (C. Iltner, Larcker, and Madhav 1997). Among works on the profitability of defense companies, it is also the most widely used variable. Studying the determinants of ROA will therefore allow us to make comparisons with other results in the literature. We then use several  $X$  control variables: size, turnover growth rate, debts, and a regional dummy (1 if US firms and 0 otherwise). Size is measured as the logarithm of total assets or headcount. The company's financial structure is summarized by the ratio of net debt to total assets. The temporal indicators make it possible to control the effects of economic shocks common to all companies, and the country indicators allow us to see whether the profitability of companies differs according to the country.

Dynamic models are characterized by the presence of one or more delayed endogenous variables among the explanatory variables. The estimation of model (1) using conventional methods (OLS and/or fixed-effects model) gives biased and non-convergent estimators because of the correlation between the lagged endogenous variable and individual heterogeneity. The introduction of the lagged variable raises the question of the simultaneity of this variable with the residual error. To consider all the partial sources of possible biases,<sup>13</sup> we apply the econometric specification developed by Blundell and Bond (1998) based on the Generalized Method of Moments (GMM) system method.<sup>14</sup> They show that the GMM system estimator is more efficient than that of GMMs in first differences (Arellano and Bond 1991); the latter gives biased results in finite samples when the instruments are weak. Finally, two tests are associated with the GMM estimator in the dynamic panel. The first is the Sargan/Hansen over-identification test, which tests the validity of lagged variables as instruments. The second is the autocorrelation test of Arellano and Bond (1991), where the null hypothesis is the absence of second-order autocorrelation of errors.

We find that the diagnostic statistics are favorable for all specifications. The Arellano and Bond test for autocorrelation conducted on the second difference and the Hansen test do not make it possible to reject the hypothesis of absence of autocorrelation of errors and that of the validity of the instruments used.

## Discussion

The first specification tested considers delayed profitability, turnover growth rate, debts, size, a spatial indicator (US or EU), and time indicators. The second specification decomposes growth in activity into growth in civil and defense activities. The third uses the company's workforce to measure its size rather than the log of total assets. We then successively add to specification 1 the fact that the company is dual defense (defense activity > 66.6% of total turnover) or dual civil (civil activity > 66.6% of total turnover) and rank in the SIPRI ranking.

The results show the importance of past profitability, debt policy, size, and defense or civilian specialization in determining the profitability of US and European defense companies. The value of the coefficient (0.15) for delayed profitability and its significance (significant at 1%) show the importance of taking the dynamic into account. Today's performance is partly determined by past performance. Numerous empirical studies have shown this phenomenon of persistence of benefits (Bou and Satorra 2007; Gallizo et al. 2014; Goddard, Tavakoli, and Wilson 2005; Gschwandtner 2005; Gschwandtner and Hirsch 2018; Mueller 1986; Pattitoni, Petracci, and Spisni 2014). It would be interesting to later compare the persistence of profits in the defense and other sectors. The value of the coefficient for defense seems lower than that obtained for other sectors (see Gschwandtner and Hirsch 2018). However, the periods, the size of the companies, and the estimation methods of these studies are not similar. As expected, the company's financial structure, summarized by the ratio of net debt to total assets, also exerts a negative and significant influence at the 1% threshold (Pepall and Shapiro 1991). This is because of the higher cost of this source of funding compared with internal or equity financing. The use of debt makes it possible to benefit from a leverage effect, but it can be riskier and more expensive. We anticipate that the recent increase in interest rates and the anticipation of an increase in financing will remain important determinants of the performance of defense companies in the future. The size of the company negatively influences profitability. Taking total assets as an indicator of size exerts a negative and significant influence on profitability in specifications 2 and 6. Similarly, the size measured by the workforce has a negative and significant influence (specification 3). Patel and Tsionas (2022) also find a negative effect of company size (measured by turnover) on the profitability of a sample of publicly traded companies. However, we only have very large firms in our sample, and there may be diseconomies of scale at the upper end of the firm size distribution (see J. Lee 2009; Ratchford and Stoops 1988). With a sample including smaller companies, the hypothesis of increasing returns to scale is confirmed (Gschwandtner and Hirsch 2018; Meyer 2019). Specialization at the activity level (civilian or defense specialization) significantly influences, at the 10% threshold, the profitability of defense companies (specifications 4 and 5).<sup>15</sup>

Across all companies, companies specializing in defense (defense activity > 66.6% of total turnover) are significantly more profitable, while companies specializing in civil matters are significantly less profitable. These differences do not mean that defense activity is always preferable to civil activity, but that over the period and for the group of companies studied, it is so. This result can be interpreted as a period of more sustained activity in defense than in civilian life. On the other hand, the sales growth rate does not exert a significant influence on the profitability of companies (specification 1; as in Gschwandtner and Hirsch 2018). Only civil activity growth has a significant and positive effect on ROA at 10%. Similarly, the position of the company (rank) in the SIPRI ranking does not exert a significant influence on the performance of companies taken as a whole either.

In all our specifications, once the individual characteristics of the companies, the effect of other variables, and the temporal specificities are taken into account, the profitability of US defense companies remains significantly higher than that of European companies. Therefore, the variables introduced above fail to fully explain the superior profitability of US companies. Specialization in defense activities



(American companies are more specialized in defense, and this specialization has a positive and significant effect on ROA) seems to be a determining factor, but other reasons must be found.

First, the higher profitability of US companies may reflect differences in the structure of the US and European defense markets. This result could be a sign of a lack of competition in the US defense market and too much fragmentation in the European market. McGowan and Vendrzyk (2002) and Wang and San Miguel (2012) find that US defense companies make a larger profit when market concentration increases. Europe has implemented policies to increase competition in defense markets (Callado-Muñoz et al. 2020), while concentration and barriers to entry have increased in the United States (Amara and Franck 2019). Thus, the Pentagon has recently pointed out (Department of Defense report 2022) that the lack of competition in the defense market in the United States represents a risk to the country's national security.

Second, the notion of profitability must also be associated with the notion of risk (Zhong and Gribbin 2009). The market demands greater profitability from riskier companies, and company margins also depend on risk. Zhong and Gribbin (2009) point out that the DOD makes company margins dependent on risk. Similarly, R&D activity, which partly determines the risk taken by a company, influences the profitability of defensive companies (Callado-Muñoz et al. 2023). However, these variables are not available for inclusion in our estimates.

Finally, the business structure of American and European companies could also explain their differing profitability. European companies are more dual-use and less specialized in defense than their American counterparts. They also have a higher proportion of export business. Their activity in more competitive markets (exports and civil vs. defense markets) is therefore more important.

To complete the interpretations obtained from the first estimates (Table 2), we distinguish between the effects on US and European companies (Table 3). The non-significance of the effect of growth in turnover on the performance of defense companies, taken as a whole, masks the differences between American and European companies. The profitability of European defense

**Table 2.** Results.

	(1) ROA	(2) ROA	(3) ROA	(4) ROA	(5) ROA	(6) ROA
LROA	0.150*** (0.0141)	0.161*** (0.0157)	0.161*** (0.0148)	0.149*** (0.0123)	0.150*** (0.0137)	0.161*** (0.0136)
Turnover Growth	0.00442 (0.00999)		−0.00948 (0.0123)	0.00417 (0.00981)	0.00390 (0.0103)	0.00727 (0.00714)
Debts	−0.0711*** (0.0117)	−0.0642*** (0.0150)	−0.0491** (0.0197)	−0.0688*** (0.0119)	−0.0689*** (0.0112)	−0.0607*** (0.0162)
Total assets (ln)	−0.00169 (0.00128)	−0.00303** (0.00140)		−0.00154 (0.00129)	−0.00136 (0.00143)	−0.00535** (0.00215)
USA dummy	0.0236*** (0.00381)	0.0273*** (0.00369)	0.0318*** (0.00556)	0.0227*** (0.00400)	0.0240*** (0.00388)	0.0249*** (0.00389)
Civ. Turnover Growth		0.000802* (0.000477)				
Def. Turnover Growth		0.00228 (0.00791)				
Employees (ln)			−0.00671** (0.00269)			
Dual defense				0.00737* (0.00428)		
Dual civil					−0.00539* (0.00317)	
Rank						−0.000143 (0.000115)
N	502	459	314	502	502	461
AR1	0.042	0.074	0.105	0.042	0.041	0.070
AR2	0.247	0.320	0.284	0.250	0.259	0.320
Test d'Hansen	0.482	0.379	0.502	0.442	0.449	0.482

Note : Robust standard errors in parentheses with \*\*\*, \*\* and \* respectively denoting significance at the 1%, 5% and 10% levels.



Table 3. European and American specificities.

	USA (1)	Europe (2)	USA (3)	Europe (4)	USA (5)	Europe (6)	USA (7)	Europe (8)	USA (9)	Europe (10)	USA (11)	Europe (12)
LROA	0.208*** (0.0154)	0.179*** (0.0200)	0.183*** (0.0213)	0.156*** (0.0133)	0.227*** (0.0340)	0.109*** (0.0150)	0.214*** (0.0160)	0.167*** (0.0236)	0.210*** (0.0165)	0.147*** (0.0228)	0.183*** (0.0196)	0.155*** (0.0138)
Turnover	−0.0308*** (0.00863)	0.00918 (0.0169)			−0.0268** (0.0131)	0.00147 (0.0156)	−0.0332*** (0.00822)	0.0104 (0.0201)	−0.0302*** (0.00912)	0.0172 (0.0176)	−0.00368 (0.00858)	0.0134 (0.0182)
Growth	−0.0473*** (0.0105)	−0.162*** (0.0373)	−0.0457*** (0.0113)	−0.209*** (0.0327)	−0.0171 (0.0219)	−0.144*** (0.0430)	−0.0492*** (0.0112)	−0.202*** (0.0353)	−0.0511*** (0.0110)	−0.176*** (0.0358)	−0.0474*** (0.0125)	−0.176*** (0.0268)
Debts												
Total assets	0.000251 (0.00113)	−0.00806*** (0.00258)	−0.000739 (0.00101)	−0.00691*** (0.00206)	0.027*** (0.00691)	0.0430 (0.00802)	0.000899 (0.00117)	−0.00568** (0.00214)	0.000420 (0.00134)	−0.00802*** (0.00257)	−0.00789*** (0.00143)	−0.00349 (0.00342)
Civ. Turnover												
Growth												
Def. Turnover												
Growth												
Employees												
(ln)												
Dual defense												
					−0.00262 (0.00232)	−0.00681* (0.00385)						
							0.00607* (0.00335)	0.00709 (0.00622)				
Dual civil												
									−0.00226 (0.00458)	−0.0167** (0.00666)		
Rank												
											−0.000413*** (0.0000700)	0.000403** (0.000157)
N	330	172	292	167	202	112	330	172	330	172	292	169
AR1	0.044	0.121	0.003	0.133	0.005	0.194	0.047	0.119	0.049	0.134	0.002	0.131
AR2	0.214	0.463	0.643	0.587	0.854	0.608	0.222	0.505	0.233	0.600	0.729	0.573
Test d'Hansen	0.231	0.979	0.181	0.837	0.173	0.932	0.232	0.785	0.295	0.915	0.158	0.984

Note : Robust standard errors in parentheses with \*\*\*, \*\* and \* respectively denoting significance at the 1%, 5% and 10% levels.

companies does not react significantly to growth in their activities, whereas that of American companies reacts negatively and significantly (at the 10% threshold). This difference could be interpreted as lower adjustment costs for European companies. One explanation could be the different use of production capacities or greater agility. The size of the firm (log of total assets or headcount specifications 1, 2, 5, and 6) has a negative and significant effect on European companies but not on US companies. This result could be due to the fact that the US firms in our sample are all very large, while the European firms are more diverse in size.

Specifications 3 and 4 disaggregate business growth (turnover) into civil and defense businesses for companies. For all companies, an increase in civil or defense activity does not have a significant effect. On the other hand, by distinguishing American companies from European companies, it appears that the profitability of European companies depends significantly and positively on the growth of their civil activity. As mentioned previously, the European market is much less unified than the American market; European defense companies are therefore more dependent on the civilian market and its development. The specialization (66.6% of total turnover) – civil or defense – of the company also influences its profitability (specifications 7, 8, 9, and 10).<sup>16</sup> American companies are significantly more profitable at the 10% threshold when they specialize in defense, while the effect is not significant for European companies. On the other hand, European companies are significantly (at the 10% threshold) less profitable when they specialize in civil matters. This could be explained by the greater dependency of European companies on the civilian market and the fact that activity (GDP) grew less during this period in Europe.

Specifications 11 and 12 include the position of the company (rank) in the SIPRI ranking. This variable does not have a significant influence on the overall performance of companies taken as a whole. On the other hand, by segmenting our sample, the position of the company exerts a significant and negative influence on US companies, while it exerts a significant and positive influence on European companies. If the position of the company in the SIPRI ranking represents the market power or the performance of the company, it is normal that it exerts a positive influence on profitability as for European companies. The result for US companies could be due to entry costs for new programs. An increase in investments (total assets) or headcount initially results in a loss of profit. Indeed, Amara and Franck (2019) show that fixed-cost development contracts have accelerated in the United States in recent years. For the DOD, they have led to a transfer of risk to companies as well as a decrease in monitoring costs. On the other hand, for the winning companies, they may have led to a drop in profits due to the significant costs incurred. Boeing would have lost \$ 3.5 billion on the KC-46 development contract.

## Conclusion

The analysis of the profitability drivers (ROA) of US and European defense companies, based on the SIPRI Top 100 ranking from 2006 to 2020, allows us to assess the influence of the different variables as well as the specificities of US and European defense companies.

For all companies, the results show the influence of past profitability, debt policy, company size, and defense specialization in determining profitability. Moreover, once individual firm characteristics, the effect of other variables, and time specificities are considered, the profitability of US defense firms appears to be higher than that of European firms. Unlike European firms, the profitability of American defense firms is negatively affected by business growth. On the other hand, the profitability of European companies depends positively on the growth of their civilian activity. Regarding the specialization of their activities, American companies are more profitable when they specialize in defense, and European companies are less profitable when they specialize in civil activities. The position of the company (rank) in the SIPRI ranking has a negative influence on the profitability of American companies, whereas it has a positive influence on the profitability of European companies.

As mentioned in the previous section, these results may reflect too much fragmentation (of orders and industries) in the European market. European defense companies are, therefore, more dependent on the civilian market and its evolution. When they manage to have a significant defense activity (rank), their profitability increases.

Owing to the changing strategic and economic environment, defense systems in the United States and Europe must adapt. Budgets are increasing in many countries, but budgetary constraints and rising costs will force states to have the most efficient business models possible to face the strategic context. The costs of defense, due in particular to the development of innovation and small quantity production, are increasing. We can also expect an increase in the cost of financing with the increase in interest rates or the ESG financing practices that are developing. Like other companies, defense contractors are also facing increases in the general price level. To contain these cost increases, in addition to a greater duality of the defense system, one solution is to take advantage of returns on scale by increasing the size of the markets and reducing the fragmentation of the industry. In Europe, there is a lot of room for improvement in this area, as demand is not very Europeanized and supply is still very fragmented. In the United States, because of the already high concentration in the defense industry, the choices will be more limited. Also, 'to spend more and better,' Europe must develop cooperation in procurement but also between companies. This choice could allow us to benefit from the economic advantages of defense spending (business performance, activity, employment, and innovation) while obtaining more freedom of assessment, decision, and action.

## Notes

1. See Callado-Muñoz et al. (2020) for a longer period.
2. Coordinated annual review on defense.
3. European Defence Fund.
4. See Kaplan and Norton (1996) and Ittner, David, and Marshall (2003).
5. See Goddar, Tavakoli, and Wilson (2005) and Griffiths, Jensen, and Webster (2011) for a review of the literature.
6. The question of the persistence and temporal evolution of profit at the firm level has also been analyzed by several researchers. Under competitive conditions, any temporary gap between firm profit and market profit should be quickly corrected by entry and exit effects.
7. Gschwandtner and Hirsch (2018) study the food industry and Gutiérrez and Philippon (2018) analyze all companies.
8. For an earlier period, see also Bohi (1973).
9. Brown and Olmstead (2017) study the profits of the energy sector in Canada, Li et al. (2019) analyze the profits of the coal sector in China, while De Witte and Saal (2010) focus on the water sector in Germany.
10. To accomplish this, the authors use profitability calculation methods such as return on assets (ROA), return on common equity (ROCE) and profit margin ratio (PMR). However, they find that this result would be less consistent with the operating margin ratio (OMR) measurement method.
11. The most relevant data for studying market concentration are microdata on contracts or payments, available only at national level. To study the impact of market structure in the US defense industry on procurement outcomes and build their HHI, Carril and Duggan (2020) use detailed microdata on Department of Defense contract awards. Although market concentration has made the contracting process less competitive, they find no evidence that consolidation has led to a significant increase in acquisition costs.
12. Uneven fragmentation across sectors: aeronautics vs. land but also depending on the type of company (prime contractors or subcontractors).
13. Bias of simultaneity, reverse causality (potentially endogenous independent variables), temporal correlation of errors, and omitted variables or some measurement errors of explanatory variables.
14. Estimates are carried out using Stata 18.0 software using the Xtabond2 command. This approach instrumentalizes the independent variables with their lagged differences and levels. More precisely, the GMM system comprises combining for each period the equation in first differences with that in levels. The GMM system was specifically developed for the estimation of dynamic panel data equations with persistent dependent variables and potentially endogenous independent variables.
15. On the other hand, the defense share (defense turnover/total turnover) does not significantly influence the profitability of companies.
16. On the other hand, the defense share (defense turnover/total turnover) does not significantly influence the profitability of companies.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## ORCID

Mahdi Fawaz  <http://orcid.org/0000-0001-9935-2361>

## References

- Amara, J., and R. Franck. 2019. "The United States and Its Defense Industries." In *The Economics of the Global Defence Industry*, edited by Hartley, and Belin, 640. New York: Routledge.
- Arellano, M., and S. Bond. 1991. "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations." *The Review of Economic Studies* 58 (2): 277–297. <https://doi.org/10.2307/2297968>.
- Belin, J., M. Fawaz, and H. Masson. 2019. "Shareholder Nationality Among the Major European and American Defense Contractors: An Exploratory Data Analysis." *Finance Bulletin* 1 (2): 36–49. <https://doi.org/10.20870/fb.2019.1.3.2406>.
- Blundell, R., and S. Bond. 1998. "Initial Conditions and Moments Restrictions in Dynamic Panel Data Models." *Journal of Econometrics* 87 (1): 115–143. [https://doi.org/10.1016/S0304-4076\(98\)00009-8](https://doi.org/10.1016/S0304-4076(98)00009-8).
- Bohi, D. 1973. "Profit Performance in the Defense Industry." *Journal of Political Economy* 81 (3): 721–728. <https://doi.org/10.1086/260067>.
- Bou, J. C., and A. Satorra. 2007. "The Persistence of Abnormal Returns at Industry and Firm Levels: Evidence from Spain." *Strategic Management Journal* 28 (7): 707–722. <https://doi.org/10.1002/smj.586>.
- Brown, D., and D. Olmstead. 2017. "Measuring Market Power and the Efficiency of alberta's Restructured Electricity Market: An Energy-Only Market Design." *Revue canadienne d'économie* 50 (3): 838–870. <https://doi.org/10.1111/caje.12280>.
- Callado-Muñoz, F. J., M. Fernández-Olmos, M. Ramírez-Alesón, and N. M. Utrero-González. 2023. Assessing the Impact of Military and Civilian R&D on Performance. *Defence and Peace Economics*. <https://doi.org/10.1080/10242694.2023.2197308>.
- Callado-Muñoz, F. J., J. Hromcová, M. Sanso-Navarro, N. Utrero-González, and M. Vera-Cabello. 2020. "Firm Performance in Regulated Markets: The Case of Spanish Defence Industry." *Defence and Peace Economics* 33 (2): 201–218. <https://doi.org/10.1080/10242694.2020.1783622>.
- Carril, R., and M. Duggan. 2020. "The Impact of Industry Consolidation on Government Procurement: Evidence from Department of Defense Contracting." *Journal of Public Economics* 184:104141. <https://doi.org/10.1016/j.jpubeco.2020.104141>.
- Department of defense report. 2022. State of Competition within the Defense Industrial Base.
- De Witte, K., and D. Saal. 2010. "Is a Little Sunshine All We Need? On the Impact of Sunshine Regulation on Profits, Productivity and Prices in the Dutch Drinking Water Sector." *Journal of Regulatory Economics* 37 (3): 219–242. <https://doi.org/10.1007/s11149-009-9112-5>.
- Dunne, J. P. 1995. "The Defense industrial base, Handbook of defense Economics." *Elsevier First Edition* 1 (14): 399–430.
- Dunne, J. P., and R. Smith. 2016. "The Evolution of Concentration in the Arms Market." *The Economics of Peace & Security Journal* 11 (1). <https://doi.org/10.15355/epsj.11.1.12>.
- Estrin, S., S. Poukliakova, and D. Shapiro. 2009. "The Performance Effects of Business Groups in Russia." *Journal of Management Studies* 46 (3): 393–420. <https://doi.org/10.1111/j.1467-6486.2008.00820.x>.
- European Defence Agency, DEFENCE DATA 2020-2021, Key Findings and Analysis. 2022.
- Fonfria, A., and P. Correa-Burrows. 2010. "Effects of Military Spending on the Profitability of Spanish Defence Contractors." *Defence and Peace Economics* 21 (2): 177–192. <https://doi.org/10.1080/10242690903569007>.
- Fungáčová, Z., A. Shamshur, and L. Weill. 2017. "Does Bank Competition Reduce Cost of Credit? Cross-Country Evidence from Europe." *Journal of Banking and Finance* 83 (issue C): 104–120. <https://doi.org/10.1016/j.jbankfin.2017.06.014>.
- Gallizo, J. S., P. Gargallo, R. Saladríguez, and M. Salvador. 2014. "The Persistence of Abnormal Return on Assets: An Exploratory Analysis of the Performance of Firms by Country and Sector." *Applied Stochastic Models in Business and Industry* 30 (5): 609–631. <https://doi.org/10.1002/asmb.2034>.
- Gedajlovic, E., and D. Shapiro. 2002. "Ownership Structure and Firm Profitability in Japan." *Academy of Management Journal* 45 (3): 565–575. <https://doi.org/10.2307/3069381>.
- Goddard, J., M. Tavakoli, and J. Wilson. 2005. "Determinants of Profitability in European Manufacturing and Services: Evidence from a Dynamic Panel Model." *Applied Financial Economics* 15 (18): 1269–1282. <https://doi.org/10.1080/09603100500387139>.
- Göktepe, G., and S. Satyanath. 2013. "The Economic Value of Military Connections in Turkey." *Public Choice* 155 (3): 531–552. <https://doi.org/10.1007/s11127-011-9886-8>.
- Griffiths, W., P. Jensen, and E. Webster. 2011. "What Creates Abnormal Profits?" *Scottish Journal of Political Economy* 58 (3): 323–346. <https://doi.org/10.1111/j.1467-9485.2011.00549.x>.
- Gschwandtner, A. 2005. "Profit Persistence in the 'Very' Long Run: Evidence from Survivors and Exiters." *Applied Economics* 37 (7): 793–806. <https://doi.org/10.1080/0003684042000337406>.
- Gschwandtner, A., and S. Hirsch. 2018. "What Drives Firm Profitability? A Comparison of the US and EU Food Processing Industry." *The Manchester School* 86 (3): 390–416. <https://doi.org/10.1111/manc.12201>.

- Gutiérrez, G., and T. Philippon. 2018. "How EU Markets Became More Competitive Than U.S. Markets: A Study of Institutional Drift." Working paper no. 24700.
- Harper, J. 1998. "Corporate Governance and Performance During Consolidation of the United States and European Defense Industries." *Journal of Management Governance* 2 (4): 335–355. <https://doi.org/10.1023/A:1009923025657>.
- Hartley, K. 2003. "The Future of European Defence Policy: An Economic Perspective." *Defence and Peace Economics* 14 (2): 107–115. <https://doi.org/10.1080/10242690302921>.
- Hartley, K., and J. Belin. 2019. *The Economics of the Global Defence Industry*, 640. New York: Taylor & Francis, Routledge Series, Studies in defence and peace economic, December.
- Hartley, K., R. White, and D. Chaundy. 1997. "Government and Industry Performance: A Comparative Study." *Applied Economics* 29 (9): 1227–1237. <https://doi.org/10.1080/00036849700000013>.
- Ittner, C. D., F. L. David, and W. M. Marshall. 2003. "Subjectivity and the Weighting of Performance Measures: Evidence from a Balanced Scorecard." *The Accounting Review* 78 (3): 725–758. <https://doi.org/10.2308/accr.2003.78.3.725>.
- Ittner, C., D. Larcker, and R. Madhav. 1997. "The Choice of Performance Measures in Annual Bonus Contracts." *The Accounting Review* 72 (2): 231–255.
- Kaplan, R. S., and D. P. Norton. 1996. *The Balanced Scorecard: Translating Strategy into Action*. Boston, MA: Harvard Business School Press.
- King, M., and E. Santor. 2008. "Family Values: Ownership Structure, Performance and Capital Structure of Canadian Firms." *Journal of Banking & Finance* 32 (11): 2423–2432. <https://doi.org/10.1016/j.jbankfin.2008.02.002>.
- Lee, J. 2009. "Does Size Matter in Firm Performance? Evidence from Us Public Firms." *International Journal of the Economics of Business* 16 (2): 189–203. <https://doi.org/10.1080/13571510902917400>.
- Lichtenberg, F. 1992. "A Perspective on Accounting for Defense Contracts." *The Accounting Review* 67 (4): 741–752.
- Li, C.-M., T. Cui, R. Nie, H. Lin, and Y. Shan. 2019. "Does Diversification Help Improve the Performance of Coal Companies? Evidence from China's Listed Coal Companies." *Resources Policy* 61:88–98. <https://doi.org/10.1016/j.resourpol.2019.01.013>.
- Mairesse, J., B. Mulkay, and B. Hall. 2001. "Investissement des entreprises et contraintes financières en France et aux États-Unis." *Economie et statistique* 341–342 (1): 67–84. <https://doi.org/10.3406/estat.2001.7470>.
- Mason, E. S. 1939. "Price and Production Policies of Large-Scale Enterprise." *The American Economic Review* 29 (1): 61–74.
- McGowan, A., and V. Vondracik. 2002. "The Relation Between Cost Shifting and Segment Profitability in the Defense-Contracting Industry." *The Accounting Review* 77 (4): 949–969. <https://doi.org/10.2308/accr.2002.77.4.949>.
- Meyer, J. 2019. "The Social Performance of Microfinance Investment Vehicles." *Journal of Sustainable Finance & Investment* 11 (2): 163–186. <https://doi.org/10.1080/20430795.2020.1715094>.
- Mueller, D. C. 1986. *Profits in the Long Run*. New York: Cambridge University Press, Cambridge.
- Patel, P. C., and M. G. Tsionas. 2022. "Cultural Interconnectedness in Supply Chain Networks and Change in Performance: An Internal Efficiency Perspective." *International Journal of Production Economics* 243:108314. <https://doi.org/10.1016/j.ijpe.2021.108314>.
- Pattitoni, P., B. Petracchi, and M. Spisni. 2014. "Determinants of Profitability in the EU-15 Area." *Applied Financial Economics* 24 (11): 763–775. <https://doi.org/10.1080/09603107.2014.904488>.
- Pepall, L., and D. Shapiro. 1991. "The Profitability of Canadian Defence Contractors." *International Journal of Industrial Organization* 9 (3): 425–440. [https://doi.org/10.1016/0167-7187\(91\)90021-C](https://doi.org/10.1016/0167-7187(91)90021-C).
- Ratchford, B. T., and G. T. Stoops. 1988. "A Model and Measurement Approach for Studying Retail Productivity." *Journal of Retailing* 64 (3): 241–263.
- Rexhäuser, S., and C. Rammer. 2014. "« Environmental Innovations and Firm Profitability: Unmasking the Porter Hypothesis »." *Environmental & Resource Economics* 57 (1): 145–167. <https://doi.org/10.1007/s10640-013-9671-x>.
- Sandler, T., and K. Hartley. 1995. *Economics of Defense*. New York: Cambridge surveys of Economic Literature.
- Siepel, J., and M. Dejardin. 2020. "How Do We Measure Firm Performance? A Review of Issues Facing Entrepreneurship Researchers." In *Handbook of Quantitative Research Methods in Entrepreneurship*, edited by G. Saridakis and M. Cowling, 4–20. Cheltenham: Edward Elgar Publishing.
- Smith, R., and F. W. Wright. 2004. "Determinants of Customer Loyalty and Financial Performance." *Journal of Management Accounting Research* 16 (1): 183–205. <https://doi.org/10.2308/jmar.2004.16.1.183>.
- Tchuigoua, H., and M. Nekhili. 2012. "« Gestion des risques et performance des institutions de microfinance »." *Revue D'Économie Industrielle* 138 (2): 127–148. <https://doi.org/10.4000/rei.5401>.
- Van Reenen, J. 1999. Innovation, R&D and Productivity, "Rapport pour la communauté européenne, Institute for fiscal studies", [www.ifs.org.uk](http://www.ifs.org.uk).
- Wang, J., and J. San Miguel. 2012. "The Excessive Profits of Defense Contractors: Evidence and Determinants." *Journal of Public Procurement* 12 (3): 386–406. <https://doi.org/10.1108/JOPP-12-03-2012-B004>.
- Zhong, K., and D. Gribbin. 2009. "Are Defense Contractors Rewarded for Risk, Innovation, and Influence?" *Quarterly Journal of Finance and Accounting* 48 (3): 61–73.