

Comparative Performance of Government-owned and Privately-owned Industrial Corporations – Empirical Results from Six Countries

by

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1. Introduction

Large corporations which are government-owned are the subject of continuing debate, especially with respect to their assumed inferior performance and also with respect to the privatization plans of West European governments¹. Corporations that are totally owned by government (or dominantly influenced by the government share of equity) represent a special form of ownership of the firm which has potential specific consequences for the behavior of the firm. On the basis of the theory of property rights² and competition theory³ the economic consequences of this form of ownership may be analyzed.

Section 2 summarizes the theoretical arguments that are transformed into specific hypotheses in Section 3. In order to investigate the explanatory power of the theory, in Section 4 the hypotheses are tested with firm-specific empirical data derived from the “Fortune 500 – Outside the US”. Thus, it is possible to compare privately-owned and government-owned industrial corporations of six industrial nations on a broad data basis⁴. It must be noted that typical corporations from the public service sector, such as railways, PTT, broadcasting, public utilities, hospitals etc. are *not* included in the sample as this type of public firm very often operates in regulated markets⁵. The analysis, therefore,

¹ See e.g. *Wirtschaftswoche* [1985]; BUTLER [1986], SLAVICH [1987].

² E.g. ALCHIAN [1965]; DEMSETZ [1967]; ALCHIAN and DEMSETZ [1973]; PICOT [1981]; KAULMANN [1987a].

³ E.g. ALCHIAN [1969]; PICOT [1984]; BÖBEL [1984].

⁴ This study is an elaboration of a previous study conducted by the authors (PICOT and KAULMANN [1985]). The present study employs a longer time frame (1975–1984) than in the previous study (1978–1982). The conclusions of the present study confirm the previous findings.

⁵ An overview of the empirical efficiency differences between state and private production is given in BORCHERDING, POMMEREHNE, and SCHNEIDER [1982]. These authors summarize 48 empirical studies, three of which show lower costs for state production, five do not exhibit significant differences and 40 found lower performance levels in state production as compared to private production.

is confined to corporations that act in unregulated markets and that are exposed to national and international competition⁶. The study aims at a micro-economic comparison, in order to ascertain whether there are systematic differences in performance between the two groups.

The investigation assumes that government-owned corporations orient their behavior towards monetary and market-oriented goals that are similar to those of their private competitors. Thus, as far as differences in performance can be traced, they can be attributed – *ceteris paribus* – to the specific property rights constellation. Of course it is very difficult to find out what the objectives of government-owned large corporations are. Even if a majority of government-owned industrial corporations pursued specific objectives that are different from those of their private competitors (e.g. employment policy, structural policy), possible differences in performance could be an indicator of the “price” that has to be paid for the different goal priority. As to what extent this “price” is caused by the specific goal orientation and/or by changing efficiency behavior induced by the property right structures is to be discussed later in the paper.

In the long run, owing to restrictions in public expenditure, government-owned large industrial corporations that compete in national and international markets must observe objectives that promote efficiency in production and sales, otherwise they cannot survive in a competitive world. The question, however, is whether government-owned industrial corporations have similar chances when pursuing such efficiency objectives as have their private competitors.

2. Property Rights Theory and the Performance of Government-owned and Privately-owned Industrial Corporations

The implications of property rights theory for the theory of the firm have been elaborated in detail elsewhere⁷. It has been shown that, from the standpoint of property rights theory, a public stock company (a so-called manager-controlled corporation) can be seen as an efficient alternative to an owner-controlled company. The division of ownership and control does not necessarily lead to a loss of performance; indeed, if competition in capital markets, markets for final goods and markets for managers is sufficient, no significant difference in performance between owner-controlled and manager-controlled companies can be found. The competitive forces in the above-mentioned markets serve as a surrogate for owner control⁸. At the same time the public stock company is

⁶ For an assessment of this kind of sampling see BLANKART [1987, 53 f.].

⁷ E.g. ALCHIAN [1965]; DEMSETZ [1967]; ALCHIAN and DEMSETZ [1973]; PICOT [1981]; TIETZEL [1981]; MEYER [1983]; GÄFGEN [1984]; PICOT and MICHAELIS [1984]; KAULMANN [1987 a].

⁸ E.g. ALCHIAN [1969]; FURUBOTN and PEJOVICH [1972, 1149 ff.]; RIDDER-AAB [1980, 70 ff.]; PICOT [1981]; DE ALESSI [1983, 73 ff.]; DEMSETZ [1983, 387 ff.]; LEIPOLD [1983, 73 ff.]; ALCHIAN [1984]; PICOT and MICHAELIS [1984]; KAULMANN [1987 a, 33 ff.].

enabled to raise the necessary capital in order to finance the growth of the corporation. Looking at the theoretical arguments as well as at the empirical studies of recent years⁹, it can be concluded that manager-controlled and owner-controlled corporations form a relatively homogeneous group that can serve as a control group (private ownership) in a comparative investigation with government-owned corporations. It is necessary, however, to explore the structure of property rights of government-owned corporations in greater detail.

The main property rights that influence the behavior of government-owned corporations are allocated as follows: the right to coordinate (to acquire and to allocate) resources is mainly in the hands of the managers of these corporations; the right to appropriation of profits (and losses) and the right to capitalization (to transfer all property rights to new owners) is in the hands of the government. Therefore, at first glance an attenuation of property rights can be concluded. In contrast to the group of privately-owned corporations where competitive market forces substitute for the division of property rights, in the government-owned case incentives for control on the side of the owners are much weaker; neither politicians nor the citizens that are represented by the government are directly affected by the appropriation of profits or losses by the government. The wealth of a private owner, however, is directly changed by losses incurred or profits earned by his firm. This is not the case for a politician who acts as an agent for the government nor for a citizen whose government owns a company. This indicates that government-owned corporations potentially offer many more degrees of freedom for the management of those companies than in the case of privately-owned companies. The larger room for discretion in government-owned corporations can be exploited by managers for other than economic goals. Incentives for control of management behavior on the side of the owners are much lower than in the case of privately-owned corporations.

The monitoring effects of the markets for final products, for capital and for managers are less strong than in the case of private corporations. When a government-owned corporation does not pursue an effective business strategy, its economic position in final product markets is affected in the same way as in the case of privately-owned corporations. However, the consequences for discretionary behavior of the managers are different. The reason can be found in a lack of market signaling power if the corporation is owned by government: the final owners (citizens) cannot decide to sell their shares when the corpora-

⁹ The debate on managerialism was triggered by BERLE and MEANS [1932]; a recent assessment of this debate is given in *Journal of Law and Economics*, vol. 26, no. 2, 1983. It is questionable whether differences in efficiency between manager-controlled and owner-controlled corporations can be convincingly observed in reality, as is shown in contributions of the mentioned issue of *Journal of Law and Economics* as well as in a recent study of KAULMANN [1987 b]. The latter publication shows that for 24 recent empirical studies only 7 find a higher profitability of owner-controlled companies. All the 11 studies carried out since 1976 do not show differences in profitability between the two groups.

tion performs poorly. The same is true for politicians as agents of the final owners. Even if there is a private minority ownership in a government-owned company, the signaling of the capital market is weakened, since the financing of government-owned corporations differs from that of privately-owned corporations owing to the trust in the liquidity of state ownership in industrialized countries. In other words, there is the expectation that the government will come to the financial aid of a government-owned enterprise which faces severe financial difficulties – thus weakening the monitoring effects of the capital market.

In the world of privately-owned corporations the threat of takeover of weakly performing corporations by third parties plays an important role for their efficient behavior. This threat does not exist in the case of government-owned corporations, as the privatization of such corporations depends not only on economic criteria but as well on diverse political factors. Hence, a declining level of efficiency will not increase the probability of a takeover and/or the probability of an exchange of management.

Of course, in government-owned corporations too there is some competition for managerial positions. However, the competitive forces of the market for managers are different and weaker than in privately-owned corporations. As the control by politicians and owners is relatively weak and the pressure of the capital and final goods markets is not very strong, managers of government-owned corporations will have more possibilities of hiring staff who are loyal to them and who at the same time do not necessarily show high performance rates. Thus potential internal competition for managerial positions becomes weaker, especially given that the vertical control of managers by their subordinates is lessened¹⁰. As a result, the market for managers does not monitor the management behavior of government-owned corporations to the same extent as in the case of privately-owned corporations; consequently, managers of government-owned corporations can pursue personal goals to a larger extent.

It is difficult to assess the difference in pecuniary incentive structures between privately- and government-owned corporations. It could be argued that the owners of a private corporation have higher motivation than the government to implement useful pecuniary incentive structures for the management. One of the very few empirical investigations in this field was undertaken by BÖBEL and DIRRHEIMER [1984]. They found that only for two years of a 12-year sample was the share of the state ownership a significant influence on the remuneration of management – and even then the significance was not strong. Therefore, pecuniary incentives are more or less the same for managers in government- and in privately-owned corporations.

¹⁰ E.g. DE ALESSI [1974, 648].

3. Hypotheses

Owing to greater scope for discretionary behavior, to lower incentives for control by politicians/owners and to weaker surrogates for private ownership, the following hypothesis may be formulated:

H 1: Government-owned corporations show lower levels of productivity than privately-owned corporations.

As relatively more input is necessary for government-owned corporations to fulfill their tasks, profits of these corporations will be lower:

H 2: Government-owned corporations show lower rates of return than privately-owned corporations.

Owing to weaker signaling of capital markets for government-owned corporations and owing to different financing behavior, we postulate:

H 3: The ratio of shareholders' equity to total assets is lower in government-owned corporations than in privately-owned corporations.

With reference to the control problems in government-owned corporations and the findings of WILLIAMSON and JACQUEMIN and DEGHELLINCK¹² on correlation between size of the firm and profit, we conclude that an increase in firm size leads to a smaller increase in profits in the case of government-owned corporations than in the case of private corporations. The reason is that a larger number of employees leads to increased monitoring and control problems which are handled more efficiently by private firms.

H 4: The increase in the size of firms leads to a smaller increase in profits in the case of government-owned corporations than in the case of private corporations.

4. Empirical Results

4.1. Source of Data and Operationaliation of Variables

Fortune's "The Foreign 500" for the years 1975–1984 form the data base for this investigation¹³. Thus, the sample includes only large industrial companies. The data cover six western industrial nations (excluding USA and Japan) and fifteen

¹² E.g. WILLIAMSON [1967], JACQUEMIN and DEGHELLINCK [1980].

¹³ The "Fortune Directory of the 500 Largest Industrial Corporations outside the U.S." is published each year in the August issue of Fortune Magazine. The "Foreign 500" list uses accounting concepts and data. There are likely to be differences between economic and accounting concepts. We assume that these measurement differences are randomly distributed and have an expected value of zero. For an appreciation of the use of accounting data in applied economic investigations, see e.g. FISCHER and MCGOWAN [1983]; BENSTON [1985]; SALAMON [1985].

industries in which government-owned corporations can be observed. The data allow us to control for the influence of important conditions (industry, country, and size) by statistical methods. Computations are made for a pooled sample covering the ten year period, that is, a combination of cross-sectional and longitudinal study¹⁴.

The group of government-owned corporations was formed by those companies that were indicated in the Fortune List as "government-owned"¹⁵. This means that the state holds a dominant share, in many cases one hundred percent of the company. Each year the qualification for government-owned or privately-owned was made anew, so that a company over the years can appear in both groups if in the meantime a nationalization or a privatization has taken place. All companies are industrial in the sense that more than fifty percent of the sales derived from industrial production and/or mining.

Size of the corporation was measured by several variables:

– *Sales:*

excluding excise taxes and customs duties; intracompany transactions are excluded, consolidated subsidiaries of more than fifty percent owned are included. Figures are shown in US dollars using an exchange rate that consists of the official average rate during each company's fiscal year; all figures in thousands of US dollars.

– *Total Assets:*

as at the end of a company's accounting year consolidated and converted into thousands of US dollars.

– *Employees:*

relating to those employees that cover the sales figure.

Depending on the causal relationship under study, the size of a corporation is measured in the multivariate statistics by one or other of the measures described above.

¹⁴ See Appendices 1 and 2; in the pooled sample each event a_{it} of the variable a of company i in the period t represents an observation. The sample was cleaned of some extreme cases (not contained in the five sigma-interval). Furthermore, for some observations specific information was missing, so that the number of cases included may vary from one computation to another.

As to what extent the selection of the largest industrial corporations from the six countries and fifteen industries could represent a selection bias with respect to all corporations cannot be clarified within this contribution.

An inclusion of Japan (no government-owned large corporations represented), an inclusion of industries without government-owned industrial corporations and an inclusion of the other countries of the Fortune 500 List has not changed the significant findings of this investigation.

¹⁵ The Fortune List only provides data on whether a corporation is privately- or government-owned. Other information is not available concerning the governments' participation in government-owned enterprises – such as the creation of incentives to reduce agency costs etc.

For operationalization of other variables two further figures were listed:

– *Net Income:*

after taxes and extraordinary items (thousands of US dollars).

– *Stockholders Equity:*

minority interest not included; all figures at the end of each company's accounting year converted to dollars at the official exchange rate (thousands of US dollars).

With these variables the following indicators for productivity can be deduced:

$$\text{– Productivity of labor} = \frac{\text{sales}}{\text{employees}}$$

$$\text{– Productivity of capital} = \frac{\text{sales}}{\text{total assets.}}$$

As measures for profitability the following ratios were computed:

$$\text{– Return on stockholders' equity} = \frac{\text{net income}}{\text{stockholders equity}}$$

$$\text{– Return on total assets} = \frac{\text{net income}}{\text{total assets}}$$

$$\text{– Return on sales} = \frac{\text{net income}}{\text{sales.}}$$

To control for special conditions, each company was allocated to an industrial classification according to its largest share of sales. A dummy variable was defined in order to represent the industry in regression analysis. A similar procedure was applied for the country variable¹⁶.

At first we use univariate analysis based on simple productivity and profitability ratios. This comparison of simple ratios is limited by the failure to take into account other influential variables, such as size and industry. The sample size is sufficient to enable us to undertake multivariate analysis so that we can determine the effect of size, industry and country, on the comparative performance of government and private corporations.

4.2. Univariate Analysis

A test of H1 on the basis of simple productivity ratios shows that government-owned companies on average demand higher factor inputs (employees, capital)

¹⁶ A control of the country and industry influence by dummy variables does not seem to be problematic because, as statistical analysis shows, multicollinearity that is possible in principle (in the form of high standard deviations of the estimated coefficients in the regression equations) does not show up.

Table 1.
Average productivity ratios of government-owned and privately-owned industrial corporations 1975-84

<u>Sales</u>		<u>Sales</u>	
Employees		Total Assets	
Private <i>n</i> = 1602	Government <i>n</i> = 238	Private <i>n</i> = 1576	Government <i>n</i> = 233
140.10	84.75	1.388	0.9890
	**		**

** 2-tailed *t*-test of the means leads to a rejection of the null hypothesis with a level of significance of $\alpha = 0.01$.

than their private counterparts. Thus, the null-hypothesis that both groups show similar productivity ratios must be rejected within a 2-tailed *t*-test¹⁷ (Table 1).

Lower productivity ratios of government-owned corporations may imply that these corporations show lower rates of return (H2). Average profitability ratios prove this assumption (Table 2).

On the average, government-owned corporations incurred losses whereas privately-owned corporations yielded profits (the span of profit reaches from minus 3,890 million dollars to plus 1,378 million dollars). The *t*-test therefore shows a high level of significance.

As can be seen from Table 3, government-owned companies show higher measures of size than their private counterparts so the differences outlined above could be due to size. Table 3 also shows that government-owned corporations, according to H3, have a lower ratio of shareholders' equity to total assets; again, the influence of size on this univariate result must be taken into account.

Table 2.
Average profitability ratios of government-owned and privately-owned corporations 1975-84

<u>Net Income</u>		<u>Net Income</u>		<u>Net income</u>	
Equity		Total Assets		Sales	
Private <i>n</i> = 1547	Government <i>n</i> = 213	Private <i>n</i> = 1550	Government <i>n</i> = 226	Private <i>n</i> = 1569	Government <i>n</i> = 226
0.0708	- 0.1222	0.0273	- 0.0206	0.0212	- 0.0237
	**		**		**

** 2-tailed *t*-test of the means leads to a rejection of the null hypothesis with a level of significance of $\alpha = 0.01$.

¹⁷ Nonparametric tests produced similar results for each of the hypotheses.

Table 3.

Averages of size variables (sales, total assets, employees) and the ratio of equity to total assets for government-owned and privately-owned corporations 1975–84

	Private	Government	
Sales	3,119,705	4,631,614	**
Total assets	2,566,657	4,791,299	**
Employees	45,032	73,597	**
Equity			
Total assets	0.290	0.214	**

** 2-tailed *t*-test of the means leads to a rejection of the null hypothesis with a level of significance of $\alpha = 0.01$.

4.3. Multivariate Analysis

A linear regression model is the basis for the following multivariate analysis. Equations (1) and (2) are related to the test of H1.

$$(1) \quad \text{SAL/E} = a_0 + a_1 \text{GOV} + a_2 \text{ASSET} + a_3 \text{LEVER} \\ + \sum_{j=1}^5 b_j \text{NAT}_j + \sum_{k=1}^{14} c_k \text{IND}_k + U;$$

meaning:

SAL/E = sales per employee;

GOV = dummy variable for ownership (= 1, if government-owned; = 0, if private);

ASSET = total assets;

LEVER = the ratio of total stockholder equity to total assets;

NAT = dummy variable for country (= 1, if corporation *i* in country *j*; otherwise = 0);

IND = dummy variable for industries (= 1, if corporation *i* in industry *k*, otherwise = 0);

U = error term with the usual assumptions (normal distributed, expected value = 0, constant variance = σ^2).

The estimated coefficients \hat{a}_1 , \hat{a}_2 , \hat{a}_3 as well as the corrected R^2 and the *F*-value of the least square estimations are documented in Table 4; results for computations with and without country- and industry-dummies are separately recorded.

In both cases, the coefficient of the variable GOV indicating the difference between the two groups has a negative sign and differs significantly from zero. In the approach with country and industry dummies, the size of the corporation measured in terms of total assets is negatively correlated with the dependent variable. This means that the larger the corporation, the smaller the ratio of sales to employees.

Table 4.

Results of the regressions for *sales per employee* as dependent variable 1975–84
(standard deviation in brackets)

	GOV \hat{a}_1	ASSET \hat{a}_2	LEVER \hat{a}_3	$\overline{R^2}$	F	n
Model without country- and industry dummies	- 54.53 ** (15.74)	1,6480 · 10 ⁻⁶ (1.2792 · 10 ⁻⁶)	43.17 (34.61)	0.01	5.10	1769
Model with country- and industry dummies	- 76.36 ** (11.84)	- 5.5738 · 10 ⁻⁶ ** (9.0533 · 10 ⁻⁷)	94.68 ** (30.49)	0.55	98.23	1769

** Coefficients in the 2-tailed t-test significantly different from zero with a level of significance of $\alpha = 0.01$

Consideration of country and industry variables increases the value of $\overline{R^2}$ but does not influence significantly the coefficient of the GOV-variable. It can therefore be concluded that the lower ratio of SAL/E in large government-owned corporations exists relatively independently of country and industry conditions.

In a similar way the productivity measure "value of sales per \$ 1 of assets" was explored in a multivariate approach:

$$(2) \quad \text{SAL/A} = a_0 + a_1 \text{GOV} + a_2 \text{EMP} + a_3 \text{LEVER} \\ + \sum_{j=1}^5 b_j \text{NAT}_j + \sum_{k=1}^{14} c_k \text{IND}_k + U$$

where:

SAL/A = sales/total assets;

EMP = employees;

(for the other variables see above).

Table 5 shows the results of this estimation.

In this context, the coefficient that represents the difference between the two groups of large corporations (\hat{a}_1) shows negative values that are significantly different from zero. The inclusion of industry and country variables partially reduces the influence of the ownership variable. However, the influence of ownership remains strongly significant.

The hypothesis that privately-owned corporations show higher capital productivity than government-owned corporations can be corroborated on the basis of these results. The size variable EMP exerts a negative influence on the dependent variable SAL/A. Thus capital productivity decreases as the number of employees increases. This implies that there are limits to firm growth.

Table 5.
Estimated coefficients for the dependent variable *sales/total assets* 1975–84
(standard deviations in brackets)

	GOV \hat{a}_1	EMP \hat{a}_2	LEVER \hat{a}_3	\bar{R}^2	F	n
Model without country- and industry dummies	-0.3334** (0.0500)	$1.2106 \cdot 10^{-6}$ ** ($2.9315 \cdot 10^{-7}$)	0.4478** (0.1150)	0.05	33.12	1773
Models with country- and industry dummies	-0.2266** (0.0496)	$-1.9033 \cdot 10^{-6}$ ** ($2.9613 \cdot 10^{-7}$)	0.7983** (0.1363)	0.26	29.13	1773

** Coefficient in the 2-tailed *t*-test significantly different from zero with a significance level of $\alpha = 0.01$

For the test of HZ similar multiple linear regression approaches were chosen:

$$(3) \quad \text{ROE} = a_0 + a_1 \text{GOV} + a_2 \text{SALES} + a_2 \text{LEVER} \\ + \sum_{j=1}^5 b_j \text{NAT}_j + \sum_{k=1}^{14} c_k \text{IND}_k + U$$

$$(4) \quad \text{ROA} = a_0 + a_1 \text{GOV} + a_2 \text{SALES} + a_3 \text{LEVER} \\ + \sum_{j=1}^5 b_j \text{NAT}_j + \sum_{k=1}^{14} c_k \text{IND}_k + U$$

where:

ROE = Return on total stockholders equity;

ROA = Return on total assets;

SALES = total sales;

(for the other variables see above).

In this case, SALES was chosen as the size measure to avoid spurious correlation between the independent and the dependent variables. Table 6 represents the main estimation results of this multivariate regression analysis.

Both measures of profitability are greater in privately-owned corporations. The influence of country and industry variables on the differences in profitability is rather weak. Government-owned corporations are throughout less profitable, the size of the corporations playing a minor role as can be seen from estimated a_2 -coefficients. As can be seen from coefficient a_3 , a good equity endowment increases profitability in a significant way. Correlations between the ratio of stockholders equity to total assets and the dummy variable for government/private ownership could play a role in this context. This will be investigated in the following section, thereby testing at the same time H3 which postulates that the ratio of shareholders' equity to total assets is lower in government-owned corporations.

Table 6.

Estimated coefficients of regressions for return on total stockholders' equity and on total assets as dependent variables 1975–84 (standard deviations in brackets)

	Dependent Variable: ROE			$\overline{R^2}$	F	n
	GOV \hat{a}_1	SALES \hat{a}_2	LEVER \hat{a}_3			
Model without country- and industry dummies	- 0.1723 ** (0.0186)	$2.9471 \cdot 10^{-9}$ ** ($1.2848 \cdot 10^{-9}$)	0.3744 ** (0.0405)	0.10	67.06	1753
Model with country- and industry dummies	- 0.1371 ** (0.0199)	$3.8697 \cdot 10^{-9}$ ** ($1.3160 \cdot 10^{-9}$)	0.3939 ** (0.0506)	0.18	18.03	1753
	Dependent variable: ROA					
Model without country- and industry dummies	- 0.0368 ** (0.0084)	$5.7924 \cdot 10^{-10}$ * ($2.3354 \cdot 10^{-10}$)	0.1375 ** (0.0076)	0.23	173.12	1756
Model with country- and industry dummies	- 0.0303 ** (0.0035)	$8.1550 \cdot 10^{-10}$ ** ($2.3576 \cdot 10^{-10}$)	0.1128 ** (0.0097)	0.31	37.20	1756

** Coefficient in the 2-tailed *t*-test significantly different from zero with a significance level of $\alpha = 0.01$; * with a significance level of $\alpha = 0.05$

Univariate results had shown that the equity endowment of privately-owned corporations is larger. This result must be investigated in more depth by multivariate methods. The approach contains ownership and industry variables, and sales is taken as the size variable. Results of the least squares estimation are shown in Table 7.

Table 7.

Estimated coefficients of regressions for total stockholders *equity/total assets* as dependent variable 1975–84 (standard deviation in brackets)

	GOV \hat{a}_1	SALES \hat{a}_2	$\overline{R^2}$	F	n
Model without country- and industry dummies	- 0.0733 ** (0.0102)	$1.8415 \cdot 10^{-9}$ ($7.2146 \cdot 10^{-10}$)	0.03	31.11	1791
Model with country- and industry dummies	- 0.0049 (0.0087)	$- 1.6177 \cdot 10^{-9}$ ** ($5.7969 \cdot 10^{-10}$)	0.45	71.51	1791

** Coefficient in the 2-tailed *t*-test significantly different from zero with a significance level of $\alpha = 0.01$

These results show that the two groups of ownership do not exert a significant influence on the endowment with equity if industry and country variables are taken into account. The respective coefficient \hat{a}_1 in the approach with country and industry dummies is negative but does not differ significantly from zero. The estimation shows a negative influence of the size variable (SALES) on the ratio of total stockholders equity to total assets. A comparison between the two approaches (with and without country and industry variables) shows that the equity endowment seems to be a country- and industry-specific phenomenon. The share of the explained variance of the dependent variable – expressed by R^2 – was less in the approach without industry and country variables (0.03) than in the approach with country and industry variables (0.45). This remarkable increase and the disappearing influence of the ownership variable show a relatively high dependency of the ratio of equity to total assets on industry and country variables. H3 cannot be sustained with respect to these results.

In order to prove H4 (size dependency of profits) the size measure EMP is chosen according to the contents of this hypothesis. The approach contains the net INCOME as dependent variable. In addition to the exogenous variables GOV, LEVER and EMP, this approach contains the interaction variable $GOV \cdot EMP$ whose coefficient a_2 represents the difference between the two groups of an increase in profit arising from a larger number of employees.¹⁸

$$(5) \quad \text{INCOME} = a_0 + a_1 \text{GOV} + a_2 \text{GOV} \cdot \text{EMP} + a_3 \text{EMP} \\ + a_4 \text{LEVER} + \sum_{j=1}^5 b_j \text{NAT}_j + \sum_{k=1}^{14} c_k \text{IND}_k + U$$

Table 8 shows that the estimation of the coefficient for this multiplicative variable is negative and significantly different from zero. The difference between the coefficients a_3 and a_2 is negative. This means that the profit in government-owned corporations is negative related to the size measured by employees. This is more than was expected in H4: it is not merely that an increase in size leads to a smaller increase in profits in the case of government-owned corporations, but that this size increase leads as well to a profit decrease in government-owned corporations. This means that in these corporations greater problems of monitoring exist due to higher numbers of employees, as was predicted in the theory. H4 is thereby empirically supported.

¹⁸ a_2 is defined as:

$$a_2 = \frac{d \text{INCOME}_G}{d \text{EMP}_G} - \frac{d \text{INCOME}_P}{d \text{EMP}_P}$$

where the subscripts G = government-owned, and P = privately-owned.

Table 8.

Estimated coefficients of regression for net income as dependent variable
(standard deviation in brackets)

	GOV \hat{a}_1	GOV EMP \hat{a}_2	EMP \hat{a}_3	LEVER \hat{a}_4	$\overline{R^2}$	F	n
Model with country- and industry dummies	- 7019 (17466)	- 1.5605** (0.1853)	1.1502** (0.0799)	217799** (31651)	0.27	28.69	1740

** Coefficients in the 2-tailed *t*-test significantly different from zero with a level of significance of $\alpha = 0.01$

5. Discussion

On the basis of empirical data from Fortune's foreign 500 list, four hypotheses derived from property rights theory and competition theory of the firm were tested. Simple comparison of the ratios of the two groups (government-owned corporations and privately-owned corporations) showed significant differences with respect to productivity, profitability and the ratio of shareholders' equity to total assets. Government-owned corporations were throughout less profitable and less productive; they showed a lower ratio of shareholders' equity to total assets.

With the help of multivariate regression analysis, it was possible to control for several conditions, such as size of the corporations, country and industry variables. This approach corroborated the results for the productivity and profitability hypotheses (H1 and H2). However, H3 (lower ratio of shareholders' equity to total assets for government-owned corporations) could not be corroborated as the financial structure of the firms was mainly influenced by industry and country specifics. The increase of profits depending on the number of employees (H4) was significantly less in government-owned companies than in privately-owned corporations, as is predicted by theory.

It can be argued that differences in performance should be attributed mainly to special labor market-oriented objectives of government economic policy with the aid of government-owned corporations. However, our results cannot prove such an assumption. The results of the productivity of capital, a measure that does not contain the number of employees, are as significant as the results of other measures of efficiency.

Furthermore, it could be claimed that the higher endowment of personnel in government-owned corporations would lead to higher capital investments (offices, machinery etc.). However, especially in the sector of industrial manufacturing and mining, these effects should be overcompensated by other trends. This means that a lower employment rate in privately-owned corporations would

lead to a relatively higher capital investment in these companies and that, on the other hand, capital investment in government-owned corporations should be lower because of the more labor-intensive production technologies used with respect to labor market objectives. If the differences in performance could be traced back solely to public employment policy, there should be no lower capital productivity in government-owned than in privately-owned corporations. However, we could find a significant higher input of employees *and* of capital in government-owned corporations, i.e. an overall lower productivity. Thus the proposition outlined at the beginning of this paper has been supported: that is, disadvantages in performance of government-owned companies are mainly caused by the difference in the property rights structure.

Future investigations should include additional possible determinants such as duration of government ownership, conditions of takeover by government (e.g. weak economic performance), intensity of competition in the respective industries, specific information about antitrust policy and government regulation in the respective countries, as well as dynamic aspects (e.g. growth rates); the latter aspect, however, poses some empirical difficulties as the influence of varying exchange rates is an obstacle to a longitudinal study with comparison of different periods.

To sum up, the preceding investigation offers the following conclusions:

1. The differences in performance between government-owned and privately-owned large industrial corporations that property rights theory would predict are confirmed by empirical evidence, especially with respect to differences in productivity and profitability, but also with respect to size effects.¹⁹

2. On the basis of our measures of performance, the following implication may be drawn: nationalization of industrial corporations may lead to long-term efficiency disadvantages (from the perspective of the individual firm); privatization is one option available to improve efficiency of government-owned enterprises.

3. An increase in the size (in terms of number of employees) of government-owned corporations leads to lower increases in profit than the same increase in the size of a private firm because larger agency problems (i.e. monitoring costs etc.) arise in government corporations.

4. The findings can form the foundation for an economic policy offering a trade-off between corporate performance of different forms of ownership, on the one hand, and possible fulfillment of other goals through government-owned enterprises, on the other hand. However, according to our current knowledge, it is not at all clear whether and to what extent industrial corporations which are owned by government are able to fulfill additional goals in structural policy and labor market policy, and it is unclear how such consequences could be empirically measured.

¹⁹ To that extent, this study complements the various existing empirical studies that test the property rights approach. See for reviews e.g. DE ALESSI [1980] and KAULMANN [1987a].

Summary

As predicted by property rights theory, the empirical evidence presented in this article confirms that privately-owned large industrial corporations exhibit superior performance compared with their government-owned counterparts, especially with respect to productivity and profitability (even after accounting for size, industry and country effects). The database comprises Fortune's "The Foreign 500" for the years 1975–1984. The sample is drawn from six countries and fifteen industries, and it is exclusively confined to corporations that act in unregulated markets (i.e. state monopolies are excluded). The study uses univariate and multivariate statistical techniques.

Zusammenfassung

Mit Hilfe der Theorie der Verfügungsrechte und der Wettbewerbstheorie wird die Aussage abgeleitet, daß private industrielle Großunternehmen effizienter als vergleichbare Unternehmen in Staatseigentum arbeiten. Der vorliegende Beitrag findet dieses Ergebnis besonders hinsichtlich der Produktivitäten und Rentabilitäten empirisch bestätigt. In der Untersuchung werden neben univariaten Vergleichen multivariate statistische Analysen durchgeführt, die den Einfluß der Unternehmungsgröße sowie die Branchen- und Länderzugehörigkeit kontrollieren. In der Stichprobe aus Fortune's "The Foreign 500" der Jahre 1975–1984 sind keine staatlichen Monopole enthalten, sondern (neben Privatunternehmen) nur solche industrielle Großunternehmen in Staatseigentum, die mit vergleichbaren privaten Unternehmen im Wettbewerb stehen.

Appendix 1.

Distribution of the sample by country according to ownership 1975–1984

Country	Government	Private
Great Britain	52	468
Canada	5	211
France	100	198
Germany	30	505
Italy	33	82
Sweden	20	164
Total	240	1628

Appendix 2.

Distribution of the sample by industry according to ownership 1975–1984

Industry	Government	Private
Building materials	4	76
Chemicals	12	187
Electronics, appl.	7	193
Ind., transportation equ.	7	171
Metal products	9	144
Metal man.-steel	41	155
Mining nonferrous	8	27
Mining coal	16	26
Petroleum	37	243
Tobacco	9	56
Shipbuilding	13	6
Office equipment, computer	3	76
Motor vehicles	25	209
Metal man., aluminium	13	20
Aerospace	36	39
Total	240	1628

References

- ALCHIAN, A. A. [1965], "The Basis of Some Recent Advances in the Theory of the Management of the Firm", *Journal of Industrial Economics*, 14, 30–41.
- [1969], "Corporate Management and Property Rights", pp. 337–360, in: Manne, H. (ed.), *Economic Policy and the Regulation of Corporate Securities*, Washington D.C.
- [1984], "Specificity, Specialization and Coalitions", *Zeitschrift für die gesamte Staatswissenschaft*, 140, 34–49.
- ALCHIAN, A. A. and DEMSETZ, H. [1973], "The Property Rights Paradigm", *Journal of Economic History*, 33, 16–27.
- BENSTON, G. J. [1985], "The Validity of Profits-Structure Studies with Particular Reference to the FTC's Line of Business Data", *American Economic Review*, 75, 37–67.
- BERLE, A. A. and MEANS, G. C. [1932], *The Modern Corporation and Private Property*, New York.
- BLANKART, C. B. [1987], "Ordnungspolitische Rahmenbedingungen und öffentliche Unternehmertätigkeit: Soll der Staat industrielles Beteiligungskapital halten?", pp. 53–65, in: Thiemeyer, T. (ed.), *Öffentliche Unternehmen und ökonomische Theorie*, Baden-Baden.
- BÖBEL, I. [1984], *Wettbewerb und Industriestruktur – Industrial Organization – Forschung im Überblick*, Berlin.
- BÖBEL, I. and DIRRHEIMER, M. [1984], "Eigentumsrechte, Managementmotivation und Marktverhalten", pp. 157–187, in: Neumann, M. (ed.), *Ansprüche, Eigentums- und Verfügungsrechte*, Berlin.
- BORCHERDING, T. E., POMMEREHNE, W., and SCHNEIDER, F. [1982], "Comparing the Efficiency of Private and Public Production: The Evidence from Five Countries", pp. 127–156, in: Bös, D., Musgrave, R. A. and Wiseman, J. (eds.), *Public Production*, *Zeitschrift für Nationalökonomie, Supplementum 2*, Vienna and New York.

- BUTLER, E. [1986], "Privatisierung – Britanniens Botschaft", *Wirtschaftswoche*, 40, 10, 70–76.
- DE ALESSI, L. [1974], "Managerial Tenure under Private and Government Ownership in the Electric Power Industry", *Journal of Political Economy*, 82, 645–653.
- [1980], "The Economics of Property Rights: A Review of the Evidence", *Research of Law and Economics*, 2, 1–47.
- [1983], "Property Rights, Transaction Costs, and X-Efficiency: An Essay in Economic Theory", *American Economic Review*, 73, 64–81.
- DEMSETZ, H. [1967], "Toward a Theory of Property Rights", *American Economic Review*, 57, 347–359.
- [1983], "The Structure of Ownership and the Theory of the Firm", *Journal of Law and Economics*, 26, 375–390.
- FISCHER, F. M. and MCGOWAN, J. J. [1983], "On the Misuse of Accounting Rates of Return to Later Monopoly Profits", *American Economic Review*, 73, 82–97.
- FURUBOTN, E. G. and PEJOVICH, S. [1972], "Property Rights and Economic Theory: A Survey of Recent Literature", *Journal of Economic Literature*, 10, 1137–1162.
- GÄFGEN, G. [1984], "Entwicklung und Stand der Theorie der Property Rights: Eine kritische Bestandsaufnahme", pp. 43–62, in: Neumann, M. (ed.), *Ansprüche, Eigentums- und Verfügungsrechte*, Berlin.
- JACQUEMIN, A. and DEHELLINCK, E. [1980], "Familial Control, Size and Performance in the Largest French Firms", *European Economic Review*, 13, 81–91.
- KAULMANN, T. [1987a], *Property Rights und Unternehmungstheorie – Stand und Weiterentwicklung der empirischen Forschung*, München.
- [1987b], "Managerialism versus the Property Rights Theory of the Firm", pp. 439–459, in: Bamberg, G. and Spremann, K. (eds.), *Agency Theory, Information and Incentives*, Berlin, Heidelberg, New York.
- LEIPOLD, H. [1983], *Eigentum und wirtschaftlich-technischer Fortschritt*, Cologne.
- MEYER, W. [1983], "Entwicklung und Bedeutung des Property Rights-Ansatzes in der Nationalökonomie", pp. 1–44, in: Schüller, A. (ed.), *Property Rights und ökonomische Theorie*, München.
- PICOT, A. [1981], "Der Beitrag der Theorie der Verfügungsrechte zur ökonomischen Analyse von Unternehmungsverfassungen", pp. 153–197, in: Bohr, K., Drukarczyk, J., Drumm, H. J. and Scherrer, G. (eds.), *Unternehmungsverfassung als Problem der Betriebswirtschaftslehre*, Berlin.
- [1984], "Verfügungsrechte und Wettbewerb als Determinanten der Entwicklung des Verwaltungsbereichs von Organisationen", pp. 198–222, in: Boettcher, E., Herder-Dorneich, P. and Schenk, K. E. (eds.), *Jahrbuch für Neue Politische Ökonomie*, vol. 3, Tübingen.
- PICOT A. and KAULMANN, T. [1985], "Industrielle Großunternehmen in Staatseigentum aus verfassungsrechtlicher Sicht", *Zeitschrift für betriebswirtschaftliche Forschung*, 37, 956–980.
- PICOT, A. and MICHAELIS, E. [1984], "Verteilung von Verfügungsrechten in Großunternehmen und Unternehmungsverfassung", *Zeitschrift für Betriebswirtschaft*, 54, 252–272.
- RIDDER-AAB, C. M. [1980], *Die moderne Aktiengesellschaft im Lichte der Theorie der Eigentumsrechte*, Frankfurt and New York.
- SALAMON, G. L. [1985], "Accounting Rates of Return", *American Economic Review*, 75, 495–504.
- SLAVICH, D M. [1987], "Grassroots Privatization – The Management Challenge", *Sloan Management Review*, 28, 55–61.
- TIETZEL, M. [1981], "Die Ökonomie der Property Rights: Ein Überblick", *Zeitschrift für Wirtschaftspolitik*, 30, 188–197.

- WILLIAMSON, O. E. [1967], "Hierarchical Control and Optimum Firm Size", *Journal of Political Economy*, 75, 123–138.
- WIRTSCHAFTSWOCHE [1985], "Frankreich – Stumpfe Speerspitze", 39, 6, 28–30.

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