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# PRIVATISING NATIONAL OIL COMPANIES: ASSESSING THE IMPACT ON FIRM PERFORMANCE

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## **Abstract**

This study empirically investigates the impact of privatisation on firm performance in the global oil and gas industry, where questions of resource control have regained widespread attention. Using a dataset of 60 public share offerings by 28 National Oil Companies it is shown that privatisation is associated with comprehensive and sustained improvements in performance and efficiency. Over the seven-year period around the initial privatisation offering, return on sales increases by 3.6 percentage points, total output by 40%, capital expenditure by 47%, and employment intensity drops by 35%. Privatisation of all remaining state-owned NOCs would, over the same period, imply an increase in global oil and gas production of 15% over current levels. Many of our observed performance improvements are already realised in anticipation of the initial privatisation date, accrue over time, and level off after the ownership change rather than accelerate. Details of residual government ownership, control transfer, and size and timing of follow-on offerings provide limited incremental explanatory power for firm performance, except for employment intensity. Based on these results partial privatisations in the oil sector might be seen to capture a significant part of the benefits associated with private capital markets without the selling government having to cede majority control.

## **Key words**

Privatisation, ownership, corporate performance, anticipation, oil and gas industry

## **JEL Classifications:**

C23, G32, L33, L71, M20, Q40

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## I. Introduction

The impact of ownership on corporate performance has been frequently scrutinised in the economic literature ever since Adam Smith observed that “characters do not exist who are more distant than the sovereign and the entrepreneur” (Smith 1776, p.771). But it was not until the 1980s that political programs of ownership reform refocused the research attention on the issue (Vickers and Yarrow 1991) – if there were any systematic disparities between public and private ownership, was privatisation *per se* the appropriate tool to unlock such performance differentials?

Detailed privatisation studies exist for a number of individual industries as well as for individual countries and larger cross-industry, cross-country samples. This paper, however, is the first comprehensive study of share-issue privatisations in the global oil and gas industry, one of the ‘commanding heights’ of the economy where questions of resource control have recently regained widespread attention.<sup>1</sup> Oil and gas has been, together with utilities and telecommunications, one of the key contributing industries to privatisation revenues (Megginson 2005), and in fact it is the sale of a minority stake in BP in 1977 which is often considered to have been the starting point of modern-day privatisation programmes. But although a number of private oil and gas companies rank amongst the largest corporations in the world, more than 90% of the world’s hydrocarbon reserves remain under the control of nation states and their National Oil Companies (‘NOCs’) (PIW 2007). Despite their economic importance there has been surprisingly little systematic research on NOCs

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<sup>1</sup> For the purposes of this paper, the oil and gas industry is defined to include those companies that generate the majority of their revenues in either exploration and production of hydrocarbons or in refining and marketing of oil products.

(McPherson 2003), and most accounts of structural inefficiencies at these companies have been largely anecdotal.

This paper analyses the operating and financial performance of privatised NOCs, based on a dataset of 60 share-issue privatisations ('SIPs') by 28 firms (from 20 countries) in the period 1977 to 2004. For each firm, a total of 22 different metrics is calculated in order to comprehensively capture firm performance and efficiency. Privatisation here is understood to be the initial sale of (part of) the government equity interest to private investors, where the government has been the controlling shareholder prior to that sale.<sup>2</sup> This definition hence includes both partial and full privatisations via the equity markets, but excludes privatisation sales to other industry buyers. For the sample of initial SIPs, we first employ a univariate testing methodology to compare the pre- and post privatisation performance levels of privatised firms. Secondly, in order to move beyond this simple comparison, we also investigate the time pattern of changes through a multivariate panel data regression analysis. Although the focus on initial SIPs is very common in comparable longitudinal studies<sup>3</sup>, privatisation is usually undertaken via multiple offerings with the government being unlikely to transfer control in the very first offering. We therefore extend – in a third step – the time horizon of analysis to include any possible follow-on offerings of the respective oil and gas companies.

The remainder of this paper is structured as follows: Section II briefly reviews the existing literature, Section III describes the dataset of global share-issue privatisations in the oil and gas sector; Section IV analyses the performance impact associated with initial SIPs; Section V focuses on follow-on SIPs; Section VI discusses some potential concerns as to the study design; Section VII concludes.

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<sup>2</sup> 'State' and 'government' ownership are used interchangeably in this paper.

<sup>3</sup> In fact most previous studies restrict themselves to the analysis of initial SIPs. We are not aware of other studies which consider all privatisation offers over time for a select group of companies.

## II. Literature review

Neither the theoretical nor empirical literature have so far been able to provide conclusive evidence as to whether state or private ownership are inherently superior in promoting economic efficiency, and/or whether privatisation is an appropriate tool to improve firm performance and efficiency.

Most theorists would argue that, under the conditions of competitive markets and the absence of other market failures, privately owned companies tend to be more efficient and more profitable than their state-owned counterparts. But because such restrictive conditions rarely hold in reality, Stiglitz (2007) reminds us that the theoretical argument becomes much less clear. Classic economic theories often cited to explain differences between the two types of ownership include agency (Jensen and Meckling 1976; Fama 1980), property rights (Alchian 1965) and public choice theory (Tullock 1965; Niskanen 1971), but none of these provide unequivocal support to either side of the argument. Having analysed the efficiency tradeoffs between government and private ownership, Laffont and Tirole (1993) thus conclude that theory on its own is unlikely to yield decisive insights.<sup>4</sup>

On the empirical side, reviewers have found well in excess of a hundred relevant studies<sup>5</sup>, which can broadly be grouped into two major research designs: cross-sectional studies of ownership effects on the one hand, and longitudinal studies of privatisation effects on the other. As Villalonga (2000) points out, inherent static superiority of private ownership is a *necessary* conditions for the success of privatisation, but not a *sufficient* one, since privatisation processes are dynamic and potentially include important changes other than ownership, such as political,

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<sup>4</sup> Comprehensive theoretical reviews can be found e.g. in Megginson (2005) and Pollitt (1995).

<sup>5</sup> The empirical evidence has been reviewed e.g. in Megginson and Netter (2001).

regulatory and organisational changes. Focusing on the longitudinal privatisation studies, two methodologies have proven to be particularly influential. The first methodology, as set out in Megginson et al. (1994) and also employed in this paper, compares the pre- and post privatisation performance of companies privatised through public share offerings. The second methodology is the social cost-benefit analysis introduced by Jones et al. (1990).

The basic Megginson methodology has been used for a wide range of privatisation samples. D'Souza and Megginson (1999) combine their own results with those of Megginson et al. (1994) and Boubakri and Cosset (1998) to yield a dataset of 211 companies from 42 countries. The three studies yield consistent findings in that privatisation significantly improves firm profitability, efficiency and output, decreases financial leverage and leads to higher dividend payments, but the effect on employment levels is inconclusive.<sup>6</sup> Their basic univariate methodology has intuitive appeal, but its technical limitations have in recent years led many authors to apply more sophisticated econometric tools. Dewenter and Malatesta (2001), Boubakri et al. (2005) and Gupta (2005) are examples of privatisation studies that use univariate tests as a first approximation within a more detailed framework of analysis.

Evidence of lower profitability does not convincingly prove that public ownership is undesirable, since public firms may be pursuing worthy purposes other than profit maximization. Galal et al.(1994) study the total welfare consequences of privatisation in 12 case studies and find that divestiture substantially improved economic welfare in 11 of the 12 cases. Using the same methodological approach, Newbery and Pollitt (1997) find that the overall welfare effect of the privatisation of the UK's Central

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<sup>6</sup> Other studies explore specific industries such as banking (Verbrugge et al. 2000) and telecoms (D'Souza and Megginson 2000), or specific countries, e.g. Canada (Boardman et al. 2000) and China (Wei et al. 2003; Jia et al. 2005).

Electricity Generating Board is positive, but that government and consumers lose out in favour of large rent capture by producers and their shareholders.

Contrary to the great number of studies on privatisation in general, there is little empirical research to be found on the impact of ownership in the oil and gas sector, and none at all on the impact of privatisation. This is rather surprising given the overall economic importance of the sector and the significant number of privatised NOCs. Al-Obaidan and Scully (1991) investigate efficiency differences between 44 private and state-owned petroleum companies. Controlling for multinationality and operational integration of the firms, they find that state-owned enterprises are, on average, only 61% to 65% as technically efficient as private, for-profit firms. Eller et al. (2007) use nonparametric Data Envelopment Analysis (DEA) as well as parametric Stochastic Frontier Analysis (SFA) on a sample of 80 firms over the period 2002-2004. Their average DEA technical efficiency score for NOCs is 0.27, compared to a sample average of 0.40 and an average score for the five biggest private companies of 0.73. The SFA results are not strictly comparable but yield a similar picture. Adding other structural features of the firm as explanatory variables, e.g. the degree of government ownership and fuel subsidies in the domestic market, moves all firms closer to the efficient frontier. Such structural features thus seem to explain some of the inefficiencies of NOCs. Based on 2004 data covering 90 firms, Victor (2007) analyses the relative efficiency of NOCs and private oil companies in converting reserves into production and revenues, using a simple linear regression function. She finds that the private oil majors are one-third better than NOCs at converting reserves into actual output, and tend to generate significantly more revenue per unit of output.

Both Eller et al. (2007) and Victor (2007) make valuable additions to the otherwise scarce literature on NOCs; our paper, however, differs on a number of

important aspects. First, whilst their papers are cross-sectional in design, we conduct the first time-series analysis of privatised NOCs. Second, they have to restrict themselves to the analysis of high-level data from a third party provider, we can consider firm performance and efficiency in more granular detail based on primary company sources. Third, our study is the only one to make use of panel data analysis to control for time-invariant fixed firm effects.

### **III. Dataset**

There are typically two options to privatise a state-owned company: either a private trade sale to an industrial or financial buyer, or a public share offering. This analysis focuses on the latter because for trade sales there is rarely any comparable pre-vs.-post disclosure available – SIPs are the only transactions for which changes can practically be observed over time. But because the most important and politically sensitive privatisations usually occur in the SIP format anyway, it is possible to argue that a sample of SIPs represent a meaningful picture of oil privatisations in general.

Overall, in the period from 1977 up to and including 2004 a total of 41 privatised companies have been identified based on previous studies, third party databases and a detailed press search by country.<sup>7</sup> Of these 41 companies, three companies were acquired shortly after privatisation, in one instance the government only sold a very minor stake relative to third party investors, in two cases the SIP constituted a negligible stake listed on the domestic stock exchange (largely employee shares), and in seven cases data could not be found or was not made available. For the remaining 28 NOCs from 20 countries extensive accounting and share price data was collected

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<sup>7</sup> All voucher privatisations and all Russian privatisations in oil and gas (whether voucher or not) have been excluded from the analysis, largely for concerns over the transparency of the privatisation process.

from listing prospectuses, annual reports and third party databases. Table 1 sets out the companies and privatisation transactions included within the sample.<sup>8</sup>

**Table 1: Sample of global oil and gas SIPs**

Company	Country	Initial share-issue privatisation				Follow-on SIPs (Years)	Current state ownership (%)
		Offering date	Issue size (US\$m)	State ownership (%)			
				Before	After		
YPF	Argentina	Jul. 93	4,200	100%	41%	-	0%
OMV	Austria	Nov. 87	117	100%	85%	1989, 1996	35%
Petrobras	Brazil	Aug. 00	4,030	62%	45%	2001	40%
Petro-Canada	Canada	Jun. 91	478	100%	81%	1992, 1995, 2004	0%
Fortum	Finland	Dec. 98	1,045	98%	76%	2002	51%
Elf Aquitaine	France	Sep. 86	493	67%	56%	1991, 1992, 1994, 1996	0%
Total	France	Jul. 92	906	32%	4%	1996	0%
Hellenic Petroleum	Greece	Jun. 98	311	100%	77%	2000	35%
MOL	Hungary	Nov. 95	153	100%	72%	1997, 1998, 2004	8%
ONGC	India	Mar. 04	2,350	84%	74%	-	74%
Eni	Italy	Nov. 95	3,907	100%	85%	1996, 1997, 1998, 2001	30%
Japex	Japan	Dec. 03	287	66%	50%	-	50%
Inpex	Japan	Nov. 04	583	54%	36%	-	29%
Statoil	Norway	Jun. 01	3,292	100%	81%	2004, [2005]	63%
Petrochina	P.R. China	Apr. 00	2,890	100%	90%	[2007]	86%
Sinopec	P.R. China	Oct. 00	3,470	100%	78%	-	76%
CNOOC	P.R. China	Mar. 01	1,400	100%	71%	[2006]	66%
OGDC	Pakistan	Nov. 03	120	100%	95%	[2006]	85%
Pakistan Petroleum	Pakistan	Jun. 04	96	93%	78%	-	78%
Petron	Philippines	Aug. 94	335	60%	40%	-	40%
PKN	Poland	Nov. 99	513	85%	55%	2000	28%
Repsol	Spain	Apr. 89	1,140	96%	69%	1993, 1995, 1996, 1997	0%
PTT E&P	Thailand	Mar. 93	52	100%	85%	1994, 1998	67%
PTT	Thailand	Nov. 01	729	100%	69%	-	68%
Tupras	Turkey	Apr. 00	1,200	96%	66%	[2005]	0%
BP	U.K.	Jun. 77	972	68%	51%	1979, 1983, 1987, [1995]	0%
Britoil	U.K.	Nov. 82	911	100%	49%	1985	0%
Enterprise Oil	U.K.	Jul. 84	524	100%	0%	-	0%

Notes:

Follow-on SIP [dates] in brackets: Offer not included in sample due to insufficient post-transaction data (except BP, see below).

Firm-specific notes:

- YPF: State ownership includes both central and provincial government; state ownership after privatisation (41%) is post debt-to-equity swap effected concurrently with IPO; YPF/Argentine government accepted takeover offer from Repsol in 1999/2000.
- OMV: Abu Dhabi state vehicle IPIC became strategic investor (20%) in 1994.
- Petrobras: State ownership is economic interest and includes central government (32%) and state-owned bank; combined state voting interest is at 58%; Petrobras long had local minority share listing (in 1983 private ownership reported at 16%) and smaller sales of preference shares, usually by state bank BNDES, took place e.g. in 1985 and 1994-97. The 2000 international IPO was significantly larger and comprised common (voting) shares.
- Fortum: Oil business spun off in 2005 ("Neste Oil"), state ownership 50.1%.
- Elf Aquitaine: Fully privatised by year-end 1996, accepted takeover/merger offer from TotalFina in 1999.
- Hellenic Petroleum: Two additional trade sales to Paneuropean Oil/Latsis Group (36% in total) in 2003/04.
- MOL: 8% are treasury shares, so officially held by company rather than state; state retains 'golden share'.
- ONGC: An additional 10% of shares is held by other state-owned Indian oil companies, so effective state ownership is 84%.
- Inpex: State diluted from 36% to 29% due to acquisition of Teikoku Oil in 2006; Japex (50% state) owns further 11% equity in Inpex.
- Statoil: State ownership diluted from 70% to 62.5% due to acquisition of Norsk Hydro Petroleum in 2007.
- Petrochina: State ownership diluted from 88% to 86% due to A-Share issue in 2007.
- CNOOC: 2004 convertible bond issue not included.
- Pakistan Petroleum: International Finance Corporation (IFC) became shareholder (6%) prior to IPO.
- Petron: Saudi-Aramco became strategic investor (40%) prior to IPO.
- PTT: 15.5% of equity now held by state-owned Vayupak Fund instead of Ministry of Finance directly.
- PTT E&P: State ownership is indirect through PTT parent company.
- Tupras: 2.5% of equity had already been sold on the local stock exchange in 1991; following an unsuccessful attempt in 2003, an additional 51% of the company was sold in 2006 to a consortium led by KOC Holdings.
- BP: The underwritten block sale of final 1.9% government shares in December 1995 is rarely reported in BP privatisation history. The sale value was US\$800 million, but is not considered in the follow-on sample due to the small percentage size of the offer.

Source: Company information, Press reports, Megginson (2005)

<sup>8</sup> No OPEC member has endorsed NOC (part-) privatisation, but countries such as Norway, Canada and Brazil are home to significant hydrocarbon provinces.



## **Initial share offerings**

22 out of the 28 initial SIPs were genuine Initial Public Offerings (IPOs), three companies already had international listings at the time of the first government sell-down, and a further three had small domestic listings.<sup>9</sup> Average state ownership prior to these SIPs was 88%, with 25% being sold to private investors. Only one company was privatised fully in a single transaction. Expressed in 2006 money, the 28 initial SIPs in the sample raised a total of US\$48.6 billion, or an average of US\$1.74 billion per transaction. The UK stands out as the frontrunner for privatisation, having sold three different companies to the equity markets by 1987. There has also been a noticeable increase in the number of transactions after the year 2000 (12 out of 28), which has consequences for the oil price environment. The average real terms oil price (in 2005 money) for the three years prior to privatisation is US\$30.4 per barrel, compared to US\$30.9 per barrel in the year of the SIP, and US\$34.3 in the three years thereafter. The data suggests that governments do not (and cannot) price their offerings at the top of the macro cycle.

## **Follow-on offerings**

In a second round of data collection, the time period of firm performance data was extended to include the 7-year periods around any SIP follow-on transactions completed by the 28 firms in the original sample. Because these offers are rarely more than seven years apart, the time series in practice were extended to cover the period from 3 years prior to the first SIP to 3 years after the final SIP. A total of 38 follow-on offerings were identified (see Table 1), of which 32 have been included in the extended data sample – 5 out of 6 of the others took place in 2005 or later, so there is

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<sup>9</sup> These small local offers mandated only limited disclosure requirements and saw very illiquid share trading. They might therefore not be seen as “proper” privatisations, with the public listing having little impact on the monitoring of managerial performance.

insufficient post-offering data available for a meaningful comparison. The full dataset of initial and follow-on offerings covers 283 observation years. Of the 27 companies that could have made follow-up offerings after the initial SIP, only eight have (so far) chosen *not* to do so, four of which were listed only recently, i.e. post 2003. The 19 other companies on average had two follow-on offerings, the maximum number being four. There is little evidence of a common pattern in the timing of such follow-ons: on average, they have been approximately three years apart from each other, but with a wide range (1 to 9 years), and irrespective of the rank of such offerings. There is also no consistent indication as to the size of follow-on offerings relative to initial SIPs.

#### **IV. Initial share-issue privatisations**

Based on this dataset we test whether the privatisation of NOCs is empirically associated with, or even the cause for, (1) increases in profitability, (2) increases in efficiency and labour productivity, (3) increases in capital investment, (4) increases in output, (5) decreases in employment, (6) decreases in financial leverage, and (7) increases in dividend payments. For that purpose a total of 22 empirical proxies are calculated for each privatised NOC:

- (1) *Profitability*: return on sales, return on assets, return on equity.
- (2) *Operating efficiency*: sales per employee, net profit per employee, physical output per employee (output defined as the sum of oil and gas either produced or refined), finding and development costs per barrel ('F&D costs per boe'), production costs per barrel, reserve replacement ratio ('RRR').<sup>10</sup>
- (3) *Capital investment*: capital expenditure, capex over sales, capex over assets.
- (4) *Output*: physical output (see above), monetary sales.

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<sup>10</sup> Production costs, F&D costs and RRR are best sourced for companies with a (primary or secondary) U.S. listing, where the SEC requires standardised disclosures of oil and gas producers in accordance with FASB No. 69. Data on other firms, if available, might not be equally standardised and reliable.

(5) *Employment*: Numbers of employees, relative change in employment, employees over assets.

(6) *Financial leverage*: debt over equity, debt over capital, debt over EBITDA.

(7) *Dividend payment*: dividends over net profit, dividends over sales.

In computing sales, sales per employee, income per employee, F&D costs, production costs and capex the nominal monetary values are deflated using the IMF's Consumer Price Index.<sup>11</sup> All per-employee metrics, F&D costs, production costs, capex, sales, physical output, relative employment and employees over assets are “normalised” to the value of 1.0 in the year of privatisation, with the other years expressed relative to unity.

Although all metrics convey useful information, some are less susceptible to technical or price volatility and are therefore ‘preferred’ choices: return on sales, physical output (total and per employee, rather than monetary sales), production costs per barrel (rather than F&D cost or RRR), balance sheet gearing (rather than cash flow multiples) and dividend over income are some of these first choice metrics. Capital expenditure is the result of mid-term financial planning, so the ratio of capex over assets as well as capex itself are informative. Finally, the labour intensity ratio of employees over assets is useful if there have been major divestments or acquisitions.

### **Pre- vs. post-privatisation**

For each firm we calculate the means and medians of the 22 empirical proxies for the pre-privatisation (-3 to -1 years) and post-privatisation (+1 to +3 years) period. The values and their changes are reported in Table 2. A non-parametric test, the one-sided Wilcoxon signed-rank test, is then employed to test whether the median

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<sup>11</sup> Balance sheet items and ratios of flow measures over balance sheet items are nominal values. Ratios based on inflation-adjusted balance sheet figures have been calculated as a cross-check.

difference in variable values is zero. In addition, we calculate the percentage of companies with improved performance as defined above.

**Table 2: Results of univariate tests**

Variable	No. of obs	Three-year averages: -3 to -1 vs. +1 to +3				
		Average (median) before	Average (median) after	Change in average (median)	z-statistic (one-sided Wilcoxon signed-rank test)	Fraction of firms that change as predicted
Return on sales	28	0.0973 (0.0468)	0.1257 (0.0787)	0.0284 (0.0319)	-2.824***	75.0%
Return on assets	28	0.0595 (0.0433)	0.0886 (0.0666)	0.0291 (0.0233)	-3.211***	71.4%
Return on equity	28	0.1412 (0.1175)	0.1830 (0.1607)	0.0418 (0.0432)	-2.049**	64.3%
Sales per employee	25	0.8777 (0.8477)	1.1512 (1.1245)	0.2735 (0.2768)	-3.054***	84.0%
Profit per employee	24	0.6717 (0.5929)	1.2210 (1.0761)	0.5494 (0.4832)	-3.486***	83.3%
Output per employee	24	0.8956 (0.9016)	1.0672 (1.0742)	0.1717 (0.1727)	-2.914***	70.8%
F&D costs per boe	10	2.7736 (1.5003)	1.5437 (1.6038)	-1.2298 (0.1035)	0.459	55.6%
Production cost per boe	14	1.0635 (1.0505)	1.0851 (0.9513)	0.0217 (-0.0992)	-0.157	61.5%
Reserve replacement	14	1.5079 (1.3539)	1.6258 (1.3272)	0.1179 (-0.0267)	-0.220	46.2%
Capex	28	0.9679 (0.8783)	1.4615 (1.3159)	0.4936 (0.4376)	-3.985***	78.6%
Capex / sales	28	0.1990 (0.1306)	0.1783 (0.1337)	-0.0206 (0.0030)	0.182	57.1%
Capex / assets	28	0.1071 (0.1032)	0.1198 (0.1163)	0.0127 (0.0131)	-1.571*	64.3%
Sales	28	0.8763 (0.8559)	1.2215 (1.1268)	0.3452 (0.2709)	-3.279***	75.0%
Physical Output	26	0.8847 (0.9351)	1.1408 (1.0749)	0.2561 (0.1398)	-4.076***	92.3%
Employment	25	62,139 (17,536)	55,245 (13,942)	-6,894 (-3,595)	1.036	48.0%
Rel. employment	25	1.1350 (1.0144)	1.1211 (1.0259)	-0.0139 (0.0115)	-0.283	48.0%
Employees / assets	25	1.2598 (1.1936)	0.8747 (0.8273)	-0.3851 (-0.3663)	4.049***	88.0%
Debt / equity	28	0.8722 (0.6767)	0.5581 (0.5177)	-0.3140 (-0.1590)	1.662**	64.3%
Debt / debt+equity	28	0.3636 (0.3894)	0.3120 (0.3388)	-0.0516 (-0.0506)	1.708**	64.3%
Debt / EBITDA	27	1.7429 (1.1747)	1.2964 (1.3507)	-0.4465 (0.1760)	1.826**	59.3%
Dividends / sales	28	0.0356 (0.0089)	0.0569 (0.0226)	0.0213 (0.0137)	-2.482***	71.4%
Dividends / profit	26	0.3523 (0.3105)	0.3986 (0.4055)	0.0464 (0.0950)	-1.562*	65.4%

Notes: \* / \*\* / \*\*\* : Denotes significance at the 10-percent / 5-percent / 1-percent level, respectively.

*Profitability.* All measures show economically and statistically significant (at 1% and 5% levels) improvements. Three out of four firms improve their return on sales.

*Efficiency.* All per-employee metrics increase at the 1% significance level, including the preferred metric of output per employee. Production cost per barrel shows some improvement at the median level, but not statistically significant. Rather than through a sustained reduction of operating costs, efficiency improvements seem to materialise through a combination of higher output, cuts in employment intensity,

and cuts in more or less well defined “overhead costs”, which enable a redirection of parts of the budget towards operating assets.

*Capital investment and output.* The significant increases in real-terms capex and in the ratio of capex over assets indicate a strong corporate emphasis on investment.<sup>12</sup> 92% of firms manage to increase their physical output, resulting in very significant improvements in output and monetary sales.

*Employment.* Often a controversial aspect of privatisation, previous studies found conflicting evidence as to the direction and magnitude of employment changes (Megginson and Netter 2001). In line with this “tradition” the companies in our sample reduce average headcount by 6,900 or 11% of staff, but this reduction is – at least statistically – not significant. Also, 52% of firms actually increase their headcount, so the average overall reduction is due to a minority of firms with high numbers of redundancies.<sup>13</sup> The highly significant reduction in the ratio of employees over assets in any case indicates that the privatised NOCs manage to operate their assets with much higher labour productivity.

*Financial leverage and dividend payout.* The results show a significant de-leveraging of privatised NOCs, as well as a higher dividend payout ratio.

The univariate tests of NOCs corroborate the positive association of privatisation and firm performance, but do not yet control for changes in oil prices or for changes within a suitable control group. Also, there is no direct evidence of improvements in production costs, or more generally in technical efficiency. Finally, the averages frequently mask a considerable range of individual firm-level performance changes - whilst performance improvements can be expected in the context of privatisation, they cannot be expected in every single case.

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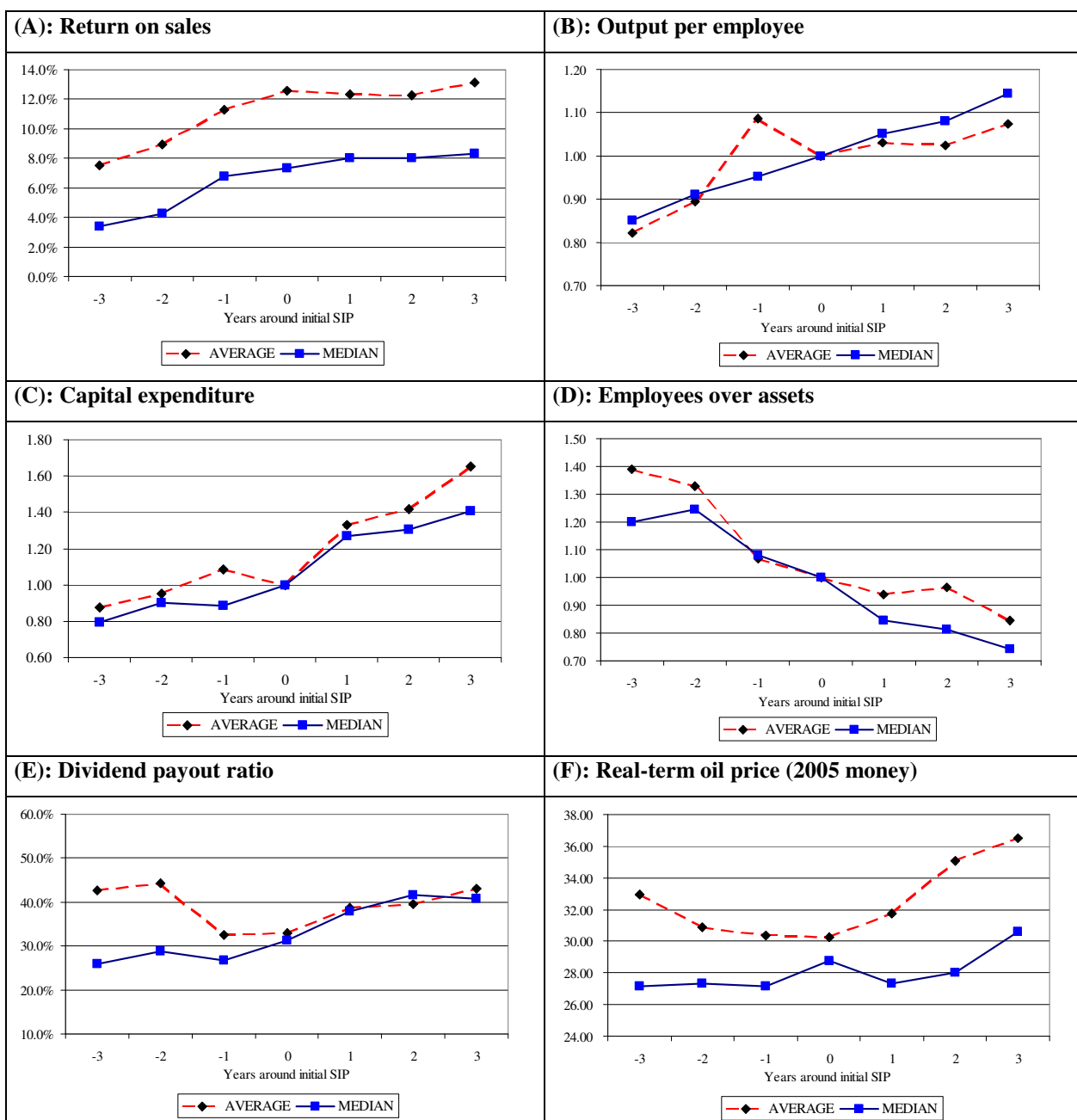
<sup>12</sup> Where disclosed, acquisitions have been excluded from capex.

<sup>13</sup> Most obvious are Sinopec and Petrochina, which reduced average payroll from 483,000 to 420,000 and from 512,000 to 421,000, respectively. Excluding these, average headcount reduction falls to 3.3%.

## Performance changes over time

Moving beyond the pre- vs. post-privatisation averages, we now consider the year-by-year performance evolution over the seven-year period. This perspective promises additional insights into the dynamics of privatisation, since e.g. Dewenter and Malatesta (2001) find that performance improvements largely occur in the three years leading up to privatisation, rather than at or after the time of privatisation.

**Figure 1 (A) to (F): Change in selected performance metrics around initial SIP**



Visual inspection of Figures 1(A) to 1(E) indicates that it is difficult to pinpoint a single discrete change for most of our preferred performance measures. Most measures start improving well before the privatisation takes place in the capital markets. Figure 1(F), the development of the real terms oil price, confirms that governments do not sell at the peak of the oil price cycle.

In order to confirm the visual inspection we estimate the following fixed-effects panel data model (see Villalonga 2000):

$$\text{Perf}_{it} = \alpha_i + \beta_1 \text{Post}_{it} + \beta_2 \text{Year}_{it} + \beta_3 [\text{Post*Year}]_{it} + \gamma \text{Oil}_{it} + \mu \text{CtrGrp}_t + \varepsilon_{it} ,$$

where:

- ‘Perf’ is the relevant performance metric,
- ‘Post’ is a dummy variable for the years post privatisation (i.e. years +1 to +3),
- ‘Year’ is a discrete variable, ranging from 1 (for observations in year –3) to 7 (for observations in year +3),
- ‘Post\*Year’ is a slope dummy variable,
- ‘Oil’ is a control variable for the oil price in real terms, and
- ‘CtrGrp’ is the median performance of the control group (where available).
- Unit fixed effects  $\alpha_i$  are significant and thus included in the specification.

In this model the coefficient of ‘Post’ captures differences in the (average) performance levels before and after privatization, the coefficient of ‘Year’ indicates the year-on-year performance trend, and ‘Post\*Year’ evidences any changes in such performance trends that take place after the privatisation transaction. A positive coefficient in ‘Post\*Year’ thus indicates that the performance trend further increases after privatization (or decreases less, if the ‘Year’ coefficient is negative). The model also includes two control variables, one for oil prices – the most important and most volatile driver of corporate performance – and another for the performance of an industry control group of firms which did not experience any changes in

ownership.<sup>14,15</sup> This control group should capture the broader developments in industry and the economy (e.g. technical progress), so that any incremental performance improvements of the privatised companies can be considered firm-specific and associated with the privatisation process.

Because the control group data is only available for the years post 1988, we first run the regression model on the full sample of initial SIPs, but without the control group variable included in the specification (see Table 3). We then define a sub-sample of those initial SIPs that took place after 1988, for which control group data is available (see Table 4). Diagnostic model tests indicate that the errors are non-spherical, i.e. subject to both serial autocorrelation and heteroskedasticity.<sup>16</sup> Whilst a number of different estimation procedures have been considered, the significance of the unit effects has been important in the choice of a fixed-effects model with cluster-robust error terms.<sup>17</sup> The results presented in this paper are based on the dataset being adjusted for outliers at the 5% level.

For the full sample, the coefficient of the 'Post' variable has the predicted sign for all performance measurements<sup>18</sup>, i.e. there is a discrete step-up in performance after the handover of property rights to private investors, but this is only significant for the increase in profitability and the reduction of employment intensity.

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<sup>14</sup> The control group is based on the "PIW Top 50 Oil Companies" rankings (PIW 1988-2007), which has the most comprehensive coverage available of both public and private oil and gas companies. It contains information on output, employees, revenues, net income and assets, but not on capital expenditure, production costs, financial leverage or dividends, as much of this is unavailable for fully state-owned NOCs. The control group consists of the 21 (public and private) companies that did not experience any changes to their ownership structure and that have featured in all of the 20 annual rankings. We take the median annual performance to be the performance of the control group.

<sup>15</sup> We use *both* variables in order to distinguish the truly exogenous impact of oil prices from other aspects of performance changes in the control group, which might be linked to management decisions.

<sup>16</sup> The autocorrelation test is based on Wooldridge (2002, p.282-3) and heteroskedasticity is tested via a likelihood-ratio test. Unit roots have been tested following Maddala and Wu (1999).

<sup>17</sup> Beck and Katz (1995) show that a commonly used variety of feasible generalized least squares, as recommended by Parks (1967) and Kmenta (1986), produces unduly optimistic standard errors unless  $T \gg N$ . But the alternative suggested by Beck and Katz, OLS with panel-corrected standard errors, does not perform well in the presence of unit effects (Adolph et al. 2005; Wilson and Butler 2007).

<sup>18</sup> For capital expenditure, the sign of the POST variable is negative, but this is overcompensated by the positive change in the time trend.



**Table 3: Regression results for performance changes (all initial SIPs)**

	Independent variables				No. of obs.	R-squ. (within)	Annual PP change / CAGR		
	Post	Year	Post*Year	OilPrice			Full period	Y1-4	Y5-7
Return on sales	0.0313 (0.0184) 1.70*	0.0119 (0.0032) 3.66***	-0.0096 (0.0041) -2.34**	0.0009 (0.0004) 2.28**	174	0.2020	0.6%	1.2%	0.0%
Return on assets	0.0358 (0.0188) 1.91*	0.0133 (0.0031) 4.31***	-0.0114 (0.0040) -2.85***	0.0008 (0.0003) 3.15***	177	0.2560	0.6%	1.3%	-0.1%
Output per employee	0.2015 (0.1452) 1.39	0.0607 (0.0222) 2.74***	-0.0463 (0.0330) -1.40	-0.0004 (0.0024) -0.15	160	0.1998	4.4%	7.0%	2.0%
Production costs	-0.3516 (0.2358) -1.49	-0.0263 (0.0277) -0.95	0.0755 (0.0545) 1.38	0.0022 (0.0054) 0.41	92	0.0401	0.3%	-2.4%	3.0%
Capex	-0.0469 (0.5319) -0.09	0.0313 (0.0406) 0.77	0.0610 (0.1030) 0.59	0.0160 (0.0041) 3.94***	183	0.3494	6.6%	2.5%	10.9%
Physical output	0.0317 (0.1288) 0.25	0.0478 (0.0101) 4.73***	0.0025 (0.0231) 0.11	-0.0007 (0.0030) -0.24	179	0.4019	5.8%	5.5%	6.2%
Employment (rel.)	-0.1680 (0.1224) -1.37	-0.0169 (0.0173) -0.98	0.0337 (0.0276) 1.22	0.0028 (0.0015) 1.79*	157	0.0548	-0.5%	-1.6%	0.5%
Employment / assets	-0.2210 (0.1320) -1.67*	-0.0780 (0.0212) -3.68***	0.0432 (0.0293) 1.47	-0.0067 (0.0018) -3.76***	157	0.5120	-6.9%	-7.6%	-6.2%
Debt / equity	-0.1793 (0.1959) -0.92	-0.0340 (0.0364) -0.93	0.0312 (0.0479) 0.65	-0.0004 (0.0024) -0.16	173	0.0683	-2.7%	-3.4%	-2.1%
Dividends / net income	0.0100 (0.1115) 0.09	0.0179 (0.0245) 0.73	0.0057 (0.0283) 0.20	-0.0026 (0.0018) -1.43	181	0.0948	2.6%	1.8%	3.4%

Notes:

Based on fixed-effects model with cluster-robust error terms. Reported are coefficients, standard errors (in parentheses) and t-statistics. Annual percentage point changes (RoS, RoA, D/E, Div/Income) and compound annual growth rates (all other metrics) are calculated assuming the average of the respective fixed unit effects and a constant real-terms oil price of US\$50/barrel

**Table 4: Regression results for performance changes (initial SIPs post 1988)**

	Independent variables			Control variables		No. of obs.	R-squ. (within)	Annual PP change / CAGR		
	Post	Year	Post*Year	OilPrice	CtrGrp			Full period	Y1-4	Y5-7
Return on sales										
- Excl. control group	0.0317 1.54	0.0141 3.95***	-0.0102 -2.28**	0.0004 0.55	- -	141	0.2268	0.8%	1.4%	0.1%
- Incl. control group	0.0248 1.09	0.0143 4.12***	-0.0090 -1.84*	-0.0003 -0.45	0.4602 1.70	139	0.2525	0.8%	1.4%	0.2%
Return on assets										
- Excl. control group	0.0358 1.67	0.0144 4.24***	-0.0118 -2.79**	0.0007 1.50	- -	146	0.2589	0.7%	1.4%	-0.1%
- Incl. control group	0.0333 1.61	0.0145 4.17***	-0.0113 -2.68**	0.0002 0.35	0.1982 1.71	144	0.2684	0.7%	1.4%	-0.1%
Output per employee										
- Excl. control group	0.2231 1.31	0.0534 2.18**	-0.0435 -1.19	-0.0017 -0.41	- -	132	0.1936	4.5%	6.3%	2.7%
- Incl. control group	0.2152 1.23	0.0573 2.14**	-0.0426 -1.15	-0.0022 -0.49	-6.7379 -1.31	129	0.1964	4.9%	6.8%	3.0%
Physical output										
- Excl. control group	0.1282 1.02	0.0371 3.08***	-0.0166 -0.86	0.0026 0.69	- -	144	0.3679	3.8%	3.8%	3.8%
- Incl. control group	0.1441 0.98	0.0502 2.44**	-0.0217 -0.89	0.0018 0.42	-0.0003 -1.37	142	0.3889	4.8%	5.3%	4.3%
Employment (rel.)										
- Excl. control group	-0.1931 -1.35	-0.0151 -0.77	0.0353 1.11	0.0029 1.05	- -	133	0.0377	-0.6%	-1.4%	0.3%
- Incl. control group	-0.1992 -1.30	-0.0161 -0.64	0.0366 1.07	0.0030 0.97	0.0164 0.03	130	0.0376	-0.6%	-1.5%	0.3%
Employment / assets										
- Excl. control group	-0.2291 -1.57	-0.0772 -3.17***	0.0476 1.50	-0.0096 -4.22***	- -	132	0.5316	-6.9%	-8.1%	-5.6%
- Incl. control group	-0.2253 -1.47	-0.0594 -2.08**	0.0449 1.35	-0.0092 -4.02***	0.1469 0.58	129	0.5092	-5.0%	-6.3%	-3.7%

Notes:

Based on reduced sample of initial SIPs post 1988 (23 out of 28 companies), for which period the control group data is available. Model specification excluding the control group is same as in Table 3. Annual PP changes/CAGR calculations assume the average performance metrics over the 20-year period for the control group.

The year-on-year trend also points into the expected direction for all of the metrics, and is in fact very significant for many of them. The interaction variable ‘Post\*Year’ in seven out of ten cases has a different sign from the trend variable, indicating a softening (or reversal) of the performance trend after privatisation. As expected the model finds oil prices to play an important role in explaining e.g. higher profitability and capital expenditure, but the net effect of privatisation on firm performance remains substantial, even when controlling for oil prices.

Over the seven-year period around privatisation, the ‘typical’ NOC – assuming the average of the fixed unit effects  $\alpha_i$ , and a constant oil price of US\$50/barrel – improves its return on sales by 3.6 percentage points (0.6 p.a.), increases output per employee by 30% (CAGR 4.4%), and capex by 47% (CAGR 6.6%); total output is up by 40% (CAGR 5.8%), and the ratio of employees over assets falls by 35% (CAGR 6.9%); the leverage ratio of debt over equity drops by 16 percentage points (2.7 p.a.), and the dividend payout increases by 16 percentage points (2.6 p.a.). The timing of performance improvements varies between metrics, but overall the importance of the pre-privatisation period is striking. In what might be called the ‘anticipation effect’ of privatisation, a significant part of the total benefits are realised in the run-up to the handover of property rights. Whilst capital expenditure is ramped up substantially following privatisation, physical output and employment intensity improve steadily throughout the seven-year period, and in terms of profitability *all* of the improvements are already realised in anticipation of the deal. As to the size and nature of operating cost reduction: in the three years leading up to privatisation the to-be-privatised firms manage to reduce their unit production costs by 7% and cut their employment levels by 5%, but based on the point estimates neither of these are sustained beyond this date, and neither of them is of statistical significance.

The analysis of the SIP sub-sample in Table 4 shows that firm-specific effects account for the large majority of performance improvements. The control group coefficients are not statistically significant, and point estimates and significance levels change little after inclusion of the control group. The annual growth rates indicate that part of the observed reduction in employment intensity is due to industry trends, but that the majority of the overall changes are firm-specific. Total output growth and output growth per employee are even greater when the control group is included in the specification – the privatised companies improve in spite of a negative industry trend.

### **Share returns analysis**

Because many of the performance improvements that we find are based on accounting data, the possibility of “window dressing” (or earnings management) has to be considered, most likely in the form of managed positive accruals prior to the offering, in order to maximise privatisation revenues. Under the ‘disappointment hypothesis’, managed accruals before the offering should result in both subsequent underperformance on accounting measures *and* downward revisions in share price (Soffer 2001). DuCharme et al. (2001) find that pre-IPO abnormal accruals are positively related to initial firm value and are significantly negatively related to subsequent firm stock returns. Calculating abnormal share returns for our sample of oil and gas privatisations is therefore a suitable check whether pre-privatisation performance improvements are temporary accounting constructs only. In contrast to studies on IPOs of private companies, previous studies on the share performance of privatised companies suggest that these stocks outperform in the long-run (Choi et al. 2006).<sup>19</sup>

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<sup>19</sup> At their offering price, the 28 privatised oil and gas companies within our sample had an aggregate market capitalisation (in 2006 money) of US\$253 billion. Excluding Britoil and Enterprise Oil, both of

We calculate buy-and-hold abnormal returns (Barber and Lyon 1997) over one-, three- and five-year periods, i.e. subtract the contemporaneous return on an index from the return on each privatised firm's shares. Benchmark indices are the Datastream Total Market Index for each country, and the Datastream Global Oil and Gas Index. Both straight and value-weighted performance averages are shown to account for the possibility of outperformance of smaller stocks. We further report the initial offer return<sup>20</sup>, which indicate moderate (at the median level) to substantial (at the mean level) underpricing of oil and gas privatisations.

**Table 5: Buy-and-hold abnormal returns**

	Initial offer return	Absolute return (%)			Rel. to country index (%)			Rel. to Global O&G index (%)		
		1y	3y	5y	1y	3y	5y	1y	3y	5y
<b>Simple averages, buy-and-hold returns, excluding IPO return on 1st day of trading</b>										
Mean	20.8%	20.4%	93.1%	160.6%	-5.9%	23.2%	60.7%	5.9%	54.3%	84.6%
Std dev.	36.3%	47.7%	154.3%	161.3%	49.4%	130.5%	159.8%	47.1%	152.5%	143.3%
Median	5.6%	8.3%	50.9%	131.9%	-7.4%	15.4%	43.8%	3.0%	8.6%	26.5%
Min	-8.8%	-32.0%	-58.1%	-69.6%	-172.6%	-78.0%	-122.7%	-51.9%	-110.6%	-130.8%
Max	136.1%	215.8%	670.5%	565.7%	135.9%	567.8%	605.2%	207.1%	636.0%	494.0%
<b>Weighted averages (by market cap at end of 1st day of trading, in inflation-adjusted US\$)</b>										
Wgt.avg.	6.0%	12.4%	45.4%	132.2%	-8.3%	-6.5%	18.8%	0.6%	21.3%	65.4%

Notes:

Initial offer returns for 22 IPOs in the sample are reported in the second column; buy-and-hold returns for all 28 privatisation offerings exclude initial offer return (i.e. assuming that shares are bought at closing price of first trading day).

Within the first year, there is some evidence of stock underperformance of privatisation offers relative to country indices, but this is neither consistent across benchmarks (there is an outperformance relative to the industry index, suggesting that the industry as a whole underperformed relative to country indices) nor across time (over the longer run oil and gas SIPs substantially outperform both their respective country and industry index). In fact, both absolute and abnormal share returns consistently improve in the longer run, suggesting that the market tends to take too pessimistic a long-term outlook on the performance improvements available to

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which have been taken over and delisted, the 26 remaining firms as of 01 March 2007 had an aggregate market capitalisation of almost US\$1.4 trillion.

<sup>20</sup> For the six companies already listed, initial offer returns are based on the closing share price on the last day before issuance of the shares to investors.

privatised NOCs.<sup>21</sup> Because, in addition to the positive abnormal share returns, these firms' accounting performance is not exhibiting a decline associated with the reversal of positive accruals, the observed pre-privatisation accounting changes seem to fairly reflect underlying economic realities.

## **V. Follow-on offerings**

Privatisation, and particularly privatisation of large or domestically important companies, is usually undertaken not in a single step, but rather through a series of public share offerings and/or trade sales (Perotti and Guney 1993; Megginson et al. 2001). A number of explanations have been proposed: the selling government can build credibility (of non-interference) over time and therefore maximise sales proceeds; the initial offering can be kept small to “test the waters” and to spread the sales risk over time; the multiple offerings help overcoming political resistance to large sell-downs, etc. As set out in Section III, this pattern also applies for privatisations within the global oil and gas industry. Governments are unlikely to transfer control in the very first offering, and partial privatisations are the norm rather than the exception. What is the impact on firm performance of such extended, gradual privatisation processes? And are the performance changes observed during the initial SIPs perpetuated or reversed at some point?

As visual inspection of the individual performance patterns provides limited generalisable insights, we perform a regression analysis of the full dataset. For the analysis of initial SIPs we were able to standardise the time period to seven years and the number of offerings under consideration to one; the data on the longer-term privatisation trajectories, on the other hand, is inevitably of greater structural

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<sup>21</sup> The distribution of share returns is skewed towards the left, i.e. a small number of privatisations have managed to yield very large share returns. Comparing simple and weighted averages shows that indeed the smaller firms outperform their (in terms of market capitalisation) larger competitors.

heterogeneity, which we attempt to capture through a number of additional dummy and interaction variables. We also introduce variables for the percentage of state ownership and for the timing of the control transfer to private shareholders. As was the case for the initial SIPs, unit effects again are shown to be significant and, therefore, a fixed-effect model with cluster-robust standard errors is estimated.

$$\text{Perf}_{it} = \alpha_i + \beta_1 \text{L.Govt}\%_{it} + \beta_2 \text{L.CtrTrans}_{it} + \beta_3 \text{Year}_{it} + \gamma \text{Oil}_{it} + \delta_m \text{Post}(m)_{it} + \mu_n [\text{Post}(n)*\text{Year}]_{it} + \varepsilon_{it} ;$$

where:

- ‘Perf’ is the relevant performance metric,
- ‘L.Govt%’ is the lagged percentage ownership of the home government,
- ‘L.CtrTrans’ is a lagged dummy variable for the periods with majority voting control transferred to private investors,
- ‘Year’ is a discrete variable, ranging from 1 to 19,
- ‘Oil’ is a control variable for the oil price in real terms,
- ‘Post(m)’, for m=1 to 5, is a dummy variable for the years post the public share offerings 1 to 5, respectively,
- ‘Post(n)\*Year’, for n=1 to 5, is a slope dummy variable.

Lagged values of government ownership and control transfer were found to be of greater significance than their non-lagged counterparts. Table 6 shows the detailed regression results for the key performance metrics. The only significant effect of higher government ownership is to increase employment intensity of the firm, which is also significantly positive related to government control. Both findings support the notion that excess employment is the most prominent inefficiency of NOCs. But the impact of government ownership on all other performance metrics is non-significant and, based on the sign of the coefficients, generally mixed.

The point estimates and significance levels for the underlying yearly performance trend, the initial SIP, and oil prices are very much in line with the results of the seven-year model. As to the follow-on offerings and their corresponding trend interaction

variables, the two main issues of interest are whether corporate performance is systematically impacted by the total *number* of privatisation offerings, and/or by the *timing* of any individual offering.

**Table 6: Results of panel data model for long-term performance trends**

	Return on Sales	Output / Employee	Production Costs	Capex	Physical Output	Employment / Assets	Debt / Equity	Dividends / Net income
Constant	0.0066 (0.0239)	1.0299 *** (0.3499)	1.4185 (0.3958)	0.4800 (0.3607)	0.8141 *** (0.1739)	1.1431 *** (0.1381)	0.8498 *** (0.2766)	0.2463 (0.1629)
L.Govt%	0.0075 (0.0205)	-0.3923 (0.3892)	-0.5547 (0.4769)	0.0211 (0.4120)	-0.0077 (0.1858)	0.3538 ** (0.1690)	-0.1485 (0.3202)	0.1490 (0.1758)
L.CtrTrans	-0.0091 (0.0102)	-0.0230 (0.1211)	0.0815 (0.2636)	0.2198 (0.1941)	0.0952 (0.0667)	-0.1487 *** (0.0521)	0.1139 (0.1301)	0.0535 (0.0633)
Year	0.0119 *** (0.0032)	0.0657 ** (0.0241)	-0.0173 (0.0279)	0.0338 (0.0374)	0.0485 *** (0.0110)	-0.0791 *** (0.0220)	-0.0267 (0.0370)	0.0172 (0.0253)
Oil	0.0011 *** (0.0002)	0.0019 (0.0021)	0.0062 (0.0042)	0.0109 *** (0.0036)	-0.0005 (0.0014)	-0.0046 *** (0.0014)	0.0007 (0.0017)	-0.0040 *** (0.0014)
Post1	0.0371 * (0.0193)	0.1742 (0.1395)	-0.4335 (0.2561)	-0.5337 (0.5073)	0.0640 (0.1366)	-0.0559 (0.1056)	-0.1919 (0.2050)	0.0756 (0.1160)
Post2	-0.0066 (0.0248)	-0.1552 (0.1684)	0.3395 (0.3875)	0.2639 (0.6772)	0.1860 (0.1581)	0.1327 (0.1584)	0.5985 (0.3532)	0.1783 (0.1482)
Post3	-0.0665 ** (0.0323)	-0.6895 * (0.3786)	-1.1138 (0.6317)	-1.2850 * (0.7533)	-0.6667 *** (0.2366)	-0.1028 (0.1443)	0.0447 (0.4849)	0.2224 (0.1708)
Post4	0.1363 *** (0.0238)	0.8635 ** (0.3893)	-1.5540 * (0.7907)	1.4588 (1.0672)	0.4354 (0.3483)	-0.1772 (0.1347)	-1.1390 * (0.5926)	-0.0686 (0.2234)
Post5	-0.0253 (0.0282)	-1.0415 * (0.6004)	1.3743 *** (0.2134)	2.1391 * (1.2247)	-0.3229 ** (0.1486)	-0.0730 (0.2111)	-0.1489 (1.1064)	0.4361 (0.3664)
Post1 x Year	-0.0107 ** (0.0041)	-0.0610 * (0.0329)	0.0538 (0.0545)	0.1485 (0.0999)	-0.0072 (0.0200)	0.0295 (0.0269)	0.0143 (0.0464)	0.0002 (0.0266)
Post2 x Year	0.0007 (0.0033)	0.0107 (0.0189)	-0.0452 (0.0450)	-0.0745 (0.0988)	-0.0327 (0.0209)	0.0021 (0.0190)	-0.0747 * (0.0432)	-0.0291 (0.0219)
Post3 x Year	0.0065 ** (0.0029)	0.0682 ** (0.0305)	0.0897 (0.7059)	0.0873 (0.0680)	0.0557 ** (0.0222)	0.0096 (0.0144)	0.0180 (0.0407)	-0.0143 (0.0188)
Post4 x Year	-0.0102 *** (0.0020)	-0.0701 ** (0.0296)	0.1346 * (0.0733)	-0.1476 * (0.0828)	-0.0330 (0.0248)	0.0235 ** (0.0091)	0.0808 * (0.0448)	0.0175 (0.0142)
Post5 x Year	0.0013 (0.0025)	0.0778 * (0.0448)	-0.1805 *** (0.0099)	-0.1406 (0.0851)	0.0285 ** (0.0125)	0.0038 (0.0173)	0.0230 (0.0881)	-0.0277 (0.0239)
N	254	228	124	261	254	234	252	258
F-test	105.9	8.6	63390.4	468.7	7717.4	86.1	21.5	8350.8
R-sq (within)	0.3375	0.4248	0.2827	0.3944	0.5696	0.7383	0.1713	0.1521

Notes:

Table shows estimates of coefficients and standard errors (in parentheses), based on the dataset adjusted for outliers at the 5% level. F-test is for joint significance of the variables listed (i.e. excluding fixed unit effects). Fixed unit effects are jointly significant at 1%-level for all regression models.

\* / \*\* / \*\*\* : Significant at the 10-percent / 5-percent / 1-percent level, respectively.

The coefficients of the dummy variables provide no evidence that performance is monotonously impacted by the total number of privatisation offerings. The corresponding dummy and trend interaction variables for follow-on offerings are closely aligned in terms of their statistical significance, and a positive coefficient for the dummy variable is usually complemented by a – less pronounced – negative coefficient in the respective interaction variable, and vice versa. Thus, moving an

individual SIP forward or back in time impacts, *ceteris paribus*, on firm performance. But the magnitude of such changes is very much limited for most metrics and only of a temporary nature as the performance trajectories eventually re-converge. In terms of the structuring of the privatisation process, there seems to be no single recipe for success – the details of the privatisation process matter rather less, as long as a credible commitment in support of privatisation is given and sustained over time. In such cases full privatisation is not necessary to reap the benefits associated with private capital markets, partial privatisation can yield substantial parts of them without the home government having to cede majority control. Based on this dataset, whilst a partial reversal of the initial performance improvements is possible in intermitting years, over the full privatisation cycle these improvements are perpetuated and often extended. An important caveat for the judgement on performance improvements, however, is the absence of reliable conclusions about production costs.

## **VI. Discussion**

Economic studies of privatisation are often subject to methodological critique and some technical limitations, which we have attempted to address, or at least contain, within this study. We primarily aim to investigate the operational and financial performance of newly privatised firms, which does not necessarily equate to economic efficiency or welfare. However, the wide range of 22 different performance metrics was specifically chosen to reach beyond the narrow profit motive of the private firm and to also include indicators of operating efficiency. A frequent criticism of privatisation studies is that publicly and privately owned companies cannot be meaningfully compared on the basis of commercial performance – and profitability in particular – because of their inherently different objective functions



(Bozec et al. 2006). Fully state-owned companies often pursue non-commercial, socio-political goals, it is argued, so that lower profits do not necessarily represent higher costs and technical inefficiencies but rather social outputs. As Boardman and Vining (1989) point out, such posited social benefits can either be *external* to the NOC (e.g. provision of public infrastructure) or *internal* to the NOC (most likely in the form of overstaffing or higher wages). External benefits are very difficult to measure or even to disprove, but an examination of profitability differences can at least reveal the shadow prices for such outputs.<sup>22</sup> Internal benefits, such as excessive employment levels, would usually only be achieved at a net deadweight loss because they are a form of producer surplus, where the firm is no natural monopoly but has a degree of market power (Boardman and Vining 1989). In addition to these theoretical considerations, this paper also addresses the issue through the wide range of chosen metrics. It is not clear that all processes in a state-owned firm would be deliberately inefficient; however it is more plausible to assume that some of the fruits of reasonably efficient operations would be directed towards non-commercial purposes.

To address the issue of commodity price volatility, the real terms oil price has been included as a control variable in the regression models. Through the use of an industry control group we were able to establish that the observed performance changes are largely firm-specific, and the share return analysis rejected the hypothesis of excessive accounting window dressing prior to the privatisation. Accounting differences between countries are not an issue, since firm performance is compared on a longitudinal basis within each country. The checks on the econometric model have been described earlier, and different model specifications have been tested to

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<sup>22</sup> As an example, Italian NOC Eni managed to improve its Return on Assets (based on the three-year averages pre vs. post initial SIP) by 5.0 percentage points – within a declining real oil price environment. Based on the average asset value of €44.4bn and assuming a 40% corporate tax rate, this implies a pre-tax allowance for social expenditure of €3.7bn per year.

corroborate the robustness of the results. The paper has not attempted to empirically distinguish the impact of privatisation from corporatisation of the NOC (Aivaziana et al. 2005), or from market liberalisation (Vickers and Yarrow 1988).<sup>23</sup> Finally, we are primarily concerned with the *extent* of performance changes rather than the *sources* of change, i.e. particular firm-level governance or institutional settings.

## VII. Conclusion

The global oil and gas industry has been one of the key contributing industries to privatisation revenues since the late 1970s. Despite their economic and political importance there has been limited research on the performance and efficiency of NOCs, whilst the question of resource ownership has regained widespread attention. This study on the performance impact of privatisation of NOCs therefore addresses a number of important, yet unanswered questions.

We first analysed the performance impact of initial SIPs using univariate tests and panel data regression analysis. Univariate tests are an intuitive but simple approach, whereas panel regression can control for exogenous factors and yield important insights into the time pattern of performance change. Both approaches yield consistent and compelling evidence that privatisation of NOCs is indeed associated with higher firm profitability, (commercial) efficiency, capital investment, output and dividend payments, as well as with lower financial leverage and employment. There is no direct evidence, though, of improved operating cost structures or hydrocarbon reserve replacement. The observed changes are found to be largely firm-specific to the privatised NOCs rather than being driven by industry-wide developments, and there is no indication of undue “window dressing” of accounts prior to the transactions. Based

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<sup>23</sup> Furthermore, the possibility of reverse causation needs to be acknowledged. It is possible that at least some of the companies in the sample have been selected for privatisation because of a significant growth potential, which needed to be funded through the capital markets.

on the panel regression model, privatised NOCs over a period of seven years around the privatisation date improve their return on sales by 3.6 percentage points, increase total output by 40%, output per employee by 30% and capital expenditure by 47%, and decrease their employment intensity (relative to assets) by a total of 35%. In the run-up to the share sale the NOCs also manage to reduce unit operating costs by 11% and cut employment by 8%, but both trends are reversed immediately after the privatisation date as growth dominates further cost reductions in absolute terms.

A thought experiment might put these performance improvements into a broader perspective. Amongst the 50 largest oil and gas companies in the world in 2006 there were 18 which are fully state-owned, with a combined oil and gas output of 47 million barrels of oil equivalent per day, 18 million barrels per day of refining capacity, and estimated revenues of one trillion US Dollars (PIW 2007). If those companies were to experience comparable performance improvements in a privatisation, global oil and gas production could increase by 2.7 million boe/d alone in the first year, which is more than all of France's current oil and gas consumption. The overall increase in output over the six yearly periods could amount to 19 million boe/d, almost 15% of current global production (and consumption) of oil and gas.<sup>24</sup> Based on the improvement in return on sales, one could expect combined annual profits to rise by US\$33 billion over the period<sup>25</sup>, even without taking into account the increasing volume sales – this *post-tax* profit could be used by governments for social infrastructure projects to compensate for any changes in the companies' objective function. Whilst these are hypothetical numbers they illustrate the magnitude of the

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<sup>24</sup> 47 million boe/d x 40% total output growth over six yearly periods = 19.0 million boe/d, which is 15% of the 2006 global oil and gas production of 128 million boe/d (BP 2007).

<sup>25</sup> PIW has revenue data (or estimates) for 16 of the 18 fully state-owned NOCs. Their combined revenues of US\$916 billion x 3.6% points improvement in RoS = US\$33 billion

potential benefits from privatisation.<sup>26</sup> Furthermore our study suggests that most of these gains might be realised by partial privatisation alone.

Second, a more detailed analysis of the time pattern of performance changes indicates that whilst there are immediate one-off improvements following the sale of shares to private investors, such improvements are usually embedded within a time trend which starts well before the actual transaction, is clearly connected to the decision to privatise, and which for the majority of performance metrics becomes less (rather than more) pronounced after the change in ownership. The benefits of privatisation therefore accrue over time, and a very considerable share materialises already in the run-up to privatisation. This very significant anticipation effect supports earlier empirical findings of Dewenter and Malatesta (2001) and the suggestion by Yarrow (1986) that the primary goal of privatisation may not be to achieve efficiency gains, but to perpetuate them in the face of changing political circumstances.

Third, extending the analysis to include any follow-on share issues of the same set of firms, it has been shown that residual government ownership in the firms and the question of control transfer to the private sector are not significant drivers of performance change, except for employment intensity, where higher government ownership and government control are responsible for substantially higher employment ratios. The number and timing of any follow-on offerings have limited incremental explanatory power for firm performance over and above the more general, gradual improvement process that has been modelled as a time trend.

Whilst our findings support the notion that excess employment is a prominent inefficiency of NOCs (and correlated with the degree of state influence), most

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<sup>26</sup> This study found no evidence of privatised NOCs improving their ability to find new oil and gas reserves, so any production increase might accelerate the depletion of conventional reserves. This and potential environmental concerns would need to be traded off against shorter-term price and supply considerations.

privatising companies do not remedy this by widespread redundancies in the workforce, but by ambitious growth programmes in investment and output, with positive ramifications for all per-employee metrics of performance and efficiency. In line with Gupta (2005) we find that – even partial – privatisation leads to an increase in the productivity of labour without major layoffs. More generally, based on our results the pervasive pattern of partial privatisations in the oil and gas sector could be explained by the fact that governments succeed in capturing large parts of the performance gains associated with private capital markets without having to cede majority control. A longer-term, sustained privatisation process might well, however, be advantageous or even required in order to defend and build on these initial gains in performance and efficiency.

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