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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%. Many of our observed performance improvements are already realised in anticipation of the initial privatisation date, accrue over time, and level off after the initial 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 performance improvement associated with private capital markets without the selling government having to cede majority control.

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

JEL Classification 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.[1] Focusing on a single industry has a number of advantages vis-à-vis multi-industry studies, most importantly that it allows for control of industry-specific effects. The global oil and gas industry can be expected to exhibit certain structural communalities across countries, and in the context of privatisation it might differ from other industries not least because the role and importance of state support in natural resources industries. 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.[2] 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

[1] 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.
[2] Megginson et al. (1994) point out that in fact it was the Adenauer Government in West Germany which in the 1960s launched the first large-scale, ideologically motivated "denationalisation" programme post World War II.

economic importance there has been surprisingly little systematic research on NOCs (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, i.e. the impact of privatisation on firm performance in the global oil and gas industry. To do so, a dataset of 60 share-issue privatisations ('SIPs') by 28 different firms (from 20 different countries) is compiled, covering both initial and follow-on privatisation offerings from the period 1977 to 2004. For each firm, a total of 22 different metrics is calculated in order to comprehensively capture different aspects of 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.[3] 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[4], 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.

[3] 'State' and 'government' ownership are used interchangeably in this paper.

[4] 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 (Williamson 1964; Jensen and Meckling 1976; Fama 1980), property rights (Alchian 1965; Alchian and Demsetz 1972) and public choice theory (Tullock 1965; Buchanan 1968; Niskanen 1971), but none of these provide unequivocal support to either side of the argument.[5] 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.[6]

On the empirical side, reviewers have found well in excess of a hundred relevant studies[7], 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

[5] Pollitt (1997) highlights two additional strands of literature, namely the theory of influence activities (Milgrom and Roberts 1988) and the notion of privatisation as a credible government commitment to reduced future interference (Sappington and Stiglitz 1987; Perotti 1995).

[6] Other comprehensive theoretical reviews can be found in Megginson (2005), Bortolotti and Siniscalco (2004), Pollitt (1995), Perotti and Guney (1993) and Vickers and Yarrow (1991).

[7] Several authors have reviewed the existing empirical evidence (see e.g. Galal et al. 1994; Sheshinski and López-Calva 1999; Shirley and Walsh 2000; Megginson and Netter 2001; Kikeri and Nellis 2002).

other than ownership, such as political, regulatory and organisational changes.

The practical difficulties of controlling for competition and regulation, but also of finding appropriate control groups has probably contributed to the mixed evidence seen in cross-sectional studies. Whilst some analyses such as Boardman and Vining (1989) and Dewenter and Malatesta (2001) find that state-owned companies are significantly less profitable and efficient than their private counterparts, other authors such as Caves and Christensen (1980) and Martin and Parker (1995) dispute this and argue instead that competition in the product market is the key determinant of firm efficiency.

As to longitudinal studies of privatisation effects, out of many possible approaches 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, uses univariate tests to compare 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 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 tends to improve firm profitability, efficiency and output, decreases financial leverage and leads to higher dividend payments.[8] Whilst most of these findings are significant at the 1% level, the effect of privatisation on employment levels is inconclusive. Other studies using the same methodology focus on specific industries such as banking (Verbrugge et al. 2000) and telecoms (D'Souza and Megginson 2000), or on specific counties, e.g. Chile (Macquieira and Zurita 1996), Canada (Boardman et al. 2000) and China (Wei et al. 2003; Jia et al. 2005). These studies in general support the above findings, although in the Chile

[8] Between the three studies, for example, profitability, defined as net income divided by sales, increases from an average value of 8.6% before privatisation to 12.6% thereafter, and 63 to 71% of the firms in each sample experience increased profitability.

study the positive impact of privatisation becomes insignificant when adjusting for general market developments. The methodology has a high intuitive appeal, but in recent years its technical limitations have led many authors to apply more sophisticated econometric tools. Dewenter and Malatesta (2001) use cross-section time-series data to examine longer time periods around privatisation in a multivariate regression framework, and find that much of the improvement in profitability is generated in the run-up to rather than after the privatisation. Jia et al. (2005), Boubakri et al. (2005) and Gupta (2005) are other 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 prove by itself 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 enterprises in four countries. They find that divestiture substantially improved economic welfare in 11 of the 12 cases, with the main drivers being an increase in investment, improved productivity, more rational pricing policies, increased competition and effective regulation. The welfare effects of privatisation were also found to be superior to the alternative of continued state ownership. Using the same methodological approach, Jones et al. (1998) confirm the positive welfare impact of privatisations in a study of 81 privatisations in Cote D'Ivoire. Newbery and Pollitt (1997) find that the overall welfare effect of the privatisation of the UK's Central 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 (part-) privatised NOCs.

Al-Obaidan and Scully (1991) investigate the efficiency differences between international private and state-owned petroleum companies. The authors estimate technical, scale and allocative efficiency differences between 44 integrated oil companies. Controlling for the levels of 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. Although the sample data is quite dated (1979-1982) and biased towards U.S. companies, and although the definitions of control variables are somewhat crude, the paper deserves praise for being the first comparative efficiency analysis for oil and gas 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 – both NOCs and private oil companies – over the period 2002-2004, testing the theoretical predictions developed in Hartley and Medlock (2007)[9] Taking revenues as output and number of employees, oil reserves and gas reserves as inputs, they calculate an average DEA technical efficiency score for NOCs of 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. The authors then show that inclusion of additional structural features of the firm as explanatory variables – the degree of government ownership as a proxy for non-commercial objectives, the degree of vertical integration, and the extent of fuel subsidies in the domestic market – moves all firms, but particularly NOCs, closer to the efficient frontier. Thus Eller et al. (2007) argue that structural features such as the degree of government ownership account for a large part of the inefficiencies of NOCs. It should be noted, however, that part of the observed increase in efficiency is a mere technical consequence of including additional variables in the model specification.

Based on 2004 data covering approximately 90 firms, Victor (2007) also analyses the relative efficiency of NOCs and private oil companies in converting hydrocarbon reserves into production and revenues, but uses a simple linear regression function to do so. She finds that the biggest private oil companies are nearly one-third better than NOCs at converting reserves into actual output, and tend to generate significantly more revenue per unit of output. Victor concludes that some of the NOCs reserves are effectively "dead

[9] They find that, relative to an economically efficient producer, a NOC is likely to favour excessive employment, to under-invest in reserves and shift extraction of resources towards the present. NOCs are also likely to be forced to sell oil products in the domestic market at subsidised prices.

oil", but acknowledges the difficulties of interpreting the often less than accurate data published by NOCs.

Both Eller et al. (2007) and Victor (2007) are recent studies that add to the otherwise scarce literature on NOCs and make valuable contributions to our understanding of these companies. Our paper, however, differs on a number of important aspects. First, whilst their papers are cross-sectional studies in design, comparing state-owned and private firms, we conduct the first time-series analysis of privatised NOCs. Second, whilst the other two studies have to restrict themselves to the analysis of high-level operational and financial data from a third party provider, we can consider firm performance and efficiency in more granular detail given the wide range of metrics extracted from 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 – Victor runs regressions based on a single year, Eller et al. have three years of data but only use this as a control for oil prices.

Some of the larger cross-industry studies on the performance of privatised firms (as discussed above) include oil and gas companies in their data samples.[10] However, none of them breaks out a sectoral result for oil and gas, and no study covers oil and gas privatisations post 1998.[11] Although not strictly empirical studies, a small number of privatisation case studies complement the picture. Vickers and Yarrow (1988) describe the privatisation process of oil and gas companies in the UK and Grosse and Yanes (1998) review the privatisation of YPF in Argentina.

III. Dataset

There are typically two options to privatise a state-owned company: either a private trade sale (involving shares or assets) to an industrial or financial buyer, or a public share offering, usually associated with a listing at a local

[10] Out of the 61 companies included in Megginson et al.(1994), which covers the years 1961 to 1990, 7 would be classified as oil and gas companies according to our definition. In the study by D'Souza and Megginson (1999), covering 1990 to 1996, 4 out of 85 firms are from the oil and gas sector. Boubakri et al. (2005) have 10 oil and gas firms in a sample of 230 privatisations in developing countries.

[11] The studies also do not control for movements of commodity prices, which have a significant impact on company performance.

and/or international stock exchange. 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 (to ensure a minimum of two years post-privatisation data) a total of 41 privatised companies have been identified based on previous studies, third party databases such as Thomson Financial SDC, industry reports and a detailed press search by country.[12] Of these 41 companies and their initial SIPs, 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, without any additional public offers thereafter), and in seven cases data could not be found or was not made available. For the remaining 28 NOCs from 20 different countries extensive accounting and share price data was collected, with the accounting data being sourced from listing prospectuses, annual reports and third party databases such as Mergent and Osiris, and the share price being sourced from Datastream. Table 1 sets out the companies and privatisation transactions included within the sample. It is worth pointing out that none of the key exporting countries (and/or OPEC members) in the Middle East or Latin America have endorsed privatisation and they are therefore absent from the sample. Countries such as Norway, Canada, Brazil and Argentina, however, are home to significant hydrocarbon provinces, and amongst the privatised companies are some of today's key global players (e.g. BP, Total, Eni, Repsol, Statoil, Petrochina and Petrobras).

[12] 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.

Initial share offerings

22 out of the 28 initial SIPs were genuine Initial Public Offerings (IPOs), i.e. the oil and gas firm was not traded on the capital markets before. Three companies (BP, Elf Aquitaine, Total) had already sizeable international listings at the time of the first government sell-down, and a further three companies (ONGC, Petrobras, Tupras) had small domestic listings already in place at the time of privatisation.[13] Before these initial privatisation offerings, the state owned an average of 88% in the 28 firms. On average a 25% stake in the company was sold in these transactions, resulting in an average retained state ownership of 63%. Only one company (Enterprise Oil of the UK) was privatised fully in a single transaction, which is consistent with the prevalence of seasoned privatisation offerings. 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 (range: US$73 – 5,861 million). The UK clearly 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 in recent years – in fact, 12 out of the 28 initial SIPs have taken place since 2000. This pattern also has consequences for the oil price environment around these offerings. The average real terms oil price (in 2005 money) for the three years preceding privatisation is US$30.4 per barrel, virtually the same price as the average for the year of privatisation, US$30.9 per barrel. In the three years following privatisation, the average price is US$34.3, 13% higher than in the pre-privatisation period. The data suggests that governments do not (and cannot) price their offerings at the top of the macro cycle.[14]

[13] 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.

[14] The government strategy for a single privatisation transaction clearly is to sell at the peak of the oil price cycle. A government with multiple offers in mind, however, might chose to act differently in order to avoid fears of overpricing for any subsequent offer. Privatisations often take several years of preparation (legal framework, parliamentary and public debate, etc.), and thus getting the timing "right" is rather challenging anyway. Follow-on offerings, in contrast, can often be executed on a daily basis, provided that required legislative approvals and stock market filings are in place.

Table 1: Sample of global oil and gas SIPs

		Initial share-issue privatisation				Follow-on SIPs (Years)	Current state ownership (%)
		Offering	Issue size	State ownership (%)			
Company	Country	date	(US$m)	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 govenent 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-owened 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 officialy 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)

For each of the oil and gas SIPs the dataset contains extensive operating and financial data (in local or reported currency) for a seven-year period around the privatisation date, i.e. three years before through three years after

privatisation.[15] Based on this data a total of 22 financial and operating performance metrics are calculated, covering profitability, efficiency, capital investment, output, employment, financial leverage and dividend payout. The metrics serve to test hypotheses on the performance impact of privatisation as detailed in Section IV.

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 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 (excluding Enterprise) that could have made follow-up offerings after the initial SIP, only eight have (so far) chosen *not* to do so: YPF was taken over less than six years after its IPO; ONGC, Japex, Inpex, and PPL were all brought to the market very recently (post 2003); in the case of Petron, the current ownership is balanced between the home government (Philippines) and a strategic investor (Saudi Arabia); PTT has seen a domestic political debate about the legality of the original privatisation process; and whilst Sinopec has not made any follow-on offerings yet, the experience from the other Chinese NOCs suggests that such an offering is imminently possible.

The 19 other companies on average had two follow-on offerings after their initial SIP, 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

[15] For three companies, data on Year –3 is limited or not available, and a further two companies have limited disclosure on the Years –3 *and* –2. Data on Year +3 is missing for two companies. Generally, not all individual metrics are reported for all years. No consolidated accounts were available for OMV.

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 (see D'Souza and Megginson 1999). For that purpose a total of 22 empirical proxies are calculated for each privatised NOC:

(1) *Profitability* is measured by return on sales, return on assets and return on equity.
(2) *Operating efficiency* is measured by sales per employee, net profit per employee, physical output per employee (physical output defined as the sum of oil and gas either produced or refined within a year), finding and development costs per barrel of oil equivalent ('F&D costs per boe'), production costs per barrel of oil equivalent (where available a blended cost for upstream and downstream is calculated, otherwise the production cost in the segment that contributed most to physical output) and reserve replacement ratio ('RRR', the ratio of oil and gas reserves replaced in any year divided by the annual production of hydrocarbons).[16]
(3) The proxies used for *capital investment* are capex itself plus the two ratios of capex over sales and capex over assets.
(4) *Output* is measured through both physical output and monetary sales.
(5) Proxies for *employment* are absolute numbers of employees, relative changes in employment, and the ratio of employees over assets.

[16] Industry-specific data such as production costs, F&D costs and RRR can be most reliably sourced for companies with a (primary or secondary) listing in the U.S., where the SEC requires oil and gas producers to report standardised disclosures in accordance with FASB Statement No. 69 (or 'FAS 69'). Information for other firms is not always available or is subject to non-standardised definitions.

(6) Three variables are used to measure *financial leverage*: debt over equity, debt over the sum of debt plus equity, and debt over EBITDA.
(7) *Dividend payment*, finally, is measured by the ratios of dividends over net profit ('payout ratio') and 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 appropriate Consumer Price Index values from the International Monetary Fund's International Financial Statistics.[17] Also, all per-employee metrics as well as 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 other years accordingly expressed relative to unity in this year 0.

Although all metrics convey useful information, some are less susceptible to volatility in the oil price environment than others and are therefore preferred choices. Return on sales is the preferred profitability measure, since it is a ratio of two current-money flow measures from the income statement. For operating efficiency, physical output per employee is preferable over monetary per-employee metrics, and production costs per barrel are more robust on an annualised basis than F&D cost or RRR.[18] Capital expenditure is the result of mid- to long-term financial planning, particularly in the oil and gas industry with its significant project lead times, so the ratio of capex over assets as well as capex itself are preferred measures. Output is best measured as physical output. Relative changes in employment can be easily compared across companies, and the ratio of employees over assets is useful if there have been major divestments or acquisitions around the time of privatisation. Balance sheet-based measurements of debt are less susceptible to commodity price changes than EBITDA-based ratios. Finally, the ratio of

[17] Balance sheet values are taken from the respective annual accounts, and ratios of flow measures over balance sheet numbers are calculated based on nominal values. Therefore some caution is advisable for observations in high-inflationary environments. Ratios based on very conservatively inflation-adjusted balance sheet figures have been calculated as a cross-check.
[18] Albeit this is due to technical/geological reasons as well as to price volatility.

dividends over net income is the most appropriate measurement for dividend policy.

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). A non-parametric test, the one-sided Wilcoxon signed-rank test, is then employed to test whether the median difference in variable values is zero. In addition, we calculate the percentage of companies for which the change in the performance variable is in the predicted direction.[19]

Table 2 (A) and (B): Results of univariate tests

[19] These three apparently similar calculations convey different information and can yield conflicting results: The Wilcoxon test checks whether the median value of the paired differences is zero, which means that, in order to be significant, *at least* 50% of observed firms need to change as predicted. But two samples with an equal fraction of positive (or negative) changes can have very different Wilcoxon significance results, depending on how far away from zero the median value turns out to be. The reported change in median values might provide a different indication because the change in the median values of two paired sub-samples is usually different from the median value of the changes. Finally, the changes as reported are absolute measures and not relative to their baseline values.

		(A) Three-year averages: -3 to -1 vs. +1 to +3					(B) Single-year: -3 vs. +3		
Variable	No. of obs	Average (median) before	Average (median) after	Change in average (median)	z-statistic (one-sided Wilcx. signed-rank test)	Fraction of firms that change as predicted	Change in average (median)	z-statistic	Fraction of firms that change as predicted
Return on sales	28	0.0973	0.1257	0.0284	-2.824***	75.0%	0.0476	-3.302***	78.6%
		(0.0468)	(0.0787)	(0.0319)			(0.0450)		
Return on assets	28	0.0595	0.0886	0.0291	-3.211***	71.4%	0.0474	-3.507***	82.1%
		(0.0433)	(0.0666)	(0.0233)			(0.0365)		
Return on equity	28	0.1412	0.1830	0.0418	-2.049**	64.3%	0.0858	-2.801***	75.0%
		(0.1175)	(0.1607)	(0.0432)			(0.0862)		
Sales per employee	25	0.8777	1.1512	0.2735	-3.054***	84.0%	0.4090	-3.377***	76.0%
		(0.8477)	(1.1245)	(0.2768)			(0.4711)		
Profit per employee	24	0.6717	1.2210	0.5494	-3.486***	83.3%	1.8507	-3.861***	87.5%
		(0.5929)	(1.0761)	(0.4832)			(0.9447)		
Output per employee	24	0.8956	1.0672	0.1717	-2.914***	70.8%	0.2350	-3.000***	79.2%
		(0.9016)	(1.0742)	(0.1727)			(0.2894)		
F&D costs per boe	10	2.7736	1.5437	-1.2298	0.459	55.6%	-2.1182	-0.255	44.4%
		(1.5003)	(1.6038)	(0.1035)			(0.3898)		
Production cost per boe	14	1.0635	1.0851	0.0217	-0.157	61.5%	0.0117	0.094	61.5%
		(1.0505)	(0.9513)	(-0.0992)			(-0.1182)		
Reserve replacement	14	1.5079	1.6258	0.1179	-0.220	46.2%	-0.5362	0.659	46.2%
		(1.3539)	(1.3272)	(-0.0267)			(-0.0165)		
Capex	28	0.9679	1.4615	0.4936	-3.985***	78.6%	0.7479	-3.848***	85.7%
		(0.8783)	(1.3159)	(0.4376)			(0.5813)		
Capex / sales	28	0.1990	0.1783	-0.0206	0.182	57.1%	-0.0524	0.843	46.4%
		(0.1306)	(0.1337)	(0.0030)			(0.0260)		
Capex / assets	28	0.1071	0.1198	0.0127	-1.571*	64.3%	0.0100	-1.571*	64.3%
		(0.1032)	(0.1163)	(0.0131)			(0.0205)		
Sales	28	0.8763	1.2215	0.3452	-3.279***	75.0%	0.5136	-3.165***	71.4%
		(0.8559)	(1.1268)	(0.2709)			(0.3920)		
Physical Output	26	0.8847	1.1408	0.2561	-4.076***	92.3%	0.3682	-4.178***	92.3%
		(0.9351)	(1.0749)	(0.1398)			(0.2170)		
Employment	25	62,139	55,245	-6,894	1.036	48.0%	-8,798	0.901	52.0%
		(17,536)	(13,942)	(-3,595)			(-6,134)		
Rel. employment	25	1.1350	1.1211	-0.0139	-0.283	48.0%	-0.0538	-0.336	52.0%
		(1.0144)	(1.0259)	(0.0115)			(0.0044)		
Employees / assets	25	1.2598	0.8747	-0.3851	4.049***	88.0%	-0.6090	4.023***	96.0%
		(1.1936)	(0.8273)	(-0.3663)			(-0.5680)		
Debt / equity	28	0.8722	0.5581	-0.3140	1.662**	64.3%	-0.3846	1.548*	60.7%
		(0.6767)	(0.5177)	(-0.1590)			(-0.1004)		
Debt / debt+equity	28	0.3636	0.3120	-0.0516	1.708**	64.3%	-0.0614	1.548*	60.7%
		(0.3894)	(0.3388)	(-0.0506)			(-0.0416)		
Debt / EBITDA	27	1.7429	1.2964	-0.4465	1.826**	59.3%	-0.4328	1.490*	63.0%
		(1.1747)	(1.3507)	(0.1760)			(-0.0582)		
Dividends / sales	28	0.0356	0.0569	0.0213	-2.482***	71.4%	0.0328	-3.051***	67.9%
		(0.0089)	(0.0226)	(0.0137)			(0.0236)		
Dividends / profit	26	0.3523	0.3986	0.0464	-1.562*	65.4%	0.1013	-2.070**	69.2%
		(0.3105)	(0.4055)	(0.0950)			(0.1527)		

Notes:
For sales, sales per employee, income per employee, F&D costs, production costs and capex the nominal monetary values are deflated using CPI data from the IMF's International Financial Statistics. Also, all per-employee metrics as well as 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 other years accordingly expressed relative to unity in this year 0.
* / ** / *** : Denotes significance at the 10-percent / 5-percent / 1-percent level, respectively.

Profitability. All three measures of profitability show very significant (at the 1% and 5% levels) improvements. On our preferred measure, return on sales, the median value increases by 3.2 percentage points and 75% of companies improve their profitability. Since state-owned companies are often charged to pursue non-commercial/social objectives, privatisation would be expected to increase the focus on profitability.[20]

[20] The appropriate measurement of performance changes has been subject to debate. See Bozec et al. (2006), Boardman & Vining (1989), and Section VI.

Efficiency. All per-employee metrics increase at the 1% significance level, including the preferred measures of output per employee, which at the median level increases by 19%. The second choice indicator in this category, 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 physical output, cuts in employment intensity (relative to the asset base), and possibly cuts in more or less well defined "overhead costs", which enable a redirection of parts of the budget towards operating assets.

Capital investment. The significant increases in real-terms capex (median value +50%) and in the ratio of capex over assets (median value +1.3 percentage points) indicate a strong corporate emphasis on investment. Where detailed disclosure was available, acquisitions have been excluded from capital expenditures. However, in some of the less transparent accounts this might have been part of the capital expenditure line item, and such expenditure then might have an immediate impact on operating metrics such as physical output.

Output. 92% of firms manage to increase their physical output, resulting in highly significant improvements in output and monetary sales.

Employment. Often the most controversial aspect of privatisations, previous studies often found conflicting and non-significant 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 their 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 only due to a small number of firms with disproportionate reductions in headcount.[21] Regardless of the changes in absolute employment, however, the highly significant reduction in the ratio of employees over assets indicate that the privatised NOCs manage to operate their assets with much higher labour productivity and efficiency.

[21] The most obvious examples are Sinopec and Petrochina, which reduced their average payroll from 483,000 to 420,000 and from 512,000 to 421,000, respectively. Excluding these two companies, average headcount reduction would shrink to 3.3%.

Financial leverage. The results show a significant de-leveraging of privatised NOCs, in line with theoretical arguments and previous study results.

Dividend payout. The average payout ratio increases by five, the median even by ten percentage points, with the result being significant at the 10% level. A number of selling governments actively reduce the NOCs' retained earnings account prior to privatisation, so the change is likely to be biased on the low side.

In summary, the univariate tests support the hypotheses that privatisation of NOCs is associated with higher firm profitability, (commercial) efficiency, capital investment, output and dividend payments, as well as with lower financial leverage and employment.[22] These results, however, do not yet control for changes in oil prices or for changes within a suitable control group, both of which will be addressed in the following. Also, there is no direct evidence of improvements in production costs, or more generally in technical efficiency. Finally, the averages often mask a considerable range of individual firm-level performance changes in almost all key metrics. Whilst performance improvements can be expected in the context of privatisation, they cannot be expected in every single case.

Performance changes over time

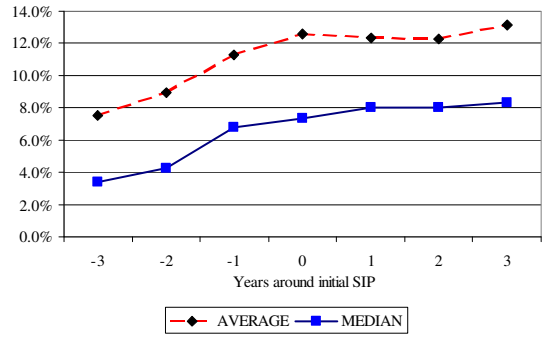
Moving beyond the pre- vs. post-privatisation averages, we now consider the year-by-year performance evolution over the seven-year period. This perspective promises additional insights into the dynamics of privatisation, since e.g. Dewenter and Malatesta (2001) find that performance improvements largely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

[22] In addition to the three-year averages, Table 2(B) also reports the differences between the point observations in year –3 and year +3. Compared to Table 2(A) the changes in averages (post minus pre) move into the predicted direction for 18 out of the 22 variables, and the same is true for the change in median values for even 19 out of the 22. For 15 out of 22 variables, the fraction of firms that change as predicted either increases or stays constant. This already implies that a gradual improvement in performance over time is not uncommon and that therefore the averaging of periods before and after the offering will tend to underestimate the true extent of change.

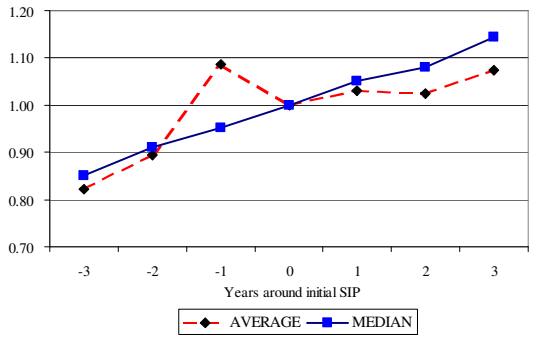
Visual inspection of Figures 1(A) to 1(E) indicates that it is difficult to pinpoint a single discrete change for most of our preferred performance measures. Return on sales, output per employee, capex and employees over assets all begin to shift into the predicted direction well before the privatisation takes place in the capital markets. The average values for dividend payout might be considered an outlier, but they are impacted by individual cases of high special dividends to the state ahead of the privatisation.[23] 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. The increase in the tail-end of the graph is the result of the very favourable oil price environment in recent years, which 12 of the SIPs in the sample were exposed to (with their respective post-privatisation period starting in 2001 and later).

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

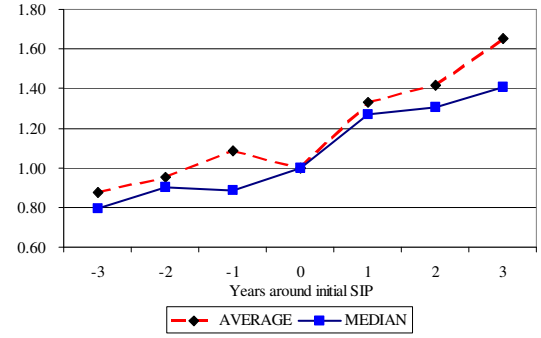
(A): Return on sales



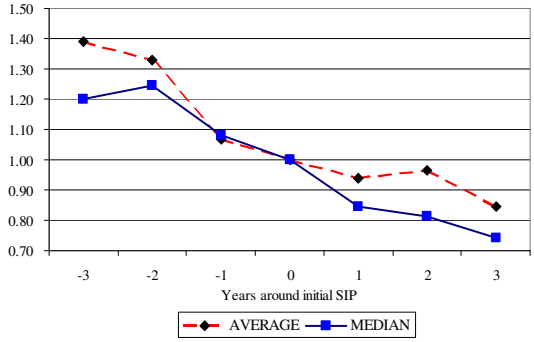
(B): Output per employee



(C): Capital expenditure



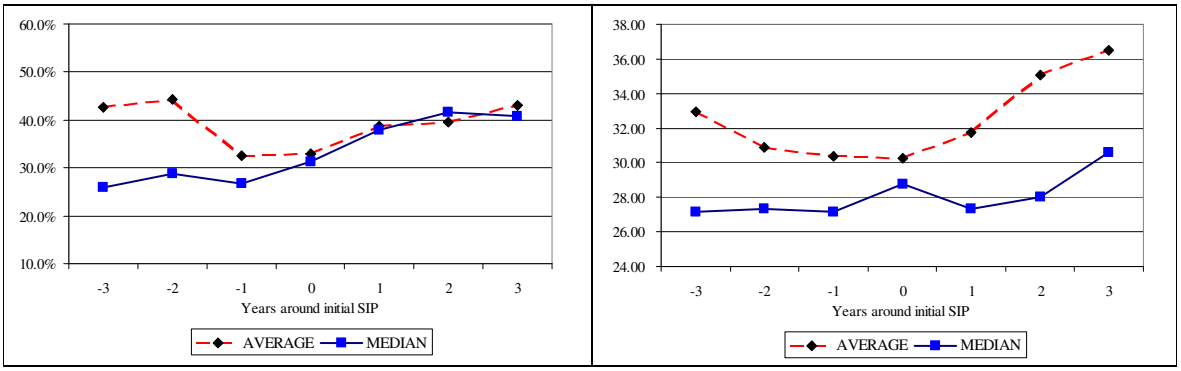
(D): Employees over assets



(E): Dividend payout ratio

(F): Real-term oil price (2005 money)

[23] It is also an ex-post decision largely unrelated to operating processes of the firm – changes in dividend policy can be enacted virtually overnight.



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

$Perf_{it} = \alpha_i + \beta_1 Post_{it} + \beta_2 Year_{it} + \beta_3 [Post*Year]_{it} + \gamma Oil_{it} + \mu CtrGrp_t + \varepsilon_{it}$,

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 α_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.[24,25] 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.

[24] The control group is based on the "PIW Top 50 Oil Companies" rankings (PIW 1988-2007), which has the most comprehensive coverage available of international oil and gas companies, irrespective of ownership status. It contains information on operating output, employees, revenues, net income and total assets, but not on capital expenditure, production costs, financial leverage or dividends, as much of this is unavailable for fully state-owned NOCs. We have checked the PIW data from the past 20 years for internal consistency and, where appropriate, have amended it using primary sources. The control group consists of the 21 (public and private) companies that – over the full sample period – 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 of these companies (subject to availability) to be the performance of the control group.

[25] 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.

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

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

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	R-squ.	Annual PP change / CAGR		
	Post	Year	Post*Year	OilPrice	CtrGrp	obs	(within)	Full period	Y1-4	Y5-7
Return on sales										
- Excl. control group	0.0317	0.0141	-0.0102	0.0004	-	141	0.2268	0.8%	1.4%	0.1%
	1.54	3.95***	-2.28**	0.55	-					
- Incl. control group	0.0248	0.0143	-0.0090	-0.0003	0.4602	139	0.2525	0.8%	1.4%	0.2%
	1.09	4.12***	-1.84*	-0.45	1.70					
Return on assets										
- Excl. control group	0.0358	0.0144	-0.0118	0.0007	-	146	0.2589	0.7%	1.4%	-0.1%
	1.67	4.24***	-2.79**	1.50	-					
- Incl. control group	0.0333	0.0145	-0.0113	0.0002	0.1982	144	0.2684	0.7%	1.4%	-0.1%
	1.61	4.17***	-2.68**	0.35	1.71					
Output per employee										
- Excl. control group	0.2231	0.0534	-0.0435	-0.0017	-	132	0.1936	4.5%	6.3%	2.7%
	1.31	2.18**	-1.19	-0.41	-					
- Incl. control group	0.2152	0.0573	-0.0426	-0.0022	-6.7379	129	0.1964	4.9%	6.8%	3.0%
	1.23	2.14**	-1.15	-0.49	-1.31					
Physical output										
- Excl. control group	0.1282	0.0371	-0.0166	0.0026	-	144	0.3679	3.8%	3.8%	3.8%
	1.02	3.08***	-0.86	0.69	-					
- Incl. control group	0.1441	0.0502	-0.0217	0.0018	-0.0003	142	0.3889	4.8%	5.3%	4.3%
	0.98	2.44**	-0.89	0.42	-1.37					
Employment (rel.)										
- Excl. control group	-0.1931	-0.0151	0.0353	0.0029	-	133	0.0377	-0.6%	-1.4%	0.3%
	-1.35	-0.77	1.11	1.05	-					
- Incl. control group	-0.1992	-0.0161	0.0366	0.0030	0.0164	130	0.0376	-0.6%	-1.5%	0.3%
	-1.30	-0.64	1.07	0.97	0.03					
Employment / assets										
- Excl. control group	-0.2291	-0.0772	0.0476	-0.0096	-	132	0.5316	-6.9%	-8.1%	-5.6%
	-1.57	-3.17***	1.50	-4.22***	-					
- Incl. control group	-0.2253	-0.0594	0.0449	-0.0092	0.1469	129	0.5092	-5.0%	-6.3%	-3.7%
	-1.47	-2.08**	1.35	-4.02***	0.58					

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.

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.[26] 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.[27] The results presented in this paper are based on the dataset being adjusted for outliers at the 5% level.[28]

For the full sample, the coefficient of the 'Post' variable has the predicted sign for all performance measurements (except capital expenditure[29]), 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. 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 in the years after privatisation. As expected the model finds oil prices to play an important role in explaining e.g. higher

[26] The autocorrelation test is based on Wooldridge (2002, p.282-3), which Drukker (2003) has shown to have good size and power properties. Heteroskedasticity is tested via a likelihood-ratio test. Unit roots have been tested (see Maddala and Wu 1999) and rejected at the 5% level for all metrics.

[27] Beck and Katz (1995) had shown that a commonly used variety of feasible generalized least squares (FGLS), as recommended by Parks (1967) and Kmenta (1986), produces unduly optimistic standard errors unless the dataset has substantially more time points than there are cross-sectional units. But the alternative suggested by Beck and Katz, OLS with panel-corrected standard errors (PCSE), does not perform well in the presence of significant unit effects (Adolph et al. 2005; Wilson and Butler 2007).

[28] The results for the dataset *not* adjusted for outliers were comparable. In most cases the adjustment excluded less than 5% of observations. Two noticeably exceptions were total employment and net income per employee, where 22% and 11% of observations were classified as outliers, respectively.

[29] For capex, the sign of the POST variable is negative, but this is overcompensated by the positive change in the time trend (indicated by POSTxTIME), so there is no overall fall in capital expenditure.

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 α_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 time distribution of performance improvements varies between the metrics, but the overall 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 the point estimates as well as the significance levels of the explanatory variables change little with the inclusion of the control group.[30] The annual growth rates indicate that part of the observed reduction in employment intensity is in line with industry trends, but that the majority of the overall changes are firm-

[30] We also ran a regression including the industry control group variable but excluding the oil prices variable. The control group then becomes significant for return on assets (with a positive sign) and for physical output (negative sign).

specific.[31] Total output growth and output growth per employee are even greater when the control group is included in the specification – the privatised companies improved in spite of a negative industry trend.

The econometric model confirms most intuitions from the visual inspection. Whilst there are a number of noticeable performance improvements at or immediately after the ownership change, such one-off improvements are usually embedded within a positive performance trend that begins well before that date. After the privatisation offering this trend is not usually one of accelerating improvement (as might have been expected), but for the majority of metrics shows a pattern of slowing down. As a result, the benefits of privatisation accrue over time and a considerable share of them occurs in anticipation of the public share offering. In the context of oil and gas privatisation, therefore, some of the key measures to improve firm performance are successfully implemented ahead of the ownership change.

One plausible scenario to connect the various data points is that the companies' focus in the run-up to privatisation is on cost reductions to boost profitability, and on realising the immediately achievable output growth with minimum capital spending, ensuring a positive cash-flow. The incremental profits are used to reduce financial leverage and to already increase dividend payout, both serving to some extent as signalling tools. Following the privatisation offering, the strategic emphasis shifts to investment in order to capture the higher hanging fruits. The increase in capital expenditure helps to sustain a high rate of output growth, but this comes at the expense of rising production costs and staffing needs. Cost control continues to be exercised, though, as evidenced by the further increase in output per employee, the continued reduction in employees over assets, and the stable profitability ratios in spite of higher unit costs and employment levels. The privatised companies are also able to further improve on their dividend payout – accommodating the preferences of their new shareholders – whilst continuing to de-lever the balance sheet.

[31] The control group exhibits a falling employment intensity over time (CAGR of -6.6% in the median value), but the correlation coefficient between the privatised NOCs and the control group is 10% only.

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. Dewenter and Malatesta (2001) note that governments may encourage or even engage in such earnings management before privatisation. 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).[32]

We calculate buy-and-hold abnormal returns ('BHAR', see 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 calculated to take into account the possibility of outperformance of smaller stocks.[33] We further report the initial

[32] This long-run positive abnormal share performance of privatisation IPOs has been interpreted as being consistent with the evidence of improved performance at these firms (Choi et al. 2006). However, interpretations of share price performance are inherently difficult, since they do not usually reflect performance changes per se, but rather performance changes *relative to market expectations*. 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 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.

[33] Choi et al. (2006) point to a number of potential problems in measuring long-term stock returns, e.g. failure to properly account for size and book-to-market ratios in selecting benchmark portfolios.

offer return[34], 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
Simple averages, buy-and-hold returns, excluding IPO return on 1st day of trading										
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%
Weighted averages (by market cap at end of 1st day of trading, in inflation-adjusted US$)										
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 in these particular years relative to country indices) nor across time (over the longer run oil and gas SIPs substantially outperform both their respective country indices and the industry index). It is in fact striking that the absolute share return as well as the abnormal returns over country and industry index consistently improve over the longer time windows, suggesting that the market tends to take too pessimistic a long-term outlook on the performance improvements available to privatised NOCs.[35] 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-

[34] Initial offering returns are only applicable for the 22 IPO transactions. For the six companies already listed at the time of the first privatisation offering, the returns are based on the closing share price on the last day before issuance of the shares to investors.

[35] 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.

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; Perotti 1995; Megginson et al. 2001). A number of explanations have been proposed to account for this pattern: 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. Taken together with the findings in the previous section, a number of relevant questions emerge: What is the impact on firm performance of such extended, gradual privatisation processes? Do the performance changes observed during the initial SIPs perpetuate or are they reversed at some point? Is there a link between diminishing government ownership over time, the eventual transfer of majority control, and firm performance? And finally, could the popularity of partial privatisations be explained not only as a matter of convenience and risk-avoidance, but possibly because it allows continued government control while introducing much of the benefits of the stock market? Gupta (2005), for example, shows that partial privatisation has had a significantly positive impact on the performance of Indian companies, contrasting with earlier contributions that stressed the importance of transfer of control (e.g. Megginson et al. 1994; Boycko et al. 1996).

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 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.

$$Perf_{it} = \alpha_i + \beta_1\ L.Govt\%_{it} + \beta_2\ L.CtrTrans_{it} + \beta_3\ Year_{it} + \gamma\ Oil_{it} + \delta_m\ Post(m)_{it} + \mu_n\ [Post(n)*Year]_{it} + \varepsilon_{it}\ ;$$

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.

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	1.0299 ***	1.4185	0.4800	0.8141 ***	1.1431 ***	0.8498 ***	0.2463
	(0.0239)	(0.3499)	(0.3958)	(0.3607)	(0.1739)	(0.1381)	(0.2766)	(0.1629)
L.Govt%	0.0075	-0.3923	-0.5547	0.0211	-0.0077	0.3538 **	-0.1485	0.1490
	(0.0205)	(0.3892)	(0.4769)	(0.4120)	(0.1858)	(0.1690)	(0.3202)	(0.1758)
L.CtrTrans	-0.0091	-0.0230	0.0815	0.2198	0.0952	-0.1487 ***	0.1139	0.0535
	(0.0102)	(0.1211)	(0.2636)	(0.1941)	(0.0667)	(0.0521)	(0.1301)	(0.0633)
Year	0.0119 ***	0.0657 **	-0.0173	0.0338	0.0485 ***	-0.0791 ***	-0.0267	0.0172
	(0.0032)	(0.0241)	(0.0279)	(0.0374)	(0.0110)	(0.0220)	(0.0370)	(0.0253)
Oil	0.0011 ***	0.0019	0.0062	0.0109 ***	-0.0005	-0.0046 ***	0.0007	-0.0040 ***
	(0.0002)	(0.0021)	(0.0042)	(0.0036)	(0.0014)	(0.0014)	(0.0017)	(0.0014)
Post1	0.0371 *	0.1742	-0.4335	-0.5337	0.0640	-0.0559	-0.1919	0.0756
	(0.0193)	(0.1395)	(0.2561)	(0.5073)	(0.1366)	(0.1056)	(0.2050)	(0.1160)
Post2	-0.0066	-0.1552	0.3395	0.2639	0.1860	0.1327	0.5985	0.1783
	(0.0248)	(0.1684)	(0.3875)	(0.6772)	(0.1581)	(0.1584)	(0.3532)	(0.1482)
Post3	-0.0665 **	-0.6895 *	-1.1138	-1.2850 *	-0.6667 ***	-0.1028	0.0447	0.2224
	(0.0323)	(0.3786)	(0.6317)	(0.7533)	(0.2366)	(0.1443)	(0.4849)	(0.1708)
Post4	0.1363 ***	0.8635 **	-1.5540 *	1.4588	0.4354	-0.1772	-1.1390 *	-0.0686
	(0.0238)	(0.3893)	(0.7907)	(1.0672)	(0.3483)	(0.1347)	(0.5926)	(0.2234)
Post5	-0.0253	-1.0415 *	1.3743 ***	2.1391 *	-0.3229 **	-0.0730	-0.1489	0.4361
	(0.0282)	(0.6004)	(0.2134)	(1.2247)	(0.1486)	(0.2111)	(1.1064)	(0.3664)
Post1 x Year	-0.0107 **	-0.0610 *	0.0538	0.1485	-0.0072	0.0295	0.0143	0.0002
	(0.0041)	(0.0329)	(0.0545)	(0.0999)	(0.0200)	(0.0269)	(0.0464)	(0.0266)
Post2 x Year	0.0007	0.0107	-0.0452	-0.0745	-0.0327	0.0021	-0.0747 *	-0.0291
	(0.0033)	(0.0189)	(0.0450)	(0.0988)	(0.0209)	(0.0190)	(0.0432)	(0.0219)
Post3 x Year	0.0065 **	0.0682 **	0.0897	0.0873	0.0557 **	0.0096	0.0180	-0.0143
	(0.0029)	(0.0305)	(0.7059)	(0.0680)	(0.0222)	(0.0144)	(0.0407)	(0.0188)
Post4 x Year	-0.0102 ***	-0.0701 **	0.1346 *	-0.1476 *	-0.0330	0.0235 **	0.0808 *	0.0175
	(0.0020)	(0.0296)	(0.0733)	(0.0828)	(0.0248)	(0.0091)	(0.0448)	(0.0142)
Post5 x Year	0.0013	0.0778 *	-0.1805 ***	-0.1406	0.0285 **	0.0038	0.0230	-0.0277
	(0.0025)	(0.0448)	(0.0099)	(0.0851)	(0.0125)	(0.0173)	(0.0881)	(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 only significant effect of higher government ownership is to increase the employment (or labour) intensity of the company, which – in addition – is also significantly positive related to government control. Both findings support the notion that excess employment (relative to the operating asset base) is the most prominent inefficiency of NOCs. But the impact of government ownership on all other performance metric is non-significant and, based on the point estimates, even associated with higher profitability, lower production costs, higher capex, lower financial gearing and higher dividend payout. The transfer of majority voting control to the private sector also has mixed consequences.

The point estimates and significance levels for the underlying yearly performance trend, the initial SIP, and oil prices[36] 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. The coefficients of the dummy variables provide no consistent evidence that performance improves with a higher or lower number of offerings over time.[37] 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 as the relative weights of the dummy and interaction variables change. But the magnitude of such performance changes is limited for most metrics,[38] and any impact from the timing of follow-on offerings is temporary only as the performance trajectories eventually re-converge.

As an illustration, Figure 2 shows key performance metrics for two alternative timetables of the same underlying privatisation structure (reduction of state ownership from 100% to 0% in four SIP offerings, the majority control being transferred with the third transaction). Return on sales is affected by the change in timetable, as it drops significantly when SIP 3 is brought forward and increases when the same is done with SIP 4[39], a volatility which might partly be attributed to the changing composition of the sample as the number

[36] The significantly negative relationship between the ratio of employment over assets and oil prices is likely to result from higher asset values in times of high oil prices.

[37] Where coefficients for two subsequent offerings are significant, their signs are different.

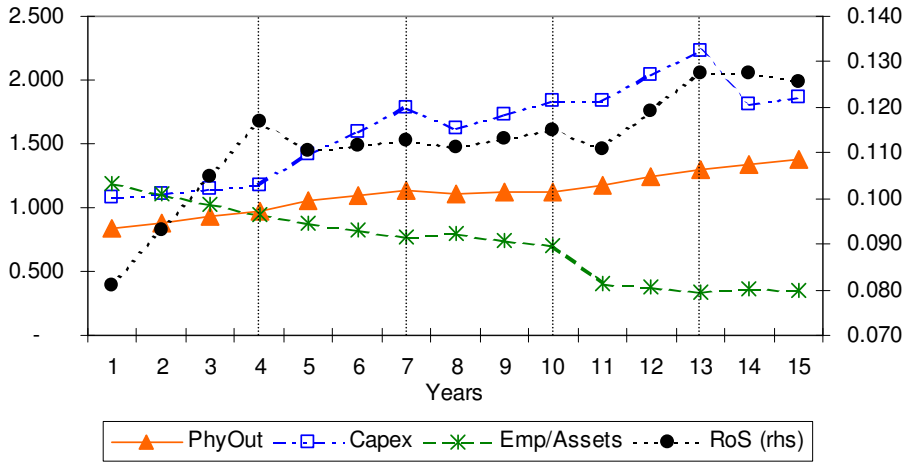
[38] A number of scenarios with different timing patterns have been run to support this assessment.

[39] As can be seen in Table 6, the coefficient of the dummy variable for SIP 3 is about ten times the coefficient of the corresponding trend interaction variable. SIP Number 3 therefore has a positive impact on RoS as long as the deal is executed after Year 10, i.e. six years after the initial SIP, and SIP 4 triggers a rise in profitability as long as it is executed in Year 13 at the latest.

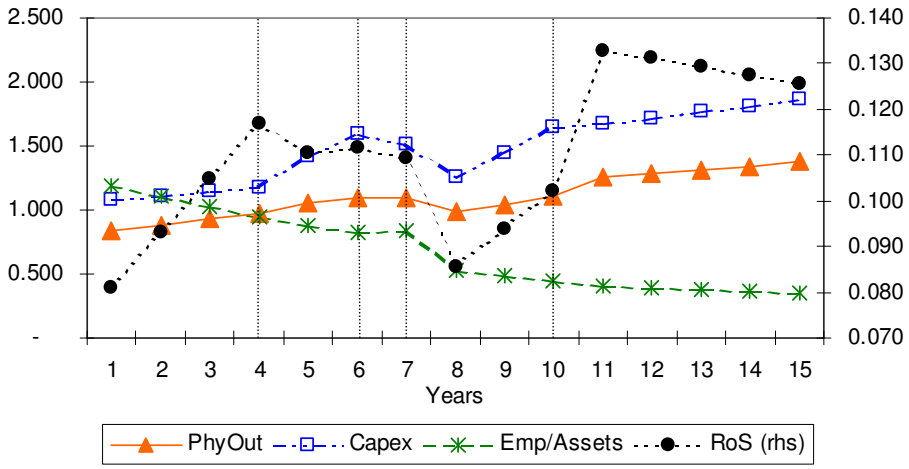
of follow-on offerings is increased. All of the other metrics, however, are much more robust to changes in the timing of offerings, and *all* performance measurements – including profitability – are fully aligned one year after the fourth share offering, i.e. from Year 14 onwards.

Figure 2 (A) and (B): Performance impact from timing change in follow-on offerings

(A): Offerings evenly spaced out in 3-year intervals



(B): Compressed timetable



Note: Dotted vertical lines indicate year of initial/follow-on SIPs.
Calculations based on results reported in Table 6 and a real-terms oil price of US$50/barrel. Both timetables assume full privatisation through four SIPs, reducing state ownership from 100% to 75%, to 51%, to 25% (change of majority control), and finally to 0%.

For oil and gas privatisations, overall corporate performance then is not monotonously impacted by the total number of privatisation offerings; the timing of any individual offering has a limited effect on most performance

categories, and where the impact is more pronounced it is only of temporary nature. 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 is the absence of reliable conclusions about production costs, but even for privatised non-U.S listed companies there is an ongoing lack of detailed disclosure in this area, not to mention any meaningful control group of fully state-owned NOCs.

VI. Discussion

Economic studies of privatisation are often subject to methodological critique and some technical limitations. A number of such issues have been addressed, or at least contained, within the context of this study. Like similar studies of this kind 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. 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.[40] 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 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).[41]

[40] 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 over the period, this implies an after-tax amount of €2.2bn per year, or – assuming a 40% corporate tax rate – a pre-tax allowance for social expenditure of €3.7bn per year.

[41] 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.

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 National Oil Companies, whilst the question of resource ownership has regained widespread attention in recent years. This study on the performance impact of privatisation in the global oil and gas industry therefore addresses a number of important, yet unanswered questions.

We first analysed the performance impact of initial share-issue privatisations using both univariate test and panel data regression analysis. Univariate tests are a simple yet effective and frequently employed approach, whereas the panel regression can control for oil prices and yield important insights on 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 do direct evidence, though, of improved operating cost structures (e.g. production costs or F&D costs) or hydrocarbon reserve replacement. The observed changes are found to be largely firm-specific to the privatised NOCs rather than being driven by wider economic developments, and there is no indication of undue “window dressing” of accounts prior to the transactions. Based 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[42], 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.[43] Based on the improvement in return on sales, one could expect combined annual profits to rise by US$33 billion over the period[44], 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 potential benefits from privatisation.[45] 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

[42] 47 million boe/d x 5.8% CAGR of output = 2.7 million boe/d.
[43] 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).
[44] 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
[45] 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.

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 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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