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

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

CHRISTIAN WOLF AND MICHAEL G. POLLITT

## 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 significant and comprehensive improvements in performance and efficiency. Over the seven-year period around the initial privatisation offering, return on sales increases by 3.6 percentage points, total output by 40%, capital expenditure by 47%, and employment intensity drops by 35%. Privatisation of all remaining state-owned NOCs would, over the same period, imply an increase in global oil and gas production of 15% over current levels. Most of our observed performance improvements are already realised in anticipation of the actual privatisation date, accrue over time, and level off after the ownership change rather than accelerate. Details of residual government ownership, control transfer, and size and timing of follow-on offerings provide little incremental explanatory power for firm performance, except for employment intensity. Based on these results partial privatisations in the oil sector capture a significant part of the performance improvements associated with private capital markets without the selling government having to cede majority control.

**Key words**
Privatisation; Ownership; Corporate performance; Efficiency; Oil and gas industry

# 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 (see Section II). 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, 2004). Despite their 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.

[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.

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 introduced by Megginson et al. (1994), which compares 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, and because the government is unlikely to transfer control in the very first offering (Perotti and Guney, 1993, Perotti, 1995, Megginson et al., 2001) the analysis in this paper extends – in a third step – the time horizon 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.

## 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

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

[4] In fact most of the studies in this area restrict themselves to the analysis of initial SIPs, an approach which does not fully capture the dynamics of gradual privatisation over time. We are not aware of other studies which consider all privatisation offers over time for a select group of companies.

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 results.[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 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

[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 undertaken reviews of the existing empirical evidence (see e.g. Kikeri and Nellis, 2002, Megginson and Netter, 2001, Shirley and Walsh, 2000, Sheshinski and López-Calva, 1999, Galal et al., 1994).

argue instead that competition in the product market is the key determinant of firm efficiency.

As to longitudinal studies of privatisation effects, it is useful to distinguish further between two very influential methodologies. The first methodology, as set out in Megginson et al. (1994) and applied in this paper, investigates the financial and operating 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 study the positive impact of privatisation becomes insignificant when adjusting for general market developments. Dewenter and Malatesta (2001) modify the basic methodology for a cross-industrial sample to examine longer time periods around privatisation and find that much of the improvement in profitability is generated in the run-up to rather than after the privatisation.

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 – mostly from infrastructure sectors such as airlines, telecom and logistics – in four developed and middle-income countries. They find that divestiture substantially improved economic welfare in 11 of the 12 cases, with the main drivers

[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.

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 very little empirical research to be found specifically on the oil and gas sector, and none on the privatisation of NOCs. This is rather surprising given the overall economic importance of the sector and the significant number of privatisations already conducted.

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. The study can be criticised on several counts – the sample data is quite dated (1979-1982) and biased towards U.S. companies, the definitions of control variables are very crude and not necessarily convincing, and the input and output variables are highly aggregated – but 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

[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.

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 oil", but acknowledges the difficulties of interpreting the often less than accurate data published by NOCs. The author also finds important structural differences between NOCs (with high per-capita-reserve NOCs from OPEC countries and low per-capita-reserve NOCs from net-importing countries) and discusses the different incentive structures for NOCs and private oil companies to exploit their respective reserve bases.[10]

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 the other two 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 very high-level operational and financial data, we can consider firm performance and efficiency in much 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

[10] What is missing in the paper is a discussion of the impact that different contractual arrangements, domestic licensing and ownership structures have on the reserves attributable to the respective NOCs.

– 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-country, cross-industry studies on the performance of privatised firms (as discussed above) include oil and gas companies in their data samples.[11] However, none of these studies breaks out a sectoral result for oil and gas, and there is no study covering oil and gas privatisations post 1998.[12] 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 process 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 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.[13] 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,

[11] 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.

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

[13] 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.

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).

**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.[14] 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).

[14] 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 and the threat of job losses or takeover.

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

| Company | Country | Initial share-issue privatisation: Offering date | Issue size (US$m) | State ownership (%): Before | After | Follow-on SIPs (Years) | Current state ownership (%) |
|---|---|---|---|---|---|---|---|
| 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% of 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)

Regarding the time distribution of deals, the Thatcher government in the UK clearly stands out as the frontrunner for the privatisation of state oil firms. By early 1986, when no other country in the world had privatised its NOC via the capital markets, the UK had already significantly reduced its ownership of BP (in three transactions) and had completely disposed of Britoil (in two transactions) and

Enterprise Oil (in a single transaction). 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 shows when analysing the oil price environment around these offerings. For the sample of initial SIPs the average real terms crude 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, which stands at US$30.9 per barrel. But in the three years following privatisation, the average real term crude price is US$34.3, which is 13% higher than the pre-privatisation period. Whilst this data suggests that governments do not (and cannot) price their offerings at the top of the macro cycle[15], these fluctuations in market prices need to be taken into account when analysing the performance changes around the privatisation date.

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.[16] 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

[15] 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.

[16] For one company, only data for the two years prior to privatisation is available (no additional disclosure in prospectuses), for two others the disclosure for year –3 is limited. Another company has only limited information for years –3 and –2, and in one case (Enterprise Oil) comparable financials only exist for one year prior to privatisation. In two cases, data post privatisation is restricted to two years, one of them because the offering happened too recently and the other because there was no data available for the third year post IPO. Also, some companies did not report all individual metrics for all years. Only accounts for OMV AG were available, not for the consolidated OMV Group.

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 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 being defined as the sum of oil and gas either produced or refined in any given 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).[17]

(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.

(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.[18] 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

[17] 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.

[18] 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 from high-inflationary environments. Ratios based on very conservatively inflation-adjusted balance sheet figures have been calculated as a cross-check.

production costs per barrel are more robust on an annualised basis than F&D cost or RRR.[19] 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 dividends over net income is the most appropriate measurement for dividend policy.

**Pre- vs. post-privatisation**

For each firm 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 are calculated. 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.[20]

*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 a massive 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 and this result cannot necessarily serve as evidence of improved efficiency. [21]

[19] Albeit this is due to technical/geological reasons as well as to price volatility.

[20] 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.

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

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

| | | (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.

*Efficiency.* All per-employee metrics have increased 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 the reduction of non-personnel operating costs, efficiency improvements thus seem to materialise through a combination of higher physical output, cuts in employment (particularly relative to the asset base), and possibly cuts in more or less well defined "overhead costs", e.g. non-commercial activities, which enable a redirection of parts of the budget towards operating assets.

*Capital investment.* Based on the significant increases of capex (median value +50%) and the ratio of capex over assets (median value +1.3 percentage points), it is

possible to conclude that privatised companies do invest more in capital expenditure. Where detailed disclosure was available, corporate acquisitions have been excluded from capital expenditures, so in theory most of this expenditure should only be reflected in the operating results beyond the three-year horizon applied in this study. However, where disclosure is poor acquisitions might have been part of the capital expenditure line in the accounts, and such expenditure then might have an immediate impact on metrics such as physical output.

*Output.* A stunning 92% of firms manage to increase their physical output throughout the privatisation process, leading to highly significant improvements both in output and monetary sales. As was mentioned before, this is likely to be the result of a combination of factors such as higher investment, better targeting of the budget towards operating assets, but possibly also operational and portfolio restructurings.

*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). This study continues this tradition of mixed messages to some extent. The companies in the 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. The most obvious examples are Sinopec and Petrochina, which reduced their payroll from 483,000 to 420,000 and from 512,000 to 421,000, respectively. Excluding those two mainland Chinese companies, average headcount reduction would shrink to 3.3%. Regardless of the changes in absolute employment, however, the highly significant reduction in the ratio of employees over assets shows that the privatised NOCs manage to operate their assets with much higher labour productivity and efficiency.

*Financial leverage.* The measures of financial leverage consistently show a significant de-leveraging of privatised NOCs, in line with theoretical arguments and previous study results.[22]

*Dividend payout.* The average payout ratio increases by five percentage points, with the result of increasing dividend payments being significant at the 10% level. It

[22] The result unfortunately cannot reveal the interplay between profitability of the firm and the (to some extent) discretionary financial policies on dividends, investments and balance sheet structure. It would be interesting to see which are managerial target variables and which are residual outcomes.

is worth pointing out that a number of selling governments actively reduce the retained earnings account of their NOCs prior to privatisation, so the result might even be biased downwards compared to the "steady state" under state ownership.

In summary, the univariate tests provide 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.[23] It is important to note, however, that these results do not yet control for changes in oil prices, and 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 trends over time**

Moving beyond the pre- vs. post-privatisation averages, we now consider the year-by-year evolution of performance metrics over the seven-year period. This perspective promises some 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. Their empirical finding is consistent with Yarrow's (1986) suggestion that the primary goal of privatisation may not be to achieve efficiency gains, but to perpetuate them in the face of changing political circumstances.

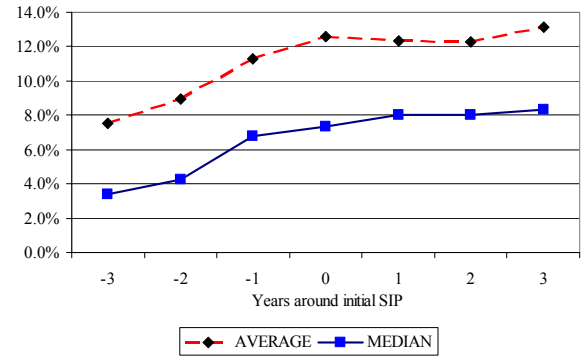
Visual inspection of Figures 1(A) to 1(E) indicates that it is indeed difficult to pinpoint a single step change for most of our preferred performance measures. Return on sales, output per employee, capex and employees over assets all begin to shift into the predicted direction well before the privatisation takes place in the capital markets. This indicates that measures to improve firm performance are successfully taken ahead of the privatisation dates and that the benefits associated with privatisation usually accrue over time. The only metric to defy this pre-transactional pattern is the

[23] 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.

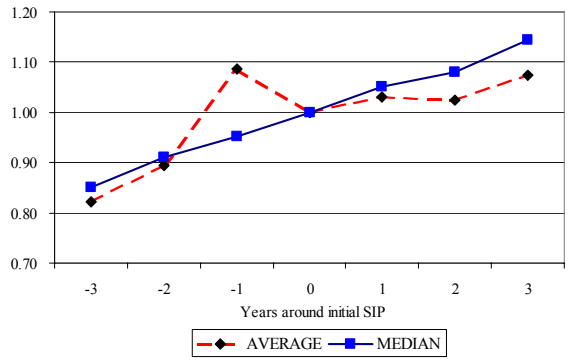
dividend payout ratio, which is unsurprising given that this is an ex-post decision unrelated to operating processes of the firm, and that changes in dividend policy can therefore be enacted virtually overnight. Figure 1(F) – the development of the real terms oil price – confirms that governments do 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**

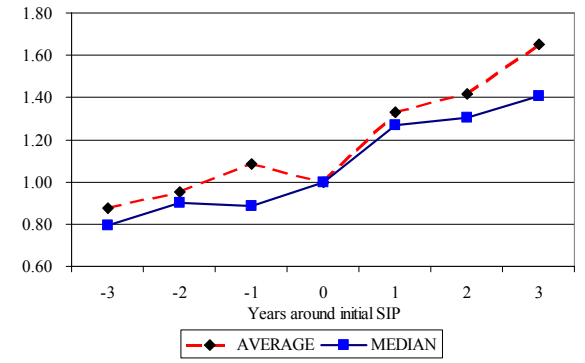
**(A): Return on sales**



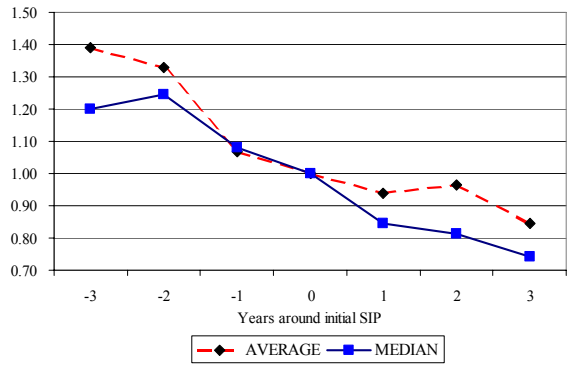

**(B): Output per employee**



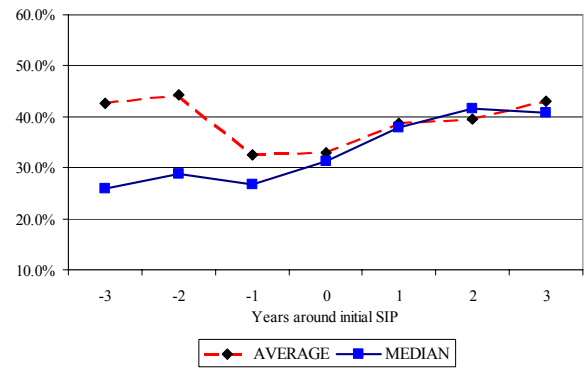

**(C): Capital expenditure**



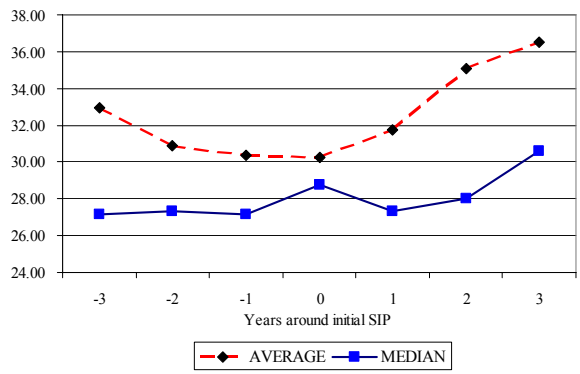

**(D): Employees over assets**




**(E): Dividend payout ratio**




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



In order to confirm the results of the visual inspection and to control for the impact of oil price changes, we investigate the time trends of performance and efficiency by estimating the following fixed-effects panel data model, which draws on Villalonga (2000):

$$PERF_{it} = \alpha_i + \beta_1 POST_{it} + \beta_2 YEAR_{it} + \beta_3 POST*YEAR_{it} + \gamma OIL_{it} + \varepsilon_{it} ,$$

whereas:

- 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, and
- OIL is a control variable for the oil price in real terms.
- Unit fixed effects are found to be 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).

Tests indicate that the errors are non-spherical, i.e. subject to both serial autocorrelation and heteroskedasticity[24], which rules out the use of simple ordinary least squares (OLS) estimation. The data has further been tested for unit roots[25]. Whilst a number of different estimation procedures have been considered, the significance of the unit effects has been an important consideration in the choice of a fixed-effects model with cluster-robust error terms.[26] Table 3 shows the results of the

[24] The test for autocorrelation is based on Wooldridge's (2002, p.282-3) test for autocorrelation in panel-data models, which Drukker (2003) has shown to have good size and power properties. Heteroskedasticity is tested via a likelihood-ratio test.

[25] Using a test procedure described in Maddala and Wu (1999), the presence of unit roots was rejected at the 5% level for all performance metrics.

[26] 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

panel data model, with the underlying dataset being adjusted for outliers at the 5% level.[27]

**Table 3: Results of panel data models for 7-year performance trends**

| | Independent variables | | | | No. of | Predicted values | | |
|---|---|---|---|---|---|---|---|---|
| | POST | YEAR | POST*YEAR | OilPrice | observations | Year 1 | Year 4 | Year 7 |
| Return on sales | 0.0313 | 0.0119 | -0.0096 | 0.0009 | 174 | 0.0769 | 0.1056 | 0.1125 |
| | (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 | 0.0540 | 0.0840 | 0.0896 |
| | (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 | 0.8126 | 1.0112 | 1.0546 |
| | (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 | 1.1342 | 1.0058 | 1.1534 |
| | (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 | 1.2041 | 1.4948 | 1.7714 |
| | (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 | 0.8317 | 1.0171 | 1.1682 |
| | (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 | 1.1031 | 1.0192 | 1.0697 |
| | (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 | 1.1127 | 0.8305 | 0.7260 |
| | (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 | 0.6678 | 0.5113 | 0.5029 |
| | (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 | 0.2305 | 0.3169 | 0.3876 |
| | (0.1115) | (0.0245) | (0.0283) | (0.0018) | | | | |
| | 0.09 | 0.73 | 0.20 | -1.43 | | | | |

Notes:
Panel data regression results are reported as estimated through fixed-effects model with cluster-robust error terms. Results show coefficients, standard errors (in parentheses) and t-test statistics.
Predicted values are calculated using the average of the fixed unit effects $\alpha_i$ and a constant real-terms oil price of US$50/barrel.

The coefficient of the POST variable has the predicted sign for all performance measurements (except capital expenditure[28]), i.e. there is a step-up in performance after the handover of property rights to private investors. The time trend also points into the expected direction for all of the above metrics, and for many this time trend is in fact the most important pattern of performance change. It is further noteworthy that for most performance metrics the interaction variable POST*YEAR has a different sign from the time trend variable, which indicates a softening (or reversal) of the time trend in the years after privatisation. As expected the model finds oil prices to play a significant role in explaining e.g. higher profitability and capital expenditure, 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).

[27] For most performance measurements, using this cut-off point resulted in the exclusion of less than 5% of observations. Two noticeably different result were regarding total employment and net income per employee, where 22% and 11% of observations were classified as outliers, respectively.

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

important message is that even controlling for oil prices the 'net effect' of privatisation on firm performance remains statistically significant and economically substantial.

Over the course of the six yearly periods between Years 1 and 7 the 'typical' privatised NOC – using the average of the fixed unit effects $\alpha_i$, net of any oil price changes – 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.). In the run-up to the actual privatisation date, i.e. between Years 1 and 4, the to-be-privatised firms also reduce their unit production costs by 11% and their employment levels by 8%, but neither of these reductions are sustained beyond Year 4: in Year 7, unit production costs are essentially back to the Year 1 levels (+1.7% overall) and the cut in headcount has been reduced to 3% compared to the baseline year. Both of these metrics are obviously key components of the overall cost base of the firm, and are thus important evidence of a big push for cost reduction prior to the offering, which is largely reversed thereafter.[29]

A very striking finding is the importance of what might be called the 'anticipation effect' in the context of privatisation benefits: for the seven key metrics reported in the previous paragraph – return on sales, output per employee, capex, physical output, employment over assets, debt over equity, and dividend payout – on average 70% (with a range of 51%-95%) of the total performance improvement is achieved over the first three periods, i.e. in preparation for the sale of shares.

The econometric model thus confirms the key outcomes of the visual inspection: Whilst there are noticeable one-off performance improvements associated with privatisation for the majority of performance metrics, such improvements are usually embedded within a time trend that begins well before the actual transaction. After the privatisation date the performance trend is not one of accelerating improvement (as might have been expected), but in most cases shows a pattern of slowing down. As a result, the benefits of privatisation accrue over time and a very considerable share of

[29] In the light of sustained rises in capital expenditure and physical output this reversal in absolute cost cutting is unsurprising. But whilst cost control is not necessarily out of the window after the SIP, it clearly becomes less important in comparison to growth.

them occurs in anticipation of the privatisation rather than after the public share offering. It is thus possible to conclude that, in the context of an oil and gas privatisation, the most important drivers of performance change have already been implemented at the time of ownership change.

Importantly, the finding of a time trend around the privatisation date does not imply that such performance improvements occur independent of privatisation or could have been enacted in a sustainable way without it. One possible cause for the emergence of a time trend within this sample could be technological progress within the industry, i.e. a general trend towards greater efficiency. But such progress would only be visible in selected variables such as physical output and employees over assets, and even there a modest annual efficiency gain would be unable to fully explain the time trend as seen in the panel data model (the TIME variable indicating e.g. annual growth of 5.8% in output, 2.6% growth in capex, and 7.0% reduction in employment intensity relative to assets).[30] The majority of the observed trend is then likely to be caused by privatisation itself and the changes that are made in the wake of its announcement.[31] For further reinsurance it is instructive to benchmark the results of the privatised NOCs against a 'control group', in this case a wider industry sample. According to the equity research department at UBS Investment Bank, for the "Global OilCo", a synthetic amalgamation of the 11 largest publicly quoted oil companies from OECD countries, the compound annual growth in physical output in the period 1996 to 2005 was 1.1% for upstream production and –0.1% for refining output. Overall growth in real-term capex was at 2.0% p.a., somewhat closer to the pre-IPO time trend of the NOC group (UBS, 2007). But the changes in the 'control group' are even biased towards the upside, because almost a quarter of the Global OilCo weighting is assigned to privatised companies such as Total or Eni.

[30] The percentage growth rates differ slightly from the coefficients of TIME in Table 3, because the baseline value in Year 1 is usually different from one due to the normalisation described earlier.
[31] These changes may be organisational, operational, financial or strategic. Stock exchange listings, particularly on an international exchange, often impose stringent requirements (and reforms) onto NOCs, e.g. regarding auditing procedures (internal and external), financial planning, transparency, board composition and independence etc., all of which can be expected to have positive ramifications for firm performance.

**Share return analysis**

The overall pre-privatisation improvements in performance are impressive, but since they are largely based on accounting data, the possibility of accounting manipulation (or 'earnings management') has to be considered. Managers can accelerate the recognition of income and delay the recognition of expense prior to the offer in order to maximise privatisation revenues. Dewenter and Malatesta (2001) note that governments may also 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) investigate earnings measurement in the context of IPOs and 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 (e.g. Boardman and Laurin, 2000, Megginson et al., 2000) suggest that these stocks outperform in the long-run (Choi et al., 2006).[32]

We calculate buy-and-hold abnormal returns ('BHAR', as defined by 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 one the one hand the Datastream Total Market Index for each country, and on the other hand the Datastream Global Oil and Gas Index. Choi et al. (2006) point out a number of potential problems in measuring long-term stock performance, e.g. failure to properly account for size and book-to-market ratios in selecting benchmark portfolios. Whilst some of their proposed adjustment would go beyond the scope of this analysis, both straight and value-weighted performance

[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.

averages are calculated to take into account the possibility of outperformance of smaller stocks. Share returns can be computed both including and excluding the initial offer return, i.e. in one scenario the investor is assumed to have bought the shares at the IPO offering price, in the second scenario (s)he is assumed to have bought them at the closing price of the first trading day.[33,34] Since the issue of underpricing is not the focal point of this analysis, the following discussion is limited to the results excluding initial offer returns.

**Table 4: 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.

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. The wide spread of individual share returns around the mean and median values, however, needs to be taken into account when interpreting the data.

[33] As a number of studies have found recurring and significant underpricing of privatisation IPOs (Jones et al., 1999), the initial offer return can be expected to be positive, which holds true for this particular oil and gas industry sample (results available from author upon request).
[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.

The relative values of mean and median as well as the maximum and minimum returns indicate that the distribution is skewed towards the left, i.e. a small number of privatisations have managed to yield very large share returns. The comparison of simple and weighted averages also illustrate that indeed the smaller firms outperform their (in terms of market capitalisation) larger competitors. Overall, it seems that the observed pre-privatisation accounting changes are indeed a fair reflection of underlying economic realities – the share return analysis does not provide any evidence to the contrary.

## V. Follow-on offerings

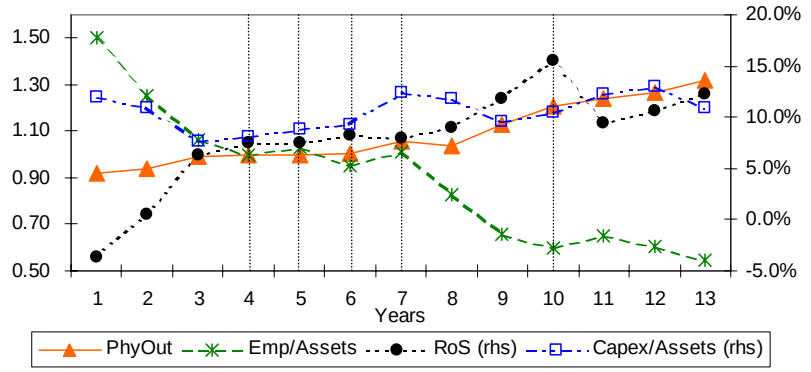
Privatisation, and particularly privatisation of large or domestically important companies, is usually undertaken not in a single step, but rather through a series of public share offerings and/or trade sales (Perotti and Guney, 1993, Perotti, 1995, Megginson et al., 2001). A number of explanations have 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. Boycko et al., 1996, Megginson et al., 1994).

Visual inspection of the longer-term performance trends of (part-)privatised NOCs is again used as a first approach. Figures 2 (A) and (B) are examples for two firms with somewhat different privatisation profiles.[35]

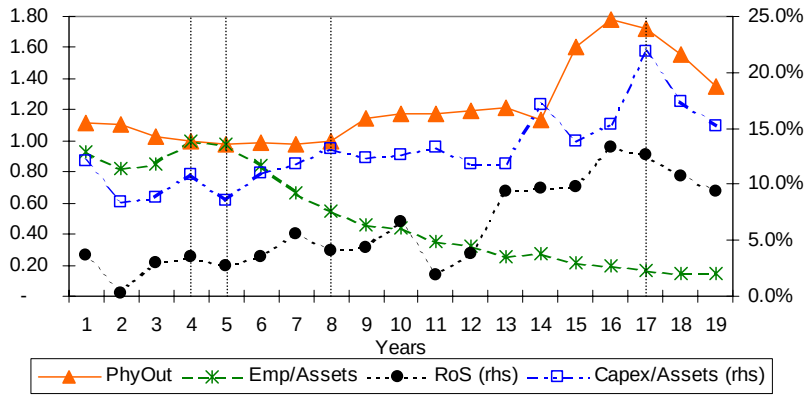
**Figure 2 (A) and (B): Longer-term change in performance metrics**

**(A): Eni**




| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Real oil price | 27.0 | 23.1 | 21.1 | 22.0 | 25.9 | 23.5 | 15.7 | 21.4 | 32.9 | 27.3 | 27.4 | 30.6 | 39.6 |
| Gov ownership | 100% | 100% | 100% | 85% | 69% | 52% | 37% | 37% | 37% | 30% | 30% | 30% | 30% |

**(B): Petro-Canada**




| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Real oil price | 24.7 | 28.7 | 35.6 | 28.8 | 27.0 | 23.1 | 21.1 | 22.0 | 25.9 | 23.5 | 15.7 | 21.4 | 32.9 | 27.3 | 27.4 | 30.6 | 39.6 | 54.5 | 63.1 |
| Gov ownership | 100% | 100% | 100% | 81% | 70% | 70% | 70% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 0% | 0% | 0% |

Note: Dotted vertical lines indicate year of initial/follow-on SIPs

Whilst the inspection of these two and other firm profiles seems to indicate some common trends (e.g. increases in output and profitability, and a fall in labour intensity over time), firm-specific circumstances clearly matter and the impact of the follow-on

[35] The two differ e.g. in the prominence of their home countries as hydrocarbon provinces, in the degree of privatisation (partial vs. full) and in the number, size, and time pattern of offerings.

offerings on performance appear mixed. Since it is difficult to visually separate the impact of declining state ownership from the impact of exogenous factors such as oil prices, a panel data regression analysis of the full dataset (including initial SIPs as well as follow-on offers) is conducted. As was the case for the analysis of initial SIPs, unit effects again are shown to be significant and, therefore, a fixed-effect model with panel-robust standard errors is estimated. In order to investigate whether the timing, size and structure of the various follow-on offerings has any incremental significance over a basic model specification, we estimate three different models for each key performance metric.

(1) $PERF_{it} = \alpha_i + \beta_1 \, L.Govt\%_{it} + \beta_2 \, L.CtrTrans_{it} + \beta_3 \, YEAR_{it} + \gamma \, OIL_{it} + \varepsilon_{it}$ ;

(2) As in (1), but including dummy variables for the period after the respective follow-on offerings (Post1 to Post5);

(3) As in (2), but including interaction dummy variables for the change in time trend after the respective follow-on offerings (Post1*YEAR to Post5*YEAR);

whereas:

- 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.

Lagged values of government ownership and control transfer were found to be of greater significance than their non-lagged counterparts. Tables 5(A) and (B) show the regression results for four key performance metrics relating to profitability, output, investment, and employment intensity.

*Government ownership.* The extent of remaining government ownership over the course of the privatisation process is generally not found to be of significance. Interestingly, the only exception to this is the ratio of employees over assets, where greater government ownership is very significant to explain higher employment levels. For each percentage point of additional government involvement, the ratio of employees over assets increases by 0.35% compared to the base level in the year of the initial SIP.

## Table 5 (A) and (B): Results of panel data model for long-term performance trends

### (A): Profitability and output

| | Return on Sales | | | Physical Output | | |
|---|---|---|---|---|---|---|
| | **Model 1** | **Model 2** | **Model 3** | **Model 1** | **Model 2** | **Model 3** |
| **Constant** | 0.0075 | 0.0102 | 0.0066 | 0.8619*** | 0.8043*** | 0.8141*** |
| | (0.0219) | (0.0248) | (0.0239) | (0.1991) | (0.1757) | (0.1739) |
| **L.Govt%** | 0.0147 | 0.0102 | 0.0075 | -0.0254 | 0.0229 | -0.0077 |
| | (0.0222) | (0.0244) | (0.0205) | (0.1969) | (0.1796) | (0.1858) |
| **L.CtrTrans** | -0.0048 | -0.0039 | -0.0091 | 0.0590 | 0.1054 | 0.0952 |
| | (0.0104) | (0.0102) | (0.0102) | (0.0771) | (0.0647) | (0.0667) |
| **Year** | 0.0048*** | 0.0054*** | 0.0119*** | 0.0344*** | 0.0434*** | 0.0485*** |
| | (0.0011) | (0.0014) | (0.0032) | (0.0083) | (0.0081) | (0.0110) |
| **Oil** | 0.0010*** | 0.0010*** | 0.0011*** | 0.0000 | -0.0006 | -0.0005 |
| | (0.0002) | (0.0002) | (0.0002) | (0.0016) | (0.0014) | (0.0014) |
| **Post1** | | -0.0008 | 0.0371* | | 0.0475 | 0.0640 |
| | | (0.0082) | (0.0193) | | (0.0557) | (0.1366) |
| **Post2** | | -0.0097 | -0.0066 | | -0.0934 | 0.1860 |
| | | (0.0088) | (0.0248) | | (0.0582) | (0.1581) |
| **Post3** | | 0.0012 | -0.0665** | | -0.1197* | -0.6667*** |
| | | (0.0095) | (0.0323) | | (0.0698) | (0.2366) |
| **Post4** | | 0.0008 | 0.1363*** | | 0.0196 | 0.4354 |
| | | (0.0160) | (0.0238) | | (0.0782) | (0.3483) |
| **Post5** | | -0.0105* | -0.0253 | | 0.0684 | -0.3229** |
| | | (0.0062) | (0.0282) | | (0.0475) | (0.1486) |
| **Post1 x Year** | | | -0.0107** | | | -0.0072 |
| | | | (0.0041) | | | (0.0200) |
| **Post2 x Year** | | | 0.0007 | | | -0.0327 |
| | | | (0.0033) | | | (0.0209) |
| **Post3 x Year** | | | 0.0065** | | | 0.0557** |
| | | | (0.0029) | | | (0.0222) |
| **Post4 x Year** | | | -0.0102*** | | | -0.0330 |
| | | | (0.0020) | | | (0.0248) |
| **Post5 x Year** | | | 0.0013 | | | 0.0285** |
| | | | (0.0025) | | | (0.0125) |
| **N** | 254 | 254 | 254 | 254 | 254 | 254 |
| **F-test** | 11.85 | 33.76 | 105.85 | 38.01 | 32.17 | 7717.41 |
| **R-sq (within)** | 0.2780 | 0.2852 | 0.3375 | 0.5025 | 0.5486 | 0.5696 |

Note: Table shows estimates of coeffients and standard errors (in parantheses) for each variable.
F-test is for joint significance of variables listed above, excluding fixed unit effects.
Fixed unit effects are jointly significant at 1%-level for all models.
* / ** / *** : Denotes significance at the 10-percent / 5-percent / 1-percent level, respectively.

**(B): Investment and employment intensity**

| | Capex | | | Employment / Assets | | |
|---|---|---|---|---|---|---|
| | **Model 1** | **Model 2** | **Model 3** | **Model 1** | **Model 2** | **Model 3** |
| **Constant** | 0.4678 | 0.3492 | 0.4800 | 1.1373*** | 1.1151*** | 1.1431*** |
| | (0.3992) | (0.3607) | (0.3607) | (0.1307) | (0.1388) | (0.1381) |
| **L.Govt%** | -0.1279 | -0.0956 | 0.0211 | 0.2104 | 0.2724 | 0.3538** |
| | (0.4155) | (0.4191) | (0.4120) | (0.1352) | (0.1687) | (0.1690) |
| **L.CtrTrans** | 0.0732 | 0.2184 | 0.2198 | -0.1178* | -0.1649*** | -0.1487*** |
| | (0.2093) | (0.1929) | (0.1941) | (0.0664) | (0.0512) | (0.0521) |
| **Year** | 0.0760*** | 0.1084*** | 0.0338 | -0.0357*** | -0.0447*** | -0.0791*** |
| | (0.0189) | (0.0353) | (0.0374) | (0.0061) | (0.0085) | (0.0220) |
| **Oil** | 0.0136*** | 0.0121*** | 0.0109*** | -0.0046*** | -0.0044*** | -0.0046*** |
| | (0.0043) | (0.0034) | (0.0036) | (0.0014) | (0.0013) | (0.0014) |
| **Post1** | | 0.0743 | -0.5337 | | -0.0084 | -0.0559 |
| | | (0.1711) | (0.5073) | | (0.0567) | (0.1056) |
| **Post2** | | -0.2088 | 0.2639 | | 0.1252** | 0.1327 |
| | | (0.1796) | (0.6772) | | (0.0601) | (0.1584) |
| **Post3** | | -0.2636 | -1.2850* | | -0.0136 | -0.1028 |
| | | (0.2558) | (0.7533) | | (0.0410) | (0.1443) |
| **Post4** | | -0.3845* | 1.4588 | | 0.1634*** | -0.1772 |
| | | (0.2243) | (1.0672) | | (0.0557) | (0.1347) |
| **Post5** | | 0.1036 | 2.1391* | | -0.0041 | -0.0730 |
| | | (0.3314) | (1.2247) | | (0.0706) | (0.2111) |
| **Post1 x Year** | | | 0.1485 | | | 0.0295 |
| | | | (0.0999) | | | (0.0269) |
| **Post2 x Year** | | | -0.0745 | | | 0.0021 |
| | | | (0.0988) | | | (0.0190) |
| **Post3 x Year** | | | 0.0873 | | | 0.0096 |
| | | | (0.0680) | | | (0.0144) |
| **Post4 x Year** | | | -0.1476* | | | 0.0235** |
| | | | (0.0828) | | | (0.0091) |
| **Post5 x Year** | | | -0.1406 | | | 0.0038 |
| | | | (0.0851) | | | (0.0173) |
| **N** | 261 | 261 | 261 | 234 | 234 | 234 |
| **F-test** | 10.11 | 9.76 | 468.65 | 35.02 | 67.00 | 86.12 |
| **R-sq (within)** | 0.3119 | 0.3576 | 0.3944 | 0.6957 | 0.7232 | 0.7383 |

Note: Table shows estimates of coeffients and standard errors (in parantheses) for each variable.
F-test is for joint significance of variables listed above, excluding fixed unit effects.
Fixed unit effects are jointly significant at 1%-level for all models.
* / ** / *** : Denotes significance at the 10-percent / 5-percent / 1-percent level, respectively.

*Transfer of control.* Similarly, the transfer of control to private investors only seems to matter (at least as far as statistical significance goes) in terms of employment, reducing the ratio of employees over assets by 15% in every year following the change in control into private hands. These findings are consistent with the notion that excess employment is the most prominent inefficiency of NOCs.

*Time trend.* Consistent with the results of the initial SIPs, an underlying time trend can be identified throughout the privatisation process, which is highly significant in explaining performance changes at the firm level.

*Oil price.* Oil prices are found to be highly significant for the changes in profitability and capital expenditure (positive relationship) as well as for changes in the ratio of employment over assets (negative relationship, likely to result from higher asset values in times of high oil prices).

*Follow-on offerings and changes in time trend*. Looking at the indicator variables for follow-on offers as well as the interaction terms for the change in time trend following such offerings, there is no apparent and/or consistent pattern to be found as to how these events impact the long-term performance of oil and gas companies. Whilst this might be unsurprising given the wide differences of the offers in terms of timing and size, the data fails to reject the impression that the detailed patterns of the privatisation processes matter rather less, as long as a more general commitment in favour of privatisation has been given and sustained over time.

## VI. Discussion

A number of potential limitations are 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 what Boardman and Vining (1989) call the "comparison is not possible" argument: fully state-owned companies often pursue non-commercial, socio-political goals, which makes performance comparisons inherently flawed – lower profits do not represent higher costs and technical inefficiencies but rather social outputs. As Boardman and Vining 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.[36] Internal benefits, such as excessive employment levels, would usually

[36] 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

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 equations. The univariate analysis is lacking an equivalent control, but not all of the 22 metrics are dependent on oil price, and where they are the exact extent of oil price changes for this sample of companies has been disclosed. The possibility of earnings overstatement prior to the privatisation transactions has been effectively addressed and rejected earlier in this paper, and 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.[37]

## 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

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.

[37] The paper has not attempted to distinguish the impact of privatisation from commercialisation and corporatisation of the NOC (Aivaziana et al., 2005), or from market liberalisation (Vickers and Yarrow, 1988). 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.

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 no indication that such improvements are caused by undue accounting manipulation 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[38], 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.[39] In terms of profitability one could expect combined annual income to rise by US$37 billion over the period, even without taking into account the increasing volume sales. Whilst these are hypothetical numbers they illustrate the magnitude of the potential benefits from privatisation.[40] Furthermore our study suggests that most of these gains might be realised by partial privatisation alone.

[38] 47 million boe/d x 5.8% CAGR of output (see p.22) = 2.7 million boe/d. This number could be as high as 3.6 mboe/d if all output improvement is concentrated in E&P and none in refining.
[39] 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).
[40] 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

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 becomes less (rather than more) pronounced after the change in ownership. The benefits of privatisation therefore accrue over time, and a very considerable share – 70% for a selection of key performance metrics – materialises already in the run-up to privatisation. This very significant anticipation effect supports earlier findings of Dewenter and Malatesta (2001).

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, the question of control transfer to the private sector, as well as the size and timing of any follow-on offerings all have little incremental explanatory power for firm performance over and above the more general, gradual improvement process that has been modelled as a time trend. The only exception to this finding has been with regard to employment intensity, where higher government ownership and lack of control transfer to the private sector are significant in explaining higher employment ratios.

Whilst this last finding is consistent with the popular notion that excess employment is the most prominent inefficiency of NOCs, it is by no means the case that widespread redundancies in the workforce have been the main driver of performance improvements in the global oil and gas sector. Instead, on average only slightly reduced workforces were able to achieve significant increases in physical output, improve profitability and deal with much higher levels of capital spending, so that all per-employee metrics have improved substantially.

As a final implication, 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 perpetuate and build on the initial gains in performance and efficiency.

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potential environmental concerns would need to be traded off against shorter-term price and supply considerations.

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