The Determinates of Oil and Gas Lobbying

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THE DETERMINATES OF OIL AND GAS LOBBYING

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Master Thesis
Submitted in fulfillment of the requirements of the degree of Master of Standardization, Social Regulation and Sustainable Development

Under the supervision of (Julien Daubanes)

September 2021

University of Geneva – Department of Sociology
www.unige.ch/sciences-societe/socio

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ACKNOWLEDGEMENTS

Firstly, I'd like to express my thanks to Professor Julien Daubanes for his supervision of this project both through keeping me on track when I got a little lost and by helping me to see the bigger picture.

To Saraly Andrade De Sa for her support in my endless stream on methodological questions.

To Felipe Fausto for his patient explanations of the finer statistical details.

To Vincent Pallud for direction on data sources.

And last buy by no means least to Ella.

ABSTRACT

I examine the factors determinate of oil and gas lobbying. Specifically, I focus on the role of cash and oil futures in predicting lobbying expenditure. This is an interesting question as previous literature has demonstrated clear effects in the other direction, the presence of a multidirectional interaction would suggest the presence of a vicious circle toward regulatory capture. Results indicate a significant and positive relationship between oil futures contracts and present lobbying expenditure. The two metric of cash flow trend significantly but in opposite directions providing evidence for reverse causality.

INTRODUCTION

What is the relationship between the financial performance of oil firms and their lobbying behaviour? Previous research has identified a strong relationship between lobbying and firms' subsequent financial performance, but does financial performance consequently result in higher lobbying expenditures? These are the questions at the core of this project. Evidence of a bidirectional process could present serious questions to models that assume perfect and efficient financial markets. For, if past lobbying is predictive of current financial performance, and financial performance is predictive of lobbying, firms who made early investments in influence may be able to capture sections of the markets. The product of lobbying creates/enforces policy barriers, which makes it harder for new firms with a like-for-like product to enter the market and disrupt the old technologies[1]. This helps to increase the rents of the lobbying firms, thereby enabling them to allocate greater resources to lobbying, in turn creating more protectionist policies ad infinitum.

Yet in the context of exacerbating climate change this problem becomes all the more pressing. Emissions of CO_2 passed the 'safe' level of 350 parts per million in 1988 and they have continued on an upward trajectory ever since. According to a study which analysed shells in deep sea sediments, concentrations haven't been this high for between 10 - 15 million years (Tripati, Roberts, and Eagle 2009). To provide context to this statistic, the homo genus only split from the australopithecus genus around 2.4 million years ago, with homo sapiens emerging just a meagre 250,000 - 360,000 years ago: according to Schlebusch et al., the last time there was time much CO_2 in the atmosphere we were still living in trees (2017). If these concentrations are not reduced, the effects to the climate are expected to be severe, with conservative estimates predicting warming between 3^{o}C - 4^{o}C (Rogelj et al. 2018).

This paper contributes to the literature primarily through its specific focus on the oil & gas sector. Whilst a considerable amount has been written on the outcomes and determinates of lobbying in general, empirical literature focusing specifically on the oil and gas is surprisingly limited. To this, further contributions come from attempt to deal with the endogeneity between both cash and lobbying, as well as a focus on the relationship between oil futures and lobbying behaviour.

To deal with both reverse causality and self-selection, I use 2SLS and a two-step instrumented Heckman model. Whilst the instrumented Heckman model is insignificant, I find a positive elasticity of 1 between increases in Operation Cash Flow (CFO) and lobbying expenditure in the same year in the 2SLS model. For oil futures, I find a positive and highly significant elasticity between 2.8-3.9 depending on the cash variable used in the model. Unexpectedly, I find a significant negative relationship between Free Cash Flow to

[1] To this, Huneeus & Kim (2018) estimate lobbying to reduce aggregate productivity by 6% compared to an economy where the lobbying return is set to zero.

the Firm (FCFF) and lobbying, where a 1% increase in FCFF results creates, on average, a 2.9% change in lobbying expenditure in year 1 and a 4.4% change in year 2.

The rest of this paper is divided into the following sections. Section 2 provides first a brief historical context on lobbying activities before outlining the existing empirical literature on lobbying and financial theories of cash. Section 3 begins by an defining the variables used in the model as well as providing summary statistics. It then outlines the conceptual framework before describing the methodology. Section 4 provides the results of the findings along with a discussion on their interpretation. Section 5 concludes.

2. LITERATURE REVIEW

2.1 POLITICAL CONTEXT

The interconnection between politics and interest representation is a relationship perhaps as old as governance itself. Waterhouse (2019) traces influence peddling back to Ancient Greek oligarchs, through to the 1215 formation of the Magna Carta, up until the industrial revolution. Whilst Piketty (2020, 99–126) evidences the role played by the proprietary class in maintaining, transforming or compensating a range of feudal seigneurial dues[2] following the 1789 French Revolution.

In the US, modern interest group politics began to take hold following the removal of British monarchical rule by the new colonists. In his book an *'Economic Interpretation of the Constitution'*, Beard claimed that the Founding Fathers were a form of interest group, and that the Constitution served their economic interests as much as those of the nation, with the merchant and proprietary class being heavily represented and the rights of bondholders heavily protected[3]. The right to petition became formalised via the First Amendment in 1791[4] and a year later the Virginia veterans hired the first lobbyist in an attempt to get higher levels of compensation for ex-soldiers (Center for Responsive Politics 2014). Yet it wasn't until the mid-19th century that lobbying became commonplace.

As the complexity and democratic reach of the US political system expanded so did the nodes and number of interactions between legislators, interest groups and the electorate. The introduction of democratically elected representatives brought with it the need for resources to finance campaigns; whilst growing enfranchisement led to a dissipation of power within the population. Greater organisation complexity was to be required if lobbying were to be effective. By the turn of the 20th century firms began to engage with citizens through tactics that were more commonly referred to as propaganda (Sproule 1997, 192–202). The effectiveness of this, as the historian Loomis writes, had a secondary effect of decreasing faith in public capacity to make rational informed decisions; thereby reconsolidating power in the easier-to-target centralised corridors of power (Loomis 2009).

Legislation did, however, not keep up with these developments, and it was not until the mid-20th century that the first pieces of policy came to fruition with the 1946 Federal

[2] Fiscal privileges which exempted the nobility from certain taxes were removed; however, lords could still collect rents from peasants living on their land *(seigneurie privee),* were initially compensated when the lucrative right of mutation in land sales *(lod)* was removed, and occasionally *banalities* (monopolies on local services such as mills and bridges) were considered to be justified. The *corvee* which required peasants provide free labour was in many cases converted into a contractual rental payment. This seemingly conservative approach, Piketty argues, was a product of the influence held by wealthy landowners.

[3] See Hrebenar & Morgan (2009, 111–31) for a chronology of interest group evolution in the US.

[4] Whilst this is normally used as evidence for lobbying as being codified in the constitution, Blackhawk (2016) provides an interesting legal counterargument for why this is not necessarily true.

Regulation of Lobbying Act. The Act attempted to provide transparency on the pressures effecting legislation by specifying disclosure requirements; however, it was poorly drafted, rife with loopholes, and sections were deemed unconstitutional in *United States vs Harriss* (Holman 2006). A far more important piece of regulation both for this paper and the lobbying literature in general came half a decade later with the 1995 Lobbying Disclosure Act modified by the Honest Leadership and Open Government Act of 2007. The introduction of these acts lead to considerable advancements in the possibilities for empirical research as well as serving to increase transparency.

Despite these developments, wider efforts to mitigate the overreach of the right to petition have largely failed. Lobbying remains highly contentious. A 2019 Pew survey finding that 53% of US citizens rank lobbying and special interests as a 'very big problem' – above fake news, violent crime and the gap between rich and poor (Pew Research Center 2019). And yet total lobbying expenditure at the federal level reached $3.49 bn in 2020, down from its 2019 record of $3.51 bn (Evers-Hillstrom 2021). Given its apparent unpopularity, it bears asking the question *what is the rationale?* Is it a reasonably deigned feature of political architecture, enabling an 'address of grievance' to actors that might be unduly affected by novel or existing legislation? Or is it a vehicle for the further entrenchment of rents and inequities into legislative economic structures?

From the former perspective, the provision of a platform to petition legislators can help to alleviate undesirable features of representative democracy. Such features include consistent over-representation of the more affluent classes[5], a risk toward a tyranny of the majority[6], the potential for voter disillusion/alienation[7], and a limitation in the informational capacities of political representatives[8]. These positive attributes are emphasised by the National Institute for Lobbying Ethics (NILE)[9] – the primary organisation representing lobbyists, or 'government relations professionals', in the US. The right to lobby, argue NILE, is cemented in the First Amendment. Special interest groups are 'an identified group expressing a point of view', and it is a misconception that only '*big money* corporations have lobbyists, the fact is that practically everyone and every issue is represented by lobbyists.

Yet this is not a view shared by everyone, Svendsen argues that lobbying 'raises the prospects of decisions that are supposedly in the public interest being distorted by the power of private actors. This, he argues, transpires through three dimensions – shaping decisions that are taken, ensuring that some decisions aren't taken, and through influencing the cultural zeitgeist so as to alter recognition on what should be decided

[5] For evidence of this see (Giger, Rosset, and Bernauer 2012; Peters and Ensink 2015; Schakel, Burgoon, and Hakhverdian 2020)

[6] For a in depth review of the impact of features of direct democracy on minority groups see the Lewis (2012); for evidence on how a tyranny of the majority is present within markets see Waldfogel (1999); and for an empirical study into the impact of parliamentary electoral structures see Engelmann et al. (2017).

[7] See Tormey (2014) for a study on the 'crisis' in Australian democracy.

[8] Bennedsen and Feldmann (2002) study the role of lobbying as information in US Congress, whilst Klüver (2012) finds that resource endowment and organisational structure are the major predictors of successful informational lobbying in the EU.

[9] https://www.lobbyinginstitute.com/about accessed 15/07/2021.

upon (Svendsen 2011). This is a view broadly shared by Helm, who argues that the regulatory environment surrounding the energy sector is characterised by rent capture, inefficiencies, and market failures. He concludes that this is the result of major players capitalising on historically large rents to exploit information asymmetries and distort both policy and markets (Helm 2010). These distortions combined with extensive public campaigns have the IPCC, UNI PRI, The Union Of Concerned Scientists and multiple environmentally NGOs to conclude that lobbying has held back meaningful progress on climate change (Al-Arshani 2021; Grifo et al. 2012; UNPRI 2018)

2.2 EMPIRICAL LITERATURE

The experimental side of this paper focuses specifically on the extent to which the financial performance of oil & gas companies is predictive of their lobbying behaviour; however, a brief discussion of the stylistic facts and measurement issues within the wider empirical literature is nonetheless relevant for the readers understanding of the research design. To begin with the stylistic facts, Figueiredo & Richter (2014) outline three main findings from the empirical literature: 1) lobbying is pervasive, with total annual spending consistently in the billions; 2) corporations and trade associations comprise the majority of spending, 84% at the federal level and 86% at the state level; 3) well-funded groups are more likely to lobby independently as opposed to as a part of a trade association, enabling greater manoeuvrability and political connectedness. In addition to this lobbying is sticky, past instances of lobbying are a good predictor of future lobbying (Kerr, Lincoln, and Mishra 2011). Drutman (2015) presents good evidence of lobbying's persistence, suggesting that it is likely due to the high initial firm-based-learning costs followed by low marginal costs for each additional year of lobbying. This perhaps explains the finding by Huneeus and Kim (2018) that the elasticity between lobbying and firm size (measured by total sales) is just below 1.

In terms of some of the measurement issues, Lowery (2013) highlights the difficulty of establishing a good counterfactual. Whilst on the surface it may appear that Firm (F) has managed to convince Policymaker (P)to move on a policy, directly or via Lobbyist (L), we would need to have a good understanding of the initial trajectory of P in the absence of both F and L. This problem is compounded – as pointed out by Simon (1953) – when considering the effect of anticipated reactions: F (directly or via L) may be overtly strong position over a specific policy with the knowledge that they will likely have to compromise with P. Lastly, it is not certain that that the direction of influence occurs definitively from F to P or even from L to P (Lowery 2013). Both F and L may be willing to move on issue *A* with the hope that they'll receive greater dividends over issue *B* in the future, or P may simply have a strong enough argument to convince either L or F to their position. With this, L may represent multiple F's across different industries and thereby be willing to sacrifice the preferences F_1 in order to benefit the preferences of F_2.

The various interactions of F, L and P can occur via numerous avenues and through a myriad of different approaches. F may attempt target P directly by providing donations, drawing on personal connections, or through the use of internal L. An Indirect approach

may be adopted through membership of industry associations, hiring of external L, funding of (usually non-objective) research, and – as the Centre for Responsive Politics (CRP) outlines – through the extensive use of a revolving door between F and P[10] (Center for Responsive Politics 2021). Alternatively, the target of influence may change, with focus placed instead on the electorate E – whom P are ultimately accountable. Possibilities here are far less bounded and distinctions muddier. Tactics employed by fossil fuel and tobacco companies have included the funding of think tanks, the discrediting of existing science, astroturf campaigning (whereby groups are created, and actors are often hired to give the impression of a grassroots campaign), along with a whole host of advertising and media tactics.

Additionally, Bombardini and Trebbi (2020) highlight that the number of lobbyists registered in a given year has been declining, peaking at 14,825 in 2007 down to 11,654 in 2018. Both the CRP and Public Citizen argue that this does not reflect a true decline in the number of active lobbyists but rather a movement underground in a growth of what's come to be known as shadow lobbying. Instead of classifying themselves as lobbyist, former Speaker of the House Newt Gingrich, former Senate Majority Leader Tom Daschle, former U.S. Representative Tom Reynolds and owner of government relations company Andy Spahn all considered themselves to be 'strategic political advisors' despite facilitating meetings and communications between firms and politicians (Campaign Legal 2015; Goodwin and Baccellieri 2016). The potential for policy loopholes means that researchers should view absolute lobbying figures with the knowledge that they are likely to be downwardly biased.

Unsurprisingly, the existing literature has employed a range of different methodologies to understand the effectiveness, benefits, and determinates of lobbying. Much of the literature[11] with its roots in Political Science and Sociology views lobbying as informational from firm F to politician P (potentially via lobbyist L). Since the primary motivation of P is held to be their re-election, the theory argues that P is looking for the crucial piece of information that will inform how the electorate will react to her decision. This, argues Figueiredo (2002), explains why spending on lobbying is relatively low when one considers the scale of federal budgets. It could also help explain the diminishing returns to lobbying identified by Meng and Rode (2019) since once P has received the crucial piece of information they may be unlikely to change their mind.

By comparison, many of the empirical studies within the economic literature tend to view lobbying as quid-pro-quo. Under this conceptualisation lobbying is essentially an exchange of value (be it political or monetary) for favourable policy. Yet this is more a function of availability of measurement tools as opposed to deep theoretical disagreements. As Bombardini and Trebbi write it's not that quid pro quo models reflect

[10] See also the extensive and quite brilliant work by Lobby View's API. This allows the user to search for a specific bill, firm or individual and then generates an interactive visualisation depicting the previous political connections of the involved lobbyists(Kim and Kunisky 2021). API available here: https://www.lobbyview.org/query?vizTab=revolvingDoor accessed 07/08/2021

[11] See (Bennedsen and Feldmann 2006; Figueiredo 2002; Figueiredo and Richter 2014; Klüver 2012; Schnakenberg 2017)

reality but because 'data on informational needs of agents and precise evidence on transmission of expertise are extremely hard to come by' (Bombardini and Trebbi 2020). The lack of good informational data is perhaps most problematic for papers focusing directly on the ways in which lobbying increases/decreases the likelihood of the passage/repeal of a specific piece of legislation. This paper somewhat sidesteps this issue, instead, by focusing on the ways in which cash determines lobbying (measured by lobbying expenditure) by oil and gas (hereafter O&G) companies. Whilst expenditure clearly does not capture the totality of lobbying activities, it is reasonable to assume that overtime and between firms it is fairly indicative.

2.3 THEORIES OF CASH

The use of cash flow and liquid assets variables connects this paper to an extensive literature on the role and impacts of cash levels between and within firms. Previous literature has attempted to resolve questions on whether there is an optimal level of cash and how it impacts firms behaviour, managerial structure and investor outlook. Keynes identified three main motivations of holding cash, 1) the transaction motive, when the holding of cash is used to make current and future purchases; 2) the precautionary motive, where cash is held to deal with future shocks and volatility; 3) the speculative motive, where cash reserves are held so as to capitalise on predicted changes in the market, thereby allowing for the movement of assets between liquid and illiquid activities (Davidson 1965).

The first motive allows firms to pay for the relevant operational expenditure. Under this motivation, it follows that industries with high CapEx (like O&G) would need comparatively higher levels of cash. This has been amplified by technological development, where the recent expansion of unconventional extraction from reserves held in sandstone, bitumen, below the Arctic tundra, or in the ultradeep water (>1,500m) amplifies both general CapEx as well as the potential for error in estimation of project costs. The second motivation also applies closely to the O&G sector. Prices of oil and gas are some of the most volatile in the world, whilst the quarterly volatility of the dollar is between 4.4%-15%, the volatility of crude ranges from 12%-90% (Regnier 2007). This makes future prices and thus future revenues very difficult to predict; indeed, there is an entire industry dedicated to the speculation of future oil price. Empirical literature shows evidence of this second motivation, whereby cash rich firms have a higher cash flow market volatility (Bates, Kahle, and Stulz 2009), as well as a higher stock price volatility — measured by its market beta(Palazzo 2012). In addition to being insulated from sector/firm specific volatility, higher cash levels also help protect firms from the impact of global exogenous shocks. For example, firms with greater cash levels performed considerably better in response under the COVID-19 pandemic than those who were highly leveraged (Ramelli and Wagner 2020).

Finally, whilst the third motive is typically applied to investors it is also relevant to O&G firms. These can be broadly divided into three different potential uses of cash which somewhat speculative: they may choose to invest internally via the exploration of new

reserves, development of existing reserves or through R&D; they can invest in external financial instruments such as treasury bonds or in equity markets; or they can choose to lobby so as to alter future policy. Theorists within energy economics have attempted to model expected firm behaviour under various macroeconomic conditions, the most famous of these models coming from being Hotelling's rule (Hotelling 1931). This outlines that owners of non-renewable resources control the release of their commodity dependent upon the macroeconomic conditions. If the value of the natural resource is rising faster than the interest rate firms will be motivated to limit the extraction of their stock, whereas if the interest rate is rising faster than the value of their stock profits will be maximised if the profits from the sale of the resource are placed in bonds. Whilst the assumptions behind Hotelling's model are likely an oversimplification, and the precise extent to which it reflects reality remains a contested topic within the literature[12], the model is illustrative of the additional speculative dimensions contained within the decision-making processes of the non-renewable energy sector.

Both the decision to lobby and the decision to explore for new reserves exist outside the assumptions of Hotelling's model. Both require the use of cash and both require forecasting of macroeconomic/political decisions. In addition to these three, a fourth, though less speculative, use of cash is the decision by firms to transfer excess cash to investors via share-buybacks and dividends. Whether there is an optimal level of cash, where companies allocate cash, and the ways in cash affects the managerial structure of companies is a core topic in management, economics and finance. A landmark paper came from Opler et al. (1999), where the authors sought to identify some of the implications of corporate cash holdings. They argue that there is an optimal level of liquid asset holdings, this occurs as the intersection between the marginal cost of liquid assets and the marginal cost of liquid asset shortages. Despite this optimal level, they find that firms hold more liquid assets than the efficient level or the level at which shareholder wealth would be maximised; the reasons for this are rooted in agency theory.

Agency theory suggests that conflicting interests exist between managers and shareholders. Differing incentives and objectives between the principle (financier) and the agent (manager) leads to differing behaviour between firms. With a focus on cash, greater stocks and flows result in lower dependence on external finance. In turn, this would create less oversight from debtors and creditors on how the extra cash was being spent, as well as reducing both transaction costs and the cost of debt. Ultimately granting managers greater oversight over the use of proceeds, whilst the additional cash protects firms from external shocks. Much of the agency literature, originating with Jensen (1986), argues that managers often do not direct excess cash to the most efficient processes, often injecting it into low net present value projects or new acquisitions when shareholders would have a preference for dividends (Ali and Yousaf 2013; Harford 1999). Managers are thus incentivized to grow firms beyond their optimal size, since increase in size results in an increase in both their oversight and, potentially, their compensation. For these reasons, Jesen argues that operational cash flow is a good proxy for agency problems. Indeed it has

[12] For a review of the literature see: (Slade and Thille 2009)

been applied as such in numerous studies[13], it also helps to explain why Rajan & Zingales use cash flow as the numerator in their "dependence on external finance' equation (see below).

Applied to lobbying agency theory suggests that managers engage in the influence of policy for their own personal gain instead of hoping to concretely change the policy environment for their firm (Skaife, Veenman, and Werner 2013; Unsal, Hassan, and Zirek 2016). Motives may include attempts to increase political connections, to mask managerial failings, or for private political reasons. Hadani and Schuler (2013) find a negative relationship between lobbying and 'corporate political investment' — defined as the sum of lobbying, PAC spending, soft money contributions and 'contributions to groups'. Cao et al. (2018) also find a negative between lobbying activities and the consequential performance of firms; however, in this case the effects are found to be heterogeneous between both industries and firms with greater growth opportunities appear to do better out of lobbying.

In contrast to this, Brown, Chen et al., and Hill et al. (2016; 2014; 2013) all find that lobbying positively impacts firm performance. Additionally political connections have been found to increase firm value (Goldman, Rocholl, and So 2009) and reduce the cost of equity capital (Boubakri et al. 2012). Further, Kang (2016) has demonstrated that whilst the marginal effect of lobbying expenditure on the probability of policy enactment is very small, the returns are very large — between 137-152% of expenditure. One contribution of this paper will be the provision of additional evidence to this debate. If the agency theory prevails high cash levels will be expected to be correlated with high lobbying expenditure. If it is misguided we will expect to see the reverse.

[13] See for example: (Faulkender and Wang 2006; Harford 1999; Richardson 2006)

3. THEORETICAL AND METHODOLOGICAL CHAPTERS

3.1 DATA AND VARIABLES

I use unbalanced panel data for 58 different fossil fuel companies observed over 20 years: from 1998-2019. There is a considerable amount of variability both between firms and within sample groups. This creates the potential for size effects to impact the output and interpretation of results. To control for this, I either scale variables to total assets (a proxy for size), or I add total assets into regression estimations. *Table 1* shows summary statistics of firms split by whether they are Globally Integrated (GI)or North American Independent (NAI). What is instantly clear is that all metrics that might be indicative of firm's size are considerable larger for GI than for NAI. The mean of Total Assets, O&G 1P reserves, Capital expenditure, CFO (described in section '3.1.3 Independent variables') for GI's is 8x larger than that of the NAI's. Interestingly for NAI's lobbying expenditure is only greater by a factor of two.

Table 1: Firm Characteristics

		Globally integrated vs Independent	
Variable	**Overall**, N = 1,143[1]	NAI[1]	GI[1]
Lobby (0 = No, 1 = Yes)			
0	794 (69%)	463 (65%)	331 (76%)
1	349 (31%)	244 (35%)	105 (24%)
Total Assets (MM)	47,542 (13,120)	12,500 (4,616)	104,364 (55,983)
CapEx (MM)	4,645 (1,534)	1,910 (938)	9,081 (5,011)
O&G reserves (1P)	3,258 (1,011)	949 (398)	7,002 (4,279)
CFO (MM)	5,984 (1,642)	1,757 (647)	12,839 (7,391)
FCFF (MM)	1,333 (6)	-89 (-85)	3,639 (1,695)
Liquid Assets (MM)	2,712 (303)	472 (35)	6,345 (2,764)
IBEI (MM)	2,636 (429)	303 (100)	6,418 (2,922)
Lobby Exp (MM)	962,680 (0)	548,756 (0)	1,633,883 (0)

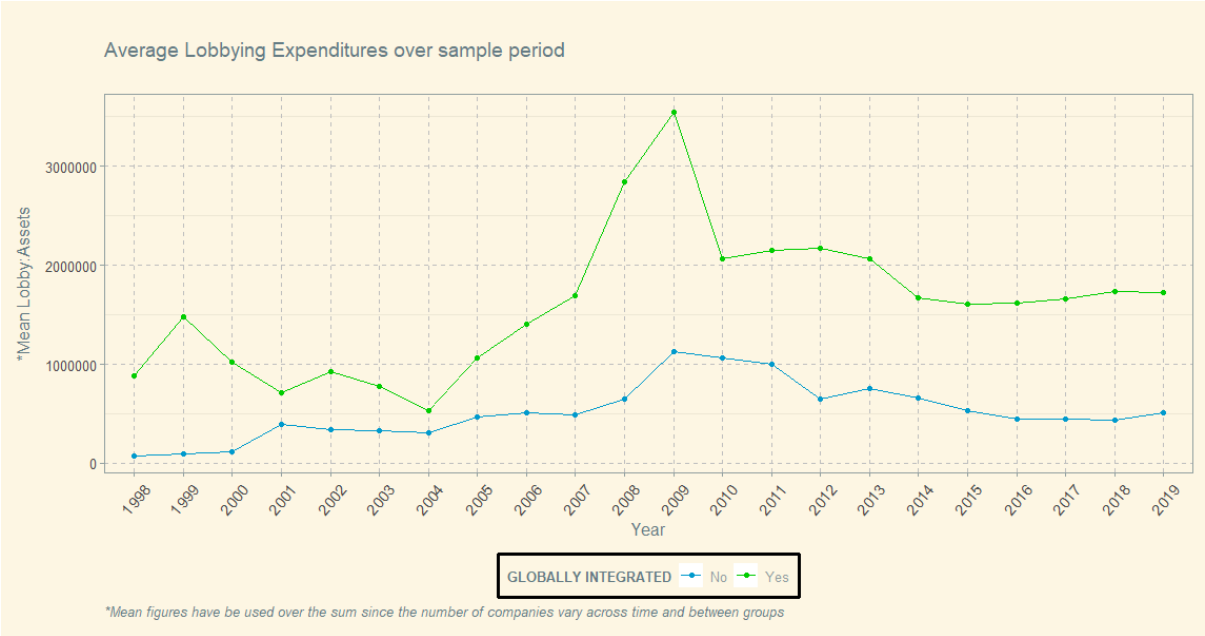
[1] n (%); Mean (Median)

.

3.1.1 COMPANY DATA

Companies are divided into two categories, those which Bloomberg classifies as being 'Global Integrated Oils Valuation Peers' (hereafter GI) and those classified as 'North America Independent E&Ps Valuation Peers' (hereafter NAI). The distinction between Globally Integrated and Independent O&G companies is a standard categorisation that captures a qualitative difference between sections of the industry. GI O&G companies have business activities in all sections of the O&G value chain and are involved in upstream, midstream, and downstream activities. Within these three sections activities include exploration, extraction, production, refining and distribution. In contrast, NAI companies focus on only one section of the O&G value chain, here specifically those involved in exploration and production.

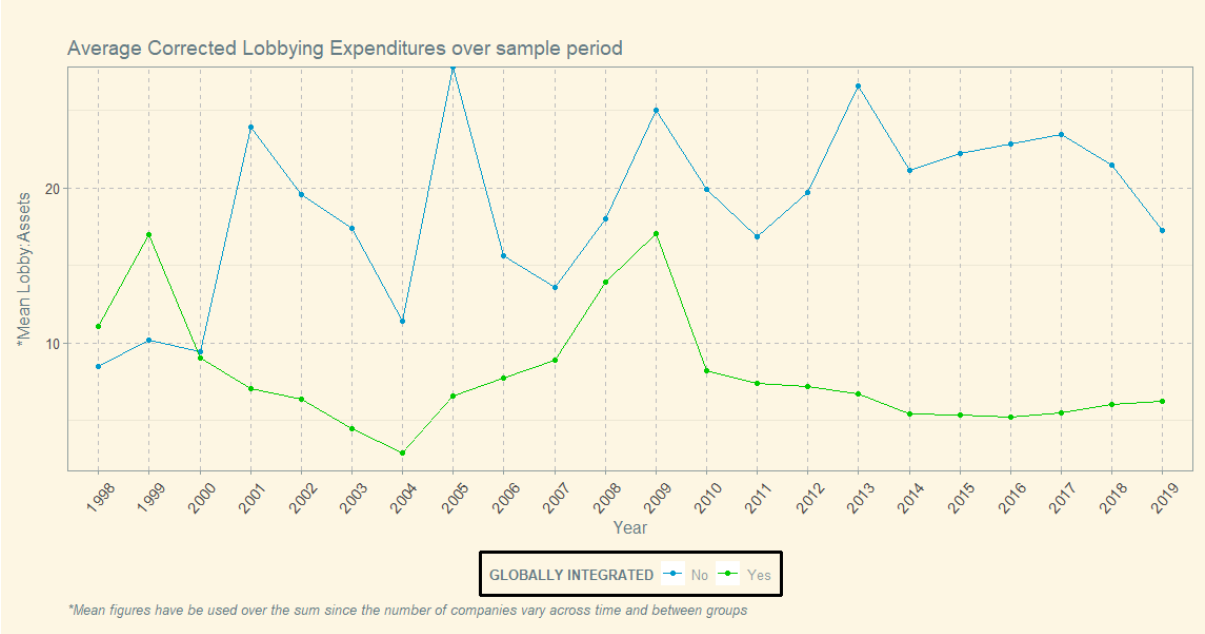
Figure 1.1: Average Lobby Expenditure of GI and NAI companies over time



Part of the rationale behind including the two samples was to obtain a better understanding of the ways in which firm characteristics influence lobbying behaviour. Much of the media publicity on oil and gas lobbying often focuses on the actions of the oil & gas majors (Laville 2019), yet it is interesting to examine how much of these activities relate to size. Figures 1.1 and 1.2 show the evolution of average annual lobbying expenditure by GI and NAI companies. In *Figure 1.1.* we can see that the mean annual expenditure is considerably higher for companies in the GI group as opposed to the NAI group. This is to be expected since GI companies are generally much larger than NAI companies (see *Table 1).* However, in *Figure 1.2* lobbying expenditure is first scaled to total assets before the average annual lobbying expenditure for each group is taken. Here we can see that NAI's overtake GI in almost all years. Whilst lobbying appears to have peaked for GI's at the end of 2008, remains fairly stable for NAI's up until 2017 before dropping off. The dip in the ratio of lobbying expenditure to assets from the NAI's in

2017 is likely explained by an increase in favourable polices from the Trump administration.

Figure 1: Average Lobby Expenditure:Total assets by GI and NAI companies over time.



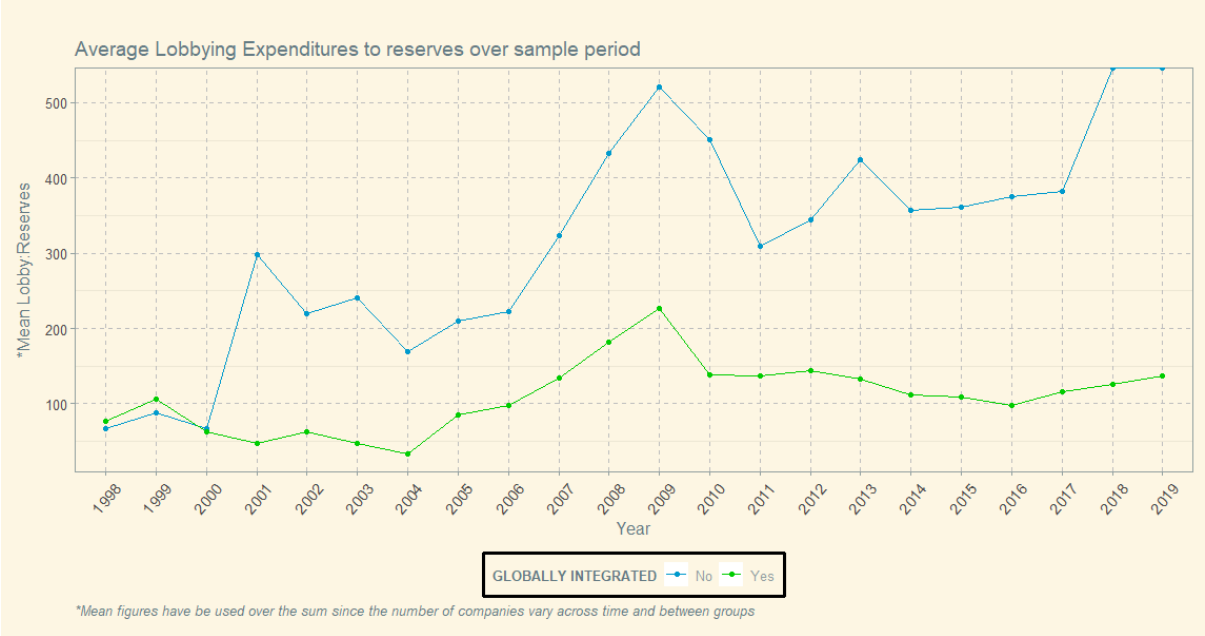
In *Figure 1.3* lobbying expendature is scaled to total oil and gas reserves. Here the gap between NAI's and GI's widens even further. The reason for NAI's outpacing GI's in their relative lobbying expendature is likily due to the fact that NAI's have the vast majority of their asset base in the Unites States and thus would be unlikely to lobby elsewhere. The operations of GI's span multiple juristictions and continents thereby their lobbying is presumed to be less concentrated. This could be tested by restricting the reserves argument to only those contined withint the U.S.; however, dueto data limitations this was not possible.

Of the 58 companies within the sample, 38 are NAI and 20 are GI. The panel is unbalanced, as several companies were not in business at the beginning of the sample period. This is more prevalent among NAI companies whose completion rate is 84% compared to 95% for the GI companies. The overall completion rate is 88% and all companies survive the entire period; thus, the unbalanced nature of the dataset is entirely due to new entrants. By 2008 93% of companies are observed; however, it is not until 2014 that data is available for all 58 companies.

On unbalanced panel data Wooldridge writes that 'if the reason a firm leaves the sample (attrition) is correlated with the idiosyncratic error then the resulting sample section problem can cause biased estimates ' (Wooldridge 2008). Whilst the rate of attrition is zero, the average rate of accretion (new entrants) is around 2% though this is almost entirely due to an 8% jump between 2007-2008. One paper finds that the accretion rate has many of the same problems of the attrition rate; however, attrition is considered unproblematic at rates of <5% (Schulz and Grimes 2002; Tebes et al. 1996). Although the rate is low it is worth identifying that the cause of the imbalance is indeed correlated with

the idiosyncratic error. This is likely due to advancements in both exploration and production technologies that lead to the US shale boom throughout the late-00's. Appropriate proxies for energy-based technological development remain a topic of debate within the energy economics literature; these include patents, energy intensity and total factor productivity (Huntington 2006; Liobikienė and Butkus 2017; Zhu et al. 2019). For simplicity I use the time dummies[14] in all fixed-effect regressions as well as a two-stage Heckman to deal with selection bias

Figure 2: Average Lobby Expenditure:Reserves by GI and NAI companies



3.1.2 LOBBYING DATA

The lobbying data for this paper relies on the work of the CRP made available via the Open Secrets website. Their data source exploits laws stipulated within the 1995 Lobbying Disclosure Act (LDA) – later modified by the Honest Leadership and Open Government Act of 2007 (HLOG). Which decrees that lobbyist must file quarterly reports on the expenditure of their clients. The legislation uses definitions outlined US Code, whereby a lobbyist is:

> Any individual who is employed or retained by a client for financial or other compensation for services that include more than one lobbying contact, other than an individual whose lobbying activities constitute less than 20 percent of the time engaged in the services provided by such individual to that client over a 3-month period' (United States Code 2011).

[14] Also considered to be a valid response by many in the literature (Hunt and Ninomiya 2005; Huntington, Barrios, and Arora 2019).

The lobbyist is required to provide a good faith estimate of lobbying expenditure throughout the period, provided it falls above a certain exclusion threshold. This exclusion threshold has steadily been declining since 1998: from $10,000 to $5,000 to $3,000. The lobbying party must disclose the name of their client, the amount spent, the name of the lobbyist, whether the lobbyist is internal or external to the client, and details on the bill that the lobbyist worked on. There is, however, no requirement to disclose the position taken, creating challenges for the empirical literature. Prior to the 2007 HLOG amendment, requirements specified that reports should be filed semi-annually, from 2008 onwards the law changed instead requiring quarterly disclosure. HLOG also required lobbyists to file their reports electronically and for them to be publicly accessible through an online database: this exists on the Senate Office of Primary Records.

For companies and non-profits who use internal lobbyists the disclosure methodology is slightly different. Instead of the US Code definition, actors must instead follow the Internal Revenue Code (IRC) definition. These specifications require filers to include lobbying payments made at the state and grassroots level; however, the specification of which public officials are included in the IRC is narrower than the LDA[15] (Jacobs 2011; Nossaman eAlert 2018; United States Code 1986). According to the CRP, this means data filed under the two methodologies aren't strictly comparable. Figures on the Open Secrets website use the IRC disclosed figures if the firm self-files, otherwise they take the aggregate of filings made with external lobbying firms (Center for Responsive Politics 2020). Whilst LobbyView data specifies whether the filing was internal vs external, for the sake of simplicity this paper treats all lobbying expenditure commensurately.

In addition to compiling the data between the methodologies, CRP also rectifies any obvious discrepancies in figures and standardizes differences in names of the firm being reported on. Errors are typically attributable to rounding or the use of differing filing methods by internal/external lobbyist. Where a parent owns multiple subsidiaries, CRP aggregates this across entities and attributes this to the parent (Center for Responsive Politics 2020). In the case of trade associations, there are currently not laws stipulating the disclosure of members, let alone the fees each member contributes. The state of voluntary disclosure is poor, with a review by Just Capital found that 58% of firms do not disclose their membership in any trade associations (Thornton 2020). As many oil and gas firms seek to preserve their external image as agents of a sustainable energy future[16], the role

[15] Interestingly, the IRC definition exists as local level lobbying expenditure was previously tax deductible. Perhaps of equal interest is the fact that this was overturned by Trump's 2017 Tax Cuts and Jobs Act. Yet loopholes remain, with activities that remain deductible under section 162 of the IRC including: 'educating the public on specific issues, researching the effects of legislative issues, and advising regulatory agencies on previously enacted legislation'(Strong 2018).

[16] Surface level examples include BP changing its logo to a green flower and the French oil giant Total changing its name to 'Total Energies'. At the structural level, BP, Total, Shell, Eni, Repsol, Occidental and Equinor have all introduced pledges to reduce their Scope 1, 2 and – with major loopholes – 3 emissions to net-zero by 2050; however, many energy-focused NGOs have criticised their roadmaps to achieving these targets(Green et al. 2018; Kusnetz 2020; Reclaim Finance 2021; Taft and Berman 2021). For example, BP does not include its 20% share in Rosneft – which accounts for a third of its production and downstream revenue; Total only commits to scope 3 in Europe – and is continuing large scale expansion projects in the Russian Arctic and African

played by trade associations is held to be of increasing importance when examining lobbying behaviour (InfluenceMap 2017; Kowal 2018). Despite this, the absence of good data mean that the activities of these groups remain outside the scope of this study.

The data for this paper is aggregated at the annual level, this is primarily a function of the availability of oil and gas reserves which are disclosed to the Security Exchange Commission on an annual basis. Lobbying expenditure is thus calculated as the sum of the semi-annual or quarterly disclosure (depending on the year). It is important to recognise that this activity may have occurred at any point over the 365-day period but is only observable in the single annual unit. In addition to this there is a possibility that the lobbying amount will be below the disclosure exclusion thresholds defined out by HLOG. Yet, the annual aggregation of the data and the fact that the lowest value observes (after zero) is $10,000 (of which there are only three instances) the odds of this having a meaningful impact on the results is minimal.

Throughout this paper, I transpose all observations where no lobbying has been reported by a company or lobbyist to zero. This does lead to many zeros within the sample. Out of a total of 1,143 by each firm *i* at each time *t* lobbying expenditure is registered 349 times – meaning that lobbying occurs in roughly 30% of the total sample (see *Table 1*)**.** Out of a total of 58 companies 25 do not register any lobbying expenditure in any of the periods, whilst 57% of firms do lobby. The propensity to lobby within this sample is much larger than propensities reported in studies encompassing a larger number of industries. Hill et al. (2013), for example, find that 18% of firms lobby in their pan-industry study. This suggests, perhaps unsurprisingly, that lobbying is relatively common within the O&G sector.

The large number of firms that report zero lobbying expenditure in year *t* suggest that might be some selection bias present within the sample. Whilst the decision to lobby is partly predicated on inter-firm variability there are likely to be a large number of time varying factors that influence the decision. The decision to lobby may change depending on the lobbying activities of other within the sector or based on the likelihood that their lobbying activity will be successful. Figueiredo & Richter (2014) that the likely presence of endogeneity in the lobbying samples may lead to incorrect inference and biased parameter estimates in standard regression models. In addition to applying Two-Staged least squares (2SLS), I construct a second model to account for self-selection. This is achieved through the us of a two-step Heckman model (also called a Tobit-2), whereby selection into the group is estimated first. This outputs the Inverse Mills Ratio which is then added to the second step of the OLS regression and marginal effects are produced (Heckman 1974).

As such there are two measures of lobbying used within this paper. The first of which is the binary operator $LobbyDummy_{i,t}$, this is used to determine whether lobbying by firm *i* occurred in year *t*. The second is the continuous variable *log(1+LobbyExp)* which captures the intensity of lobbying by the firm in the relevant period. The lobbying expense variable

subcontinent; and Equinor, Repsol and Occidental only include the emission intensity of their products (Carbon Tracker 2021).

has been transformed by the natural logarithm to account for the considerable amount of positive skew present within the variable, the constant '1' has been added to all observations to allow for this transformation to affect the multitude of zero values present within the sample. Whilst the presence of the constant is not strictly necessary in the second stage of the Heckman, is has been included in both the Heckman and in the 2SLS to allow for comparability between the results of both outputs.

3.1.3 INDEPENDENT VARIABLES

The sample of the companies along with range of predictor and control variables have been sourced from the Bloomberg Terminal. Five[17] independent variables are of interest for this paper. These include two measures of cash flow ($CFO_{i,t}$ & $FCFF_{i,t}$), one measure of cash stock ($Cstock_{i,t}$), a measure of financial performance ($IBEI_{i,t}$), and a measure of projected oil price (*ICE)*. All independent variables are modelled at both year *t* and at year *t-1*, this is to see whether there is a difference in the effect between measurement periods and is consistent with previous research (Chen, Parsley, and Yang 2015; Hill et al. 2013, 2014). Whilst the four financial variables are disclosed quarterly, figures for the fiscal year are used. This creates an important difference in the meaning of time for the flow variables (cash flow and financial performance) versus the single stock variable. Where the flow variables represent the flow over the previous year, the stock variable is a point-in-time (calculated as the mean of the four quarterly disclosure intervals). The effect of the stock variable at time *t* is hypothesised to have less of an impact on both $LobbyDummy_{i,t}$ and $LobbyExp_{i,t}$ when compared to time *t-1*. This is because the averaging of the four quarters means that there is less time for both the x and y variables to capture the change in the firms lobbying behaviour.

The selection of the independent variables were made based on the findings of several other papers within the literature namely (Chen, Parsley, and Yang 2015; Hill et al. 2013). Firstly, the cash flow variables are measured by $CFO_{i,t}$, $CFO_{i,t-1}$, $FCFF_{i,t}$, and $FCFF_{i,t-1}$. Where CFO (Cash From Operations) is a continuous variable representing the total amount of cash that a company generates from its operations over the relevant financial year. Sensitive to changes in both assets and liability, this value can be either positive or negative and indicates the total amount of cash being transferred into and out of the firm. In their study of the effect of lobbying on financial performance, Chen et al. (2015) find that CFO consistently has the weakest effect. It was considered interesting to see whether this effect is the same when the reverse relationship is tested. CFO is calculated via the following equation:

[17] The binary variable $LobbyDummy_{i,t-1}$ is also included in the first stage of the two-step Heckman regression; however the dynamics of this have already been discussed in detail above.

(eq. 1)

$$CFO = Net\ Income + Depreciation\ \&\ Amortization + Noncash\ Adjustments + Changes\ in\ Noncash\ Working\ Capital$$

Second, FCFF (Free Cash Flow to the Firm) – sometimes called Operating Free Cash Flow – measures the cash generated by a company's operations that then becomes available for distribution or saving after accounting for various necessary expenditures. FCFF is a slightly expanded version of Free Cash Flow which is calculated as CapEx subtracted from CFO. Hill et al. (2013) use this metric in their paper investigating the determinates of lobbying[18]. FCFF is defined as:

(eq. 2)

$$FCFF = CFO + Capital\ Expendatures + Interest\ Expendatures \times \left(1 - \frac{Effective\ tax\ rate}{100}\right)$$

On the stock side, for variable $Cstock_{i,t}$ the measure used here is Cash and Marketable Securities. This metric includes cash and liquid securities that can be converted quickly into cash. Its purpose is to capture the amount of liquid assets available to the firms' managers without considerable transaction costs. As such $Cstock_{i,t}$ is measured via the following equation:

(eq. 3)

$$Cstock = Cash\ \&\ Near\ Cash\ Items + Marketable\ Securities + ShortTerm\ investments + LongTerm\ Investments$$

The financial variable $IBEI_{i,t}$ is an acronym for Income (loss) Before Extraordinary Items and refer to the Net Income excluding the effects of discontinued operations, accounting standard changes and natural disasters. This variable has been included since Chen et al. (2015) find it to be the most significant dependant variable when measuring the effect of lobbying on financial performance. They argue that $IBEI_{i,t}$ is the most insulated from endogeneity issues in the short term compared to metrics that account for tax rates. If this is true the effect of lobbying $IBEI_{i,t}$ will be expected to be minimal. The variable is defined as following:

(eq. 4)

$$IBEI = Toal\ Revenue - Ordinary\ Expenses$$

Finally, the oil futures variable *ICE* is the InterContinental Exchange's 12-month Brent futures calendar spread. The ICE calculates this by coming a weighted average of historical prices with a straight average of designated assessments published in media reports. The purpose of this variable is to capture how changes in predicted oil price will affect firms lobbying behaviour. The effect of this variable is interesting when considering

[18] However, Hill et al. scale this to firms total assets in order to deal with size effects.

a downward price trend. Do firms anticipate a dip in the oil price lobby policy makers for tax breaks? Or do they save the cash to survive the volatility?

3.1.4 CONTROL VARIABLES

I use three control variables and one instrument in this paper. The three controls are $Asset_{i,t}$, $O\&GRes_{i,t}$ and GI_i. $Asset_{i,t}$ is the total assets of the firm in the relevant time period and are calculated as liabilities plus assets – covering essentially anything that could be converted to cash if everything were liquidated, and all debts paid. This variable is used to control for heterogeneous size effects amongst firms.

The second control variable, $O\&GRes_{i,t}$, is also used to control for time varying factors in firm behaviour. It is calculated as the sum of all proved oil, liquids and natural gas reserves owned by the firm and with a 90% probability of extraction under current economic and technological constraints. Natural gas in often reported in Millions of Cubic Feet (MMcf) whilst crude oil and natural gas liquids (NGLs) are often reported in Thousands of Barrels of oil (Mbbl), these units have been converted into the common unit of Millions of Barrels of oil Equivalent (MMboe). Firms with relatively high MMboe may be more likely to lobby against a policy that adversely effects the likelihood probability of extraction.

In the two-step Heckman model, GI_i is added both as a means to control for inherent variability in firm characteristics and as an interaction term between several of the regressors. This is a binary term whereby the value 1 is given in the firm is GI and 0 if NAI. As can be seen in *Table 1* there is considerable variation between NAI and GI companies the addition of this variable was so as to attempt to capture the ways in which this difference way effect the estimations. In the 2SLS model GI_i is swallowed up by the specification of panel individual fixed effects. As such, the term exists purely as an interaction term with the regressors. The instrumental variable $OilPrice_{i,t-1}$ is also added to the first stage of the 2SLS in order to control for endogeneity between the explanatory variable and the variable of interest (see '*3.2.2 Method*' for a full explanation of this).

3.2 Conceptual framework and methodology

There are two papers at the intersection of cash and lobbying that are explicitly relevant to the empirical design of this paper. Using panel data from 1998-2006, Chen et al. (2015) find that on average lobbying has a significant and positive impact on firms financial performance and that portfolios of firms with the highest lobbying expenditures outperform benchmarks in the years following. The authors have three metrics of financial performance IBEI, net income, and operating cash flow (CFO). Of these, they claim that IBEI is more effective than EBITDA[19] as it has greater insulation from reverse

[19] Earnings Before Interest, Taxes, Depreciation, and Amortization.

causality — since lobbying activities may affect tax and interest rates. In reference to this they write, 'one critique that is immediately apparent concerns the direction of causality, i.e., does lobbying influence financial performance or the reverse?'. The authors attempt to resolve this by running a reverse regression; however, reverse regression may not be the most efficient way to deal with endogeneity. Theory shows that a reverse regression is likely to produce bias estimates unless there is no random error in the dependent variable (Fornell, Rhee, and Yi 1991; Goldberger 1984).

A second paper comes from Hill et al. (2013), who seek to understand the determinants and value of corporate lobbying. Dividing their paper into two parts, the authors first attempt to measure the primary factors behind firms' motivation to lobby. Lobbying is positively and significantly correlated with size and with market to book ratio, suggesting that politics is more important to larger firms and the investment opportunities influence lobbying behaviour. Interestingly, they find a significant and negative relationship between a one-year lag of cash flow and present lobbying expenditure. This leads them to reject agency theories conception of lobbying. However, the inclusion of a lag may also not be a sufficient approach to deal with the presence of endogeneity. On this, Bellemare et al. (2017) write that rather than mitigating endogeneity, 'lag identification merely moves the channel through which endogeneity affects the estimates of parameters of interest'. Instead of removing the cycle of reverse causality, the variable $x_{i,t-1}$ affects $y_{i,t-1}$, which in turn affects $x_{i,t}$ which itself affects $y_{i,t}$ (Blackwell and Glynn 2018). I use an instrumental variable approach to deal with the presence of endogeneity.

An additional effect may also be introduced in terms of relationships to credit. These occur through two potentially self-perpetuating channels. First, firms with greater cash flows and stocks will have less dependence on external finance. Rajan & Zingales (1996) define this dependence on finance as the ratio of capital expenditure minus operational cash flow divided by capital expenditure. Intuitively, firms will prefer to fund their operations via their own revenue streams rather than via the more costly and less autonomous avenues of equity or creditor finance. Secondly, firms with higher cash flows are able to access credit more easily. A recent paper by Lian & Ma (2021) shows that 80% of lending is based on 'cash flow-based lending', with 20% based on assets. They identify a variety of earnings based borrowing constraints, demonstrating how additional earnings increase the ease of acquiring finance. Yet the extent of this effect within the oil and gas sector is not clear. Hattendorff (2012) finds low dependence — using Rajan & Zingales' metric — of the natural resource sector on short-term liquidity, but high dependence for investment and cash flow.

The above considerations lead into the first hypothesis of this paper:

> **Hypothesis One** Both cash stocks and flow have a positive impact on firms lobbying expenditure.

Moreover, this paper builds on previous literature by predictive power of cash and oil price exclusively within the O&G companies. The O&G sector is a special case, since the in-situ value of non-renewable resources endows their products with an additional scarcity

value less present in other non-extractive industries. The difference between the marginal cost of extraction and the spot price of fossil fuels (known as Hotelling's rent) is often considerable, endowing the industry with considerable profitability (Erlei and Neumann 2014). It follows that these rents will provide the industry with high levels of cash reserves. Mainsali et al. (2019) show that the extractive and mining industries have relatively high stocks of cash (measured as cash by total assets), though there is likely to be considerable inter-firm heterogeneity. The effect of predicted oil prices on lobbying is also an interesting interaction to examine since it is used by firms to predict futures revenues and the allocation of investments. To measure this the variable *ICE* is used, which is the 12-month Brent futures price from the InterContinental Exchange. The *ICE* price uses historical oil prices in combination with analysts' forecasts and as such correlates closely with spot prices – the use of historical prices to predict future prices is defined as random-walk theory in the literature. Whilst spot prices are reasonable predictors of the future oil price in the very short term, futures prices outperforms random-walk models in the medium to long term (Arezki et al. 2017; Beckers and Beidas-Strom 2015).

Khan et al. (2020) show that a rise in the oil price negatively affects the stock price, cash flow and market values of oil and gas companies. Whilst counter-intuitive at first, firms positive outlook leads to greater investments internally and lower cash flows. Firms will partly fund these investments via equity, the greater number of shares in circulation will lead to deflation of price; however, over a longer timeframe the effect is positive[20]. It therefore follows that firms' lobbying behaviour would in some way depend both on the current and medium-term future price of a barrel of oil.

In the short-term, one would imagine that if the price of oil were to drop, firms would seek tax breaks, bailouts, or favourable policy in order to continue remaining profitable through the price decline. Evidence for this comes from Norway, where following the 1998 oil price crash the O&G sector launched an extensive, but ultimately unsuccessful, campaign for a tax reduction on North Sea oil extraction (Ihlen and Berntzen 2007). Increased activity can also be seen with oil futures recently being valued below zero following the impacts of the coronavirus (Price and French 2020). In the medium-longer term the opposite effect is predicted, the rise in prices will increase firms' cash stocks and flows thereby providing them with more liquid capital to dedicate toward lobbying. Since the time-series interval in this sample is annual, the longer term effect is more likely to be picked up by the data.

If a relationship is established, one clear benefit of this variable is both its visibility and resolution. ICE futures are traded by the second and the price is available instantly online. Whilst oil firms' behaviour is unlikely to be responsive to the second one could imagine the monthly fluctuations might serve as a benchmark.

> **Hypothesis Two** A positive relationship between current oil futures and lobbying is predicted

[20] For a discussion on the uses of cash by oil and gas firms see section 2.3 Theories of cash'.

3.2.2 METHOD

To address reverse causality, I use a two-stage least squares method with $OilPrice_{it-1}$ as an instrument for three different cash and one financial performance variables. Wooldridge (2008) writes that valid instrumental variables must be both exogenous and relevant. In terms of exogeneity, past and present oil prices are largely dictated by OPEC who control the vast majority of global oil supplies. Decisions by OPEC to alter the supply of oil into the economy are largely a function of geopolitical, economic, and technological developments. In terms of relevance, changes in oil prices affect all firms unanimously and data show that cash flows are sensitive to these changes (Zhang, Zhang, and Zhou 2020). Whilst it is likely that GI and NAI companies will have different sensitivities to fluctuations in oil price, the within group effects remain strong.

Testing this, Tables 2 and 3 show the output of OLS regressions of the log $OilPrice_{it-1}$ on the log of the three cash variables, we can see that the effect is significant at both the aggregate and at the group levels. The instrument is weakest when applied to *FCFF* and strongest when applied to *CFO*. This is likely due to the fact the *CFO* is a more direct top level indicator, whereas *FCFF* is adjusted by interest expenses and effective tax rates. We can also see that the effect is stronger among GI companies when compared to NAI, this is broadly in line with speculative motivations for holding cash outlined in section 2.3. Rationalising this, GI companies will likely have less control over their exposure to price fluctuations in their mid and downstream activities. By contrast, NAI companies exclusive focus on upstream activities allow them to capitalize on short term spikes in prices by increasing production; whilst insulating them from the worst effects of price drops.

Table 2: Effect of IV on Independent Variables

Aggregate of IV on cash variables

	Dependent variable:		
	CFO	FCFF	Cash stock
	(1)	(2)	(3)
OilPrice t-1	1.558***	0.563***	2.618***
	(0.303)	(0.116)	(0.910)
SqrPrice t-1	-0.133***	-0.080***	-0.231*
	(0.040)	(0.015)	(0.120)
Observations	1,142	1,142	1,142
R^2	0.294	0.039	0.105
Adjusted R^2	0.254	-0.014	0.055
F Statistic	224.575***	22.171***	63.323***
Note:	*p<0.1; **p<0.05; ***p<0.01		

Table 3: Group level effect of IV on Independent Variables

Group IV on cash variables by group						
	Dependent variable:					
	NAI CFO	NAI FCFF	NAI Cash stock	GI CFO	GI FCFF	GI Cash stock
	(1)	(2)	(3)	(4)	(5)	(6)
OilPrice t-1	1.229***	0.137	2.539**	2.039***	1.776***	2.673**
	(0.391)	(0.084)	(1.288)	(0.476)	(0.519)	(1.168)
SqrPrice t-1	-0.094*	-0.022**	-0.230	-0.191***	-0.250***	-0.224
	(0.051)	(0.011)	(0.169)	(0.063)	(0.068)	(0.154)
Observations	706	706	706	437	437	437
R^2	0.257	0.027	0.072	0.354	0.046	0.196
Adjusted R^2	0.214	-0.030	0.018	0.319	-0.005	0.153
F Statistic	115.297***	9.105***	25.906***	113.279***	10.002***	50.334***
Note:						*p<0.1; **p<0.05; ***p<0.01

Zhang et al. (2020) find that the relationship between oil price uncertainty and cash holdings exhibit an inverted U-shape, increasing initially before dropping. To test whether a quadratic relationship exists between oil price and cash flow the squared term of $OilPrice_{it-1}$ has also been added in the printout of the regression. These squared values have not been included in the formal regressions, nonetheless it was deemed interesting to briefly examine the extent to whether a similar effect exists for spot prices. Indeed, a significant and positive relationship transforms into a significant and negative relationship between for 7/9 of the cash variables at both the aggregate and group level. The remaining two follow the same levelling off but not all outputs are significant. This suggests that the effect of oil price on cash holdings is not completely linear and begins to wear off after a saturation point. *Figure 3*: IV nonlinearity on cash stocks &*Figure* 4: IV nonlinearity on cash stocks show that the relationship is not particularly pronounced both at the group and aggregate level. Further, although the linear specification of OLS requires effects to be constant across all margins, both Angrist & Pischke (2010) and Mogstad & Wiswall (2010) argue that this requirement can be weakened in the case of a IV on an independent variable. The low level of the nonlinearity in combination with the theoretical backing led to the conclusion that this effect is unlikely to significantly impact results.

A high level of positive skew in each of the variables resulted in non-normality of residuals in untransformed regressions. As such the regressors, controls and the independent variables have been converted to their natural logarithm in all equations. The variables $LobbyExp_{i,t}$, $Assets_{i,t}$, $O\&GRes_{i,t}$ and $Cstock_{I,t}$ contain a number of zeros, so a constant of one additional unit was added to each of these variable before making the transformation. The varibels $CFO_{i,t}$, $FCFF_{i,t}$ and $IBEI_{i,t}$ contains multiple negative values. In these instances, the minimum unit plus one was added to all variables before making

the log transformations. The result of this is that regression outputs in Tables 4 and 5 should be interpreted as elasticities and not as marginal effects.

Figure 3: IV nonlinearity on cash stocks

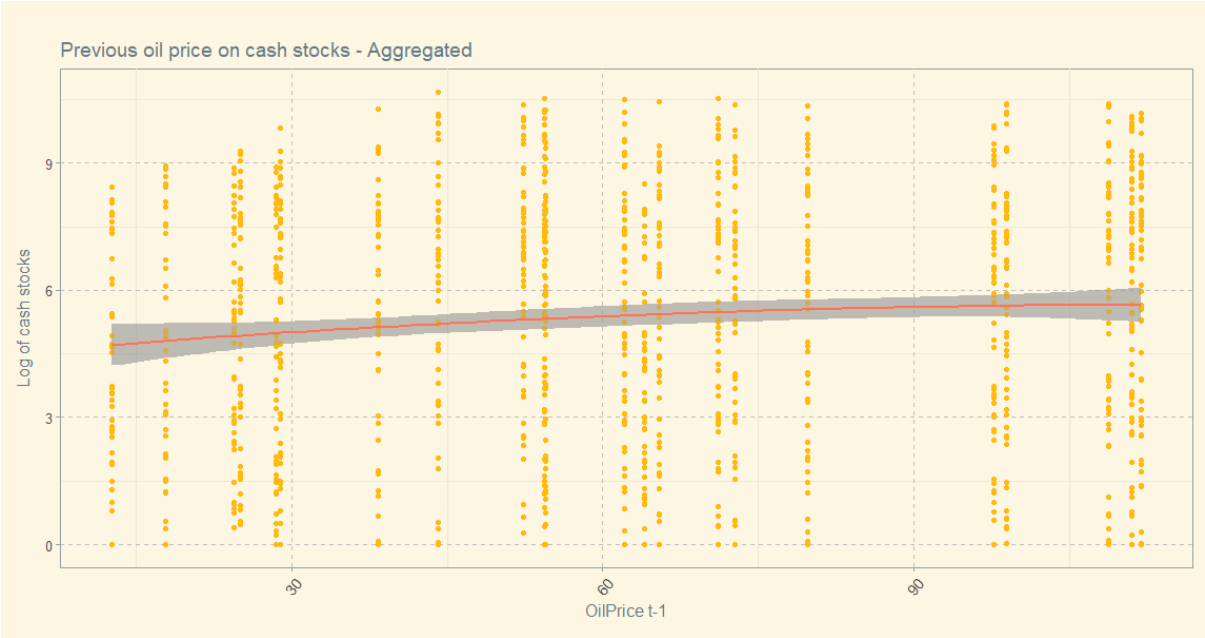
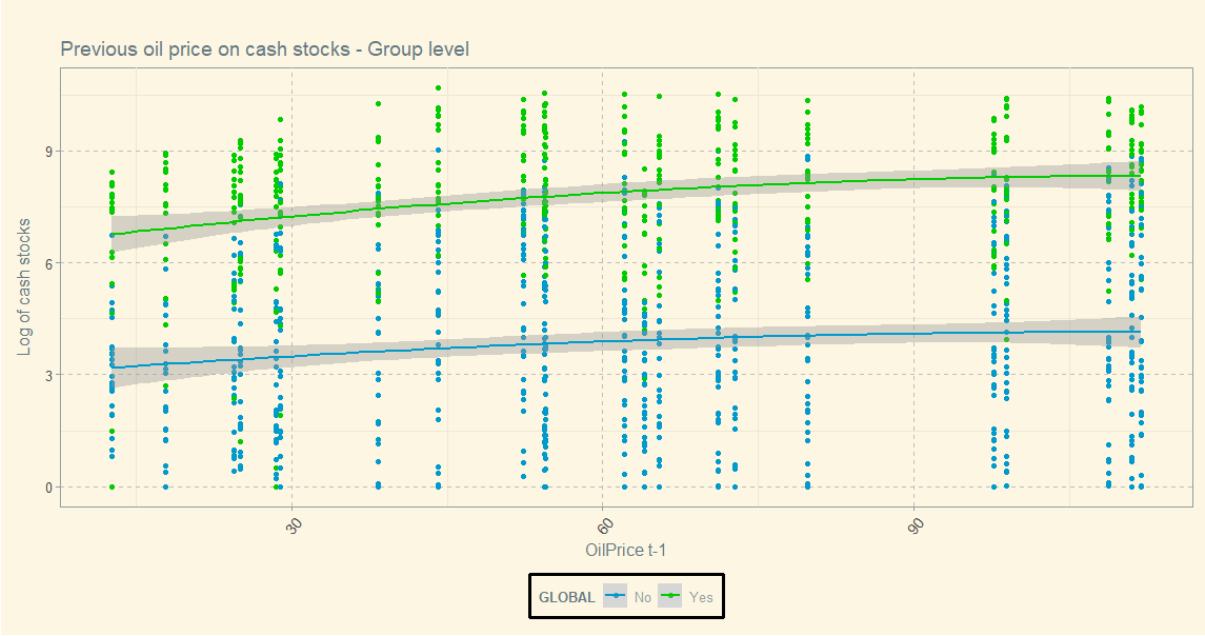


Figure 4: IV nonlinearity on cash stocks



To gain a better understating of the lagged effects on lobbying, the model was estimated at both time *t* and time *t-1,* represented in the equations as *t-k* where *k* takes a value of either zero or one. In terms of model specification, a Chow Test for poolability was run in addition to a Hausman test to compare between random and fixed effects. The results of these two led to the decision to select a fixed effects 2SLS model was chosen. The first step of this is estimated via the following equation:

(eq. 5): Stage one of 2SLS

$$\widehat{logCash}_{i,t} = \alpha_i + logOilPrice_{i,t-k} + \mu_{i,t}$$

Where $Cash_{i,t}$ is one of the four different measures of cash flow, stock and performance, $OilPrice_{it-1}$ is the mean spot price of oil for the previous period and $\mu_{i,t}$ is the error term. After an estimate of cash is realised, the second step of the 2SLS is estimated by the following equation:

(eq. 6) Stage two of 2SLS

$$\begin{aligned} logLobbyExp_{i,t} &= \beta_1 \widehat{logCash}_{i,t-k} + \beta_2 logAssets_{i,t-k} + \beta_3 logO\&G\ res_{i,t-k} \\ &+ \beta_4 logICE_t + \beta_5 \widehat{logCash}_{i,t-k} GI_i + \beta_6 logAssets_{i,t-k} GI_i \\ &+ \beta_7 logO\&G\ res_{i,t-k} GI_i + YearDummies_t + \alpha_i + \epsilon_{i,t} \end{aligned}$$

Where α_i are intercepts specific to the firm that captures heterogenies between entities and $\epsilon_{i,t}$ is the exogenous error term. All variables have been log transformed so as to deal with positive skew and non-normally distributed residuals. $YearDummies_t$ were added after a the null – insignificant time effects – of a Lagrange Multiplier Test was rejected at high significance.

Whilst one of the benefits of a fixed effect panel regression is its capacity to control for time-invariant firm specific omitted variables, the interaction term GI_i has been added to capture the differences in β estimates between GI's and NAI's. This is complicit with the statistical theory, which allows for interaction terms contained within a fixed-effect estimation provided that one variable is time-constant and the other is time-varying (Giesselmann and Schmidt-Catran 2020). The addition of this effect allows the estimates to pick up on the heterogeneity between the two categories of firm

A second methodological problem within in the literature on lobbying is the presence of selection bias. Firms lobby based on a range of internal and external factors, this choice is not random. Panel data may not be sufficient in controlling for this bias, since it relies on the assumption that missing confounding variables are time invariant. Firms choose whether to lobby on not as a piece of legislation arises, the occurrence of this varies due a vast number of reasons. An alternative approach, employed by a number of papers in the literature[21], uses a two-step Heckman estimation model, whereby the probability of lobbying and the Inverse Mills Ratio is calculated through a probit model at the first stage. The output of this is fed into the second stage of the regression and the effect is estimated with the selectivity bias removed.

In addition to the use of 2SLS I attempt to deal with selectivity-bias vias the use of a two-step Heckman. The first stage attempts to estimate the probability that firm *i* will lobby in

[21] See for example: (Gibson and Odabasioglu 2021; Hill et al. 2013; Mathur et al. 2013; Richter, Samphantharak, and Timmons 2009).

year *t*. To estimate this I create the variable $LobbyDummy_{i,t}$ which takes the value of one is firm *i* lobbies in year *t* and a value of zero otherwise. The first step is as followed:

(eq. 7) Heckman first step

$$LobbyDummy_{i,t} = \alpha + \delta_1 logOGres_{i,t} + \delta_2 logAsset_{i,t} + \delta_3 LobbyDummy_{i,t-1} + \epsilon_t$$

Where $LobbyDummy_{i,t}$ is a binary variable created to take the value of 1 if firm *i* lobbies in year *t* and 0 if it does not; $OGRes_{i,t}$ is the natural logarithm 1 plus proved oil and gas reserves[22]; $Asset_{i,t}$ is the natural logarithm of total assets of firm *i* at time *t*; $LobbyDummy_{i,t-1}$ is the binary variable from the year prior; and, $\epsilon_{i,t}$is the normally distributed error term. $LobbyDummy_{i,t-1}$ was added as previous research has identified that past lobbying is a good predictor of present lobbying (Kerr, Lincoln, and Mishra 2011).

Through the estimation of the first stage of this model the Inverse Mill Ratio is achieved. This is then added to the OLS regression of the second step via the following equation

(eq. 8) Heckman second step

$$logLobbyExp_{i,t} = \beta_1 \widehat{logCash}_{i,t-k} + \beta_2 logAssets_{i,t-k} + \beta_3 logO\&G\ res_{i,t-k} + \beta_4 logICE_t + \beta_1 \widehat{logCash}_{i,t-k} GI_i + \beta_6 logAssets_{i,t-k} GI_i + \beta_7 logO\&G\ res_{i,t-k} GI_i + IMR + \alpha_i + \epsilon_{i,t}$$

The parameters in *eq.8* are much the same as those specified in ep.6 except the IMR is added. The instrumented estimation $\beta_1 \widehat{logCash}_{i,t-k}$ from the first stage of 2SLS has also been added into this model. No package currently exists in the R programming language to incorporate both a Heckman two-step with an instrumented 2SLS. As such this parameter has been added by hand. The downside of this approach is that the possibility for human error increases.

[22] Also written as 1p or P90, proved reserves refer to the total oil, liquids and gas reserves held by the firm that have a 90% probability of extraction under current economic and technological conditions.

4. RESULTS & DISCUSSION

4.1 RESULTS

Table 4 shows the resulting elasticities from the 2SLS regression, with values displayed both at time *t* and at time *t-1*. With 99% significance the 12-month oil futures variable (ICE) has a sizable and positive relationship with lobbying expenditure. A 1% increase in the oil futures price results in between a 2.79% and a 3.99% relative increase in lobbying expenditure by firm *i*. This result is robust to all measurements of cash and to all inclusions and exclusions of the various control variables.

Interestingly, coefficients vary considerably between the different measures of cash flow. Operational cash flow is both positive and significant at the 99% level and 95% level when considering effects from the previous year. A 1% increase in CFO results in a 1.09% change in lobbying expenditure within the same year. In contrast, Free Cash Flow to the Firm is shown to have a sizeable and significantly negative relationship with lobbying at both timescales. A 1% increase in a FCFF results in a 2.93% decrease in lobbying expenditure for the same year and a 4.37% decrease when the values are lagged.

Looking down the first four columns we can also observe the results of the interaction effects between both variables and the classification of the firms (GI or NAI). For each of the two cash flow variables in both of the time lags the interaction produces significant countervailing effects.

For the $Cstock_{i,t}$ only observations of the variable in time *t* has been included in the results as the *t-1* measurement was insignificant. A slightly positive interaction can be observed; however, significance is capped at the 90% level. Interestingly cash stocks are also significantly sensitive to the interaction with the dummy variable GI. Whilst the relationship is slightly negative. Income Before Extraordinary Items (IBEI) has not been reported in the regression printout due to insignificance of results. This is in line with the results reported by Chen et al. (2015)

Table 5 shows the output from the instrumented two-stage Heckman regression. The significance from all values has completely disappeared from both time *t* and time *t-1* independent variables, including the previously robust ICE_t variable. Only the control variables $Asset_{I,t}$ and $Oc\&Gres_{i,t}$ remains significant, though this is to be expected. The is significantly different from zero, suggesting that selection bias is present within the model. With this the reduction in the number of observations is sizeable falling from 1142 down to 349.

Unreported in either of the summary tables is the potential for autocorrelation between the variables. A Breusch-Godfrey/Wooldridge test for serial correlation in the idiosyncratic errors was ran and the alternative hypothesis that the residuals are cross-sectionally dependant was accepted. However, Baltagi (2008, 259–89) claims that this is

only really a problem in panels with very large *T* - defined as panels spreading over more than 20 to 30 years. Since the time series in this data set extends 20 years (1998-2019) the biasing effect of the serial-correlation is deemed to be unproblematic.

Table 4: 2SLS regression results

IV on cash variables

	Dependent variable:				
	Lobby_log				
	(1)	(2)	(3)	(4)	(5)
CFO	1.096***				
	(0.317)				
CFO t-1		0.726**			
		(0.298)			
FCFF			-2.926**		
			(1.195)		
FCFF t-1				-4.369***	
				(1.084)	
Cstock					0.140*
					(0.080)
ICE	2.786***	3.950***	3.118***	3.777***	3.986***
	(0.535)	(0.483)	(0.495)	(0.479)	(0.489)
CFO:GI	-1.654***				
	(0.472)				
FCFF:GI			3.184**		
			(1.317)		
Cstock:GI		-1.389***			
		(0.469)			
FCFF:GI t-1				4.531***	
				(1.121)	
Cstock:GI t-1					-0.479***
					(0.151)
Observations	1,142	1,142	1,142	1,142	1,142
R^2	0.187	0.201	0.179	0.206	0.202
Adjusted R^2	0.122	0.137	0.113	0.143	0.137
F Statistic	243.133***	266.436***	230.419***	274.636***	266.671***
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 5: Two-step Heckman regresion output

Two-step Heckman with IV

	Dependent variable:			
	Lobby_log			
	(1)	(2)	(3)	(4)
cfo_hat	0.444			
	(0.518)			
FCFF_hat		-1.600		
		(3.638)		
Cstock_hat			0.385	
			(0.382)	
IBEI_hat				-7.514
				(15.943)
ICE_log	-0.063	-0.054	-0.051	-0.055
	(0.192)	(0.191)	(0.192)	(0.191)
Asset_log	0.513***	0.518***	0.526***	0.517***
	(0.081)	(0.080)	(0.081)	(0.080)
OG_res	0.0001***	0.0001***	0.0001***	0.0001***
	(0.00004)	(0.00004)	(0.00004)	(0.00004)
Constant	5.014	23.838	6.241***	84.383
	(3.439)	(35.758)	(1.546)	(161.841)
R^2	0.630	0.630	0.628	0.630
Adjusted R^2	0.621	0.621	0.619	0.621
rho	-0.497	-0.500	-0.497	-0.499
Inverse Mills Ratio	-0.559*** (0.106)	-0.563*** (0.106)	-0.561*** (0.106)	-0.562*** (0.106)
Note: 1142 observations (793 censored and 349 observed)				*p<0.1; **p<0.05; ***p<0.01

4.2 Discussion

The results of 2SLS show high significance for both cash flow variables and yet countervailing trends. FCFF closely resembles the measure used by Hill et al. (2013), yet they scale to total assets first whereas here total assets are controlled for directly in the model. The negative relationship found under 2SLS is in-line with their findings. A possible explanation for lower FCFF leading to lower lobbying expenditure could be that firms are anticipating a period of financial difficulty. In this sense lobbying could be as a relatively high-risk strategy given a decrease in available cash. However, reconciling this finding with the other two statistically significant and positive relationships *CFO* and *ICE* is slightly complex.

Starting with the later, in *'Table 2: Effect of IV on Independent Variables'* we can see that $OilPrice_{t-1}$ is positively correlated with FCFF, albeit explaining almost none of the of the variance. Since ICE_t is largely a function of oil price trends and ICE_t is positively and significantly correlated with lobbying expenditure one would imagine that FCFF would also be positively correlated with lobbying; however, this is not apparent the 2SLS model. In contrast the CFO variable does indicate a positive relationship in both estimations, however it is important to point out that these flows measure quite different things. CFO measure the total flow of operational cash accounting for depreciation, amortization and

changes in nonworking capital; whilst FCFF add CapEx, interest rates and tax rates to this equation. FCFF is, thus, a better indicator of the cash available to the firm; however, the inclusion of tax rates in its estimation makes it more prone to the endogeneity between past lobbying expenditure and current FCFF. The low adjusted r^2 for FCCF could indicate that the instrument $OilPrice_t$ does not adequately control for this reverse causality. To this, lobbying expenditure may also be picking up on a firm's political connectedness. An increase in lobbying expenditure in time *t* could result in an increase in political connectedness in time *t+1*, thereby reducing the need to hold cash in time *t+1* and even *t+2*. Evidence for this rationalisation comes from Hill et al. (2014). The authors estimate the relationship between political connectedness and find that the market is aware of the reduce value and increased agency cost of holding cash among politically connected firms. Under this reasoning the countervailing trends provide evidence for the presence of reverse causality and thereby the potential existence of a vicious cash-lobby-cash circle.

An explanation for the relationship between the oil futures variable ICE_t and $LobbyExp_{i,t}$ is perhaps less complex. A rise in oil prices over the coming year will lead firms to anticipate an increase in near-term cash. They may therefore choose to capitalise on this by lobbying for both favourable policy and increase in political connectedness. Dividends in either of these two will likely insulate themselves from potential shocks in the future.

Yet the robustness of these result do not hold under the two-step instrumented Heckman model. The removal of roughly two thirds of the sample under the first stage in combination with a limited number of observations per company may partially explain the significance of the result. All values are observed at the annual level thereby providing a maximum of 21 observations per-company, a 70% decrease is likely to increase the margin of error. Additionally, the combination of the two controls for bias may have resulted in an overfitting of the results. A final possibility is that there is no significant relationship between any of the independent variables and lobbying within the oil and gas sector, though this is neither in line with intuition nor previous empirical findings.

5. CONCLUSION

This paper has sought to better understand the some of the factors that may determine the lobbying behaviour of oil and gas companies. It began with a review of the various empirical and theorical literature within the fields of lobbying and finance, detailing some of the various stylistic facts as well as the more intricate disputes within the quasi-experimental literature. These included the different conceptions of lobbying as well as the theorised agency costs associated with cash rich firms.

For the empirical side of the paper, I attempted to unpin the complex reverse causality between lobbying expenditure and firms' financial performance. This was done through the utilisation of both a two-stage least square regression and a two-step instrumented Heckman model. Oil price in the previous year was used to instrument for this endogeneity under the logic that firm's current financial performance and lobbying behaviour have no impact on past oil prices.

Findings are mixed between models, variables in the Heckman model were found to be insignificant across all independent variable, which may be a function of sample size or overfitting. The two-stage least squares model produced more statistically interesting results. A 1% increase in Cash Flow from Operations (CFO) was found to result in a 1% increase in lobbying expenditure in the same year, whilst a 1% increase in Free Cash Flow to the Firm was found to result in a 2.9% decrease in lobbying expenditure in year 1 and a 4.4% decrease in year 2. The discrepancy between is theorised to be due a to the possibility that lobbying expenditure can serve as a proxy for political connections. So that firms who lobby in year t are better politically connected in $t+1$, better insulated from shocks and therefore have less of a need to hold onto cash. As well as evidence for reverse causality between the two metrics.

Additionally, a 1% increase in the 12 months oil futures price is found to be significantly associated with a 2.8-3.9% increase in lobbying expenditure depending on the model applied. The visibility of this metric makes it potentially useful for both researchers and third-sector groups hoping to anticipate future lobbying behaviour by oil and gas companies.

Unpinning the complex relationship between oil and gas lobbying and their financial performance of is clearly a significant challenge. This paper has provided statistically significance evidence of a relationship from financial performance to lobbying expenditure. Whilst the limitations of this study are numerous, this finding should serve as a warning of the potential capture of the regulatory environment surrounding fossil fuel companies. This is particularly pressing given the limited timeframe available to mitigate and adapt to the effects of climate degradation.

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