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Measuring the Asymmetric Effect of Luck on CEO Compensation in the Exploration and Production Industry

Colin F. Pinto
University of Pennsylvania, pcolin@wharton.upenn.edu

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Abstract

Studies have shown that there is asymmetry in how sensitive CEO compensation is to lucky factors (factors beyond management's control) depending on if they increase or decrease the company's market capitalization. This study surveys compensation asymmetry within the exploration and production industry due to its susceptibility to the lucky factor of commodity price. The study finds that compensation asymmetry in the E&P industry is more extreme than the broader market. In the broader market, previous studies have found that a CEO's compensation becomes less sensitive to luck in years of bad luck relative to years of good luck. The directional relationship remains the same. In the E&P industry, however, the directional relationship of this sensitivity reverses in bad luck years, and an E&P CEO's total compensation actually increases when market capitalization decreases due to luck. The driving factor of this enhanced asymmetry are likely abundant external job market opportunities.

Keywords

Compensation, energy, pay for luck, asymmetry, CEO

Disciplines

Accounting | Finance and Financial Management

MEASURING THE ASYMMETRIC EFFECT OF LUCK ON CEO COMPENSATION IN THE EXPLORATION AND PRODUCTION INDUSTRY

By

Colin Pinto

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JOSEPH WHARTON SCHOLARS

Faculty Advisor:

Erik Gilje

Assistant Professor of Finance

THE WHARTON SCHOOL, UNIVERSITY OF PENNSYLVANIA

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ABSTRACT

Studies have shown that there is asymmetry in how sensitive CEO compensation is to lucky factors (factors beyond management's control) depending on if they increase or decrease the company's market capitalization. This study surveys compensation asymmetry within the exploration and production industry due to its susceptibility to the lucky factor of commodity price. The study finds that compensation asymmetry in the E&P industry is more extreme than the broader market. In the broader market, previous studies have found that a CEO's compensation becomes less sensitive to luck in years of bad luck relative to years of good luck. The directional relationship remains the same. In the E&P industry, however, the directional relationship of this sensitivity reverses in bad luck years, and an E&P CEO's total compensation actually increases when market capitalization decreases due to luck. The driving factor of this enhanced asymmetry are likely abundant external job market opportunities.

Keywords: Compensation, energy, pay for luck, asymmetry, CEO

Discipline: Business, Finance

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1. INTRODUCTION

Executive compensation is a frequently covered topic by the media. Stories of CEOs taking home millions of dollars, often times when their company is performing poorly, never fail to garner attention and create outcry amongst investors and the broader population. In recent years, the disproportionate face of many of these stories has been CEOs within the exploration and production industry. The driving factor behind this phenomenon is likely the drastic success of fracking that led to a domestic boom in oil and gas production. With this radical success, however, came outsized compensation. Naturally, the industry leaders who spearheaded this effort should be, and have been compensated well for their success. However, the exorbitance of some of these compensation packages has come under criticism by the media as being pointedly unjust.

Perhaps a more interesting point is that there seemed to be a number of notable cases of exorbitant compensation even following the natural gas price collapse in 2008 and the oil price collapse of 2014, when many E&P companies were performing poorly. In 2008, Aubrey McClendon, CEO of natural gas producer Chesapeake Energy, took home a paycheck of over $100 million dollars despite extremely poor stock price performance (Healy et al. 2012). This was an unprecedented level of compensation regardless of industry, and to make matters worse, it was at a time when shareholders were losing money and Chesapeake’s employees were being laid off. Similarly, Tom Ward of SandRidge Energy received growing $20m+ paychecks every year despite his company’s stock tumbling 80% since its initial public offering (Wilmoth 2017). The overwhelming justification for these exorbitant salaries the board gives is that poor stock performance is due to volatile commodity prices, which are beyond a managers control. However, there seems to be little mention of this factor when commodity prices are booming and the majority of the industry's executives are reaping the rewards. This seems to suggest the phenomenon of asymmetry in how compensation varies with commodity price. It appears as if an E&P CEO's compensation benefits from commodity price increases, but is relatively insulated from decreases.

While the severity of the cases of Aubrey McClendon and Tom Ward's compensation certainly aren't representative of all E&P companies, a couple of quick calculations seem to suggest that the same asymmetry problem may exist throughout the industry. From a period of 2007-2014 when oil prices were booming, the XOP, an ETF that tracks E&P firms increased ~90% while median sector CEO compensation increased ~63%. However, after oil prices collapsed the XOP fell ~56% from 2014-2016, while median CEO salaries only fell ~12%. This is a rough method of illustrating the phenomenon, but it suggests that the same compensation dilemma may exist across the entire E&P industry. Because commodity price is such an integral part of an E&P company's value it seems as if it has become an easily manipulatable method of asymmetrically compensating CEOs even when the factor is beyond their control. This research paper will outline a detailed study of whether this asymmetry phenomenon actually exists within the industry and if it does, what factors are driving it.

2. EXECUTIVE COMPENSATION THEORY

2.1 The Function of the Compensation Contract

Before exploring how commodity price may asymmetrically benefit E&P CEOs, it is important to cycle back and understand the broader theories of executive compensation design. The need for a properly designed executive compensation policy stems from principal-agent conflicts. A manager is naturally incentivized to maximize his personal wealth with the lowest effort expenditure, while the shareholder's goal is to maximize the value of the company to generate returns on their equity. Because the manager runs the day to day operations of the firm and the shareholder cannot easily observe his or her actions, the best way to ensure the shareholder's goals are met is to align the manager's decision-making incentives with those of shareholders. The compensation contract is the tool that creates the bridge between these incentives.

While this may seem like a simple concept in theory, this goal of perfect incentive alignment through contract design is almost impossible to achieve in the real world due to significant intervening factors. The two predominant factors are the influence of the talent market for executives and poor corporate governance that prevents compensation committees from operating at arms-length from managers. In addition, even if an ideal compensation scheme has been reached it is not possible to know when or what it is composed of. This is because of the endogeneity present in attempting to measure how compensation specifically affects firm performance and the opaqueness from the public shareholder's perspective as to what factors go into determining compensation because a large portion is undisclosed or discretionary in nature. Two theories have emerged from previous literature that attempt to explain how compensation design might function in the real world.

2.2 Shareholder Value Maximization Theory

The first and most predominant theory in the literature is "shareholder value maximization," which argues that compensation contracts are simply the outcome of an efficient talent market. They are designed to maximize value for shareholders under the constraint that firms must compete in the labor market for executives. This talent market competition aspect implies that firms must offer executives pay and incentives beyond that which is aligned with shareholders (i.e equity or options). This includes a fixed base salary, severance packages, and other personal perks. The theory assumes that the board constructs the CEO's compensation contract to the point at which the CEO has no better external opportunity and the firm cannot find a better executive with a greater value proposition for shareholders (Edmans et al. 2017).

2.3 Rent Extraction Theory

Shareholder value maximization makes major assumptions that may not be reflective of reality, namely that compensation committee members design the policies at "arm's length," meaning they are not influenced by relationships with managers themselves (Bebchuk et al. 2005). Common intuition tells us that this is unlikely to be true, which leads us to the second major theory, the "rent extraction view." The rent extraction view argues that managers have significant influence over a company's compensation committee through personal relationships and are able to effectively set their compensation contracts themselves. The level of compensation is subsequently determined as the maximum amount of pay they can extract without drawing intervention from shareholders (Edmans et al. 2017).

3. PAY FOR LUCK LITERATURE REVIEW

3.1 Defining Pay for Performance vs Pay For Luck

According to the value maximization theory, compensation is only optimal if it rewards CEOs for making decisions that increase value for shareholders, or if it is necessary to retain the services of the CEO and prevent departure to another firm. The first of these two factors can be deemed "pay for performance." The CEO is compensated for exerting effort in making a decision or creating a strategy that directly benefits shareholders. Thus, the optimal contract should vary compensation on any observable measure that is informative of a CEO's effort in increasing firm value (Holstrom 1979). "Pay for Luck" then is compensation that is the result of a change in firm value from factors that are beyond a CEO's effort. It is important to note that these factors must be readily observable and measurable, such as commodity price or exchange rates, not random variation from unknown effects. In optimal contract theory, these observable luck measures should be included in a contract for the purpose of obtaining a more accurate measure of what portion of firm success is due to a CEO's effort. Observable measures of luck should be essentially used to back out the firm's success due to a manager's performance. This implies that compensation should not have any correlation with the luck measure. The phenomenon of Pay for Luck in the real world, however, is that manager's compensation does in fact significantly vary with observable luck measures.

3.2 Evidence of Pay for Luck

The literature has exhibited evidence that Pay for Luck exists in a variety of different settings. In a seminal study, Bertrand and Mullainathan found that CEO compensation had a significant relationship with observable luck measures in three different contexts, the oil and gas industry, the trading goods sector, and through relative performance evaluation. It was found that the compensation varies just as much with "the general dollar as the lucky dollar." This means that the authors found little to no evidence of the filtering effect discussed in the preceding paragraph that an observable measure of luck would be used for in an optimal contract (Bertrand and Mullainathan 2001). In addition, Gopalan, Milbourne, and Song demonstrated that CEO pay has a significant relationship with a firm's sector performance, while according to optimal contract theory there should be no correlation (2010). Thus, it is clearly established that managers are compensated on luck measures in the real world.

3.3 Evidence of Asymmetry in Pay for Luck

Symmetric Pay for Luck does not benefit a risk averse manager. In fact, a risk averse manager would prefer to have compensation vary purely on performance, than to have it vary symmetrically with a luck measure. This is because their firm related wealth can vary up or down in equal increments based on how the luck measure performs. The concept of risk aversion states that a loss in wealth hurts more than an equivalent gain. Because of this, a manager would prefer to have no exposure at all than exposure to the risk of luck with an expected net effect on wealth of zero (symmetric). Thus, managers only benefit from pay for luck when it is asymmetric in nature. This means that their wealth increases with an increase in a luck measure more than it decreases with an equivalent decrease in luck.

Evidence of asymmetry in pay for luck is a more contested issue, however existing literature skews in favor of the idea that it exists. The leading work on the subject is from Garvey and Milbourn, who found that there is significant asymmetry in the effect of pay for luck on annual total compensation. By analyzing how total compensation correlates to market risk in various time frames, they found that managers generally lose 25-45% less pay from bad luck, than they benefit through good luck (Garvey and Milbourne 2006). Daniel, Li, and Naveen, however, offer two criticisms of this conclusion that they argue diminishes the significance of Garvey and Milbourne's findings. First, they argue that annual compensation is not the right dependent variable to properly measure pay for luck as it only encompasses a small portion of an executive's total compensation. Instead, they argue that the change in the executive's firm related wealth should be used to proxy "total effective compensation." Multiple different executive compensation scholars have supported this concept as discussed earlier (Edmans et al. 2017). In measuring the change in firm specific wealth the authors found no significant asymmetry (Daniel et al. 2013). A second study criticized Garvey and Milbourne's lack of control for firm size. They found no significant asymmetry in pay for luck after excluding the top

0.4% of firms by market cap (Daniel et al. 2016). Thus, it is not abundantly clear that pay for luck asymmetry is a pervasive factor across all firms.

3.4 Theories of Why Pay for Luck Exists

Rent Skimming Rationale for Pay for Luck

Bertrand and Mullainathan justified the existence of pay for luck through the rent skimming theory. They argued that managers have control over their board, and as a result can influence their contracts to include compensation based on a luck measure. As a result, in times of good performance when shareholders are less likely to scrutinize management compensation, managers can extract more rents by taking pay for luck compensation that would likely go unnoticed. They empirically support this claim by showing that executives of firms with low corporate governance had significantly more pay for luck than firms with stringent governance. Garvey and Milbourne concur with Bertrand and Mullainathan claiming that the asymmetry in pay for luck they exhibited was more prominent in firms with lower corporate governance measures.

Shareholder Value Maximization Rationale 1: CEO Retention

Another potential explanation utilizing the shareholder value maximization theory, is that pay for luck is a necessary factor in determining the efficient compensation level in the CEO talent market. Cremers and Grinstein tested how pay for luck varies based on the market for talent within different industries. They found that homogenous industries have significantly greater pay for luck than heterogeneous industries. Homogenous industries are ones in which businesses have little differentiation such as in oil and gas, while heterogeneous are more specialized. Their proposed rationale was that executives in homogenous industries have more external opportunities because their skillset applies to a greater number of companies. Thus, the optimal compensation level necessary in order to retain an executive increases and decreases with market performance because the number of external opportunities an executive can pursue varies with market performance as well (Cremers and Grinstein 2013). This implies pay for luck is necessary in order to maximize shareholder value as compensation increases when external opportunities are high, and decreases when they are scarce. Another study that analyzed how peer benchmarking affected executive pay contends that the asymmetry in pay for luck is not explained by rent skimming, but rather the effect of benchmarking. The authors found no significant asymmetry for firms that paid executives above peers, and attributed all of the asymmetry Garvey and Milbourne found to firms in which executives were paid below peers. The authors argue that this asymmetry in pay for luck reflects the use of competitive benchmarking to proxy the reservation wage of a CEO (Bizjak et al. 2008). Firms that already pay their executives below peers cannot afford to pay less in a market downturn due to the enhanced risk of the executive leaving for an external opportunity, which creates this asymmetry.

Shareholder Value Maximization Rationale 2: Strategy Adjustment for Industry Trends

A second shareholder maximization rationale is that pay for luck is a necessary component of compensation as it incentivizes the manager to put effort into anticipating and appropriately responding to changes in market conditions. Gopalan, Milbourne, and Song found that there was significantly more pay for luck in firms with multiple segments and firms that had more flexibility to alter segment exposure. In these firms, pay for luck serves as an incentive for the executives to invest in costly industry information and to consequently shift firm exposure to sectors with more promising outlooks in order to benefit the firm in the case of industry shocks. Thus, in some industries, pay for luck is actually an optimal contract feature in order to maximize shareholder value (Gopalan et al. 2010). Bertrand and Mullainathan respond to this rationale with their own criticism. They agree that executives with exceptional industry forecasting ability should be rewarded for such foresight, however, they tested pay for luck amongst the average firm and still found a significant relationship. Utilizing this rationale would imply that executives with just average industry forecasting ability are being compensated, which they argue is likely not rational.

4. E&P INDUSTRY SIGNIFICANCE IN ANALYZING PAY FOR LUCK

4.1 Enhanced Exposure to Luck

The exploration and production industry produces almost a pure commodity product with very little differentiation between firms. Because of this the value of E&P firms fluctuate significantly with oil and gas prices. This provides us with a clearly observable, and extremely significant measure of luck relative to other industries. Because of this enhanced industry effect, evidence of pay for luck can be more easily distinguished in the E&P industry than in studies that cover the entire market, which is what almost the entirety of previous literature entails. Given the current debate about whether or not asymmetry in pay for luck actually exists, a focused study of an industry in which pay for luck has an extremely significant effect could offer some clarity. Additionally, it could be the case that performing these studies on the overall market obscures some significance. It seems unlikely that industries respond in the same manner to pay for luck, yet this seems to be an overarching assumption of much of the previous literature.

4.2 Lack of Previous Academic Research

Commodity price is one of the single most important factors in the E&P industry. Yet, academic executive compensation research covering this topic is limited to a two-page case study within Bertrand and Mullainathan’s paper on pay for luck. The study analyzed the top 50 oil and gas firms from 1977-1994, and was quick and dirty in nature. By looking at the 50 largest oil and gas companies they are almost certainly looking at diversified oil and gas conglomerates in which the relationship to commodity price is far more indirect than E&P firms. Thus, the significance of their findings is likely obscured. Finally, the data is significantly outdated and more than twenty years old. Since then, there has been significant economic developments in the industry that have caused dramatic swings in commodity price as well as developments in the structure of compensation policies. This provides an interesting new environment to test pay for luck.

4.3 Major Economic Events in Recent Time Frame

These economic developments are largely due to the industry revolution of hydraulic fracturing. Technological advancement in the process of hydraulic fracturing, or “fracking” led to a domestic boom in the production of oil and gas as producers were able to pump from previously inaccessible reserves (Zuckerman 2013). This was a major economic change that quite literally shifted the United States’ dependence on imports for energy. The onset of fracking and the subsequent market effects that followed for both oil and gas caused significant price movements. First, for natural gas, oversupply by domestic producers without the proper infrastructure to deliver it to high demand locations caused natural gas prices to collapse in 2008. Second, for oil, in response to the rapid uptick in supply of oil from the United States, OPEC drastically increased their own production, which caused oil prices to plummet. This sent the domestic E&P industry into distress as producers struggled to breakeven on production costs. These significant fluctuations in price paired with the significant changes in compensation that followed makes this recent time period an ideal environment to test pay for luck.

4.4 Overview of Current E&P Compensation Trends

Alvarez & Marsal conducted a survey of the compensation policies of the top 100 largest exploration and production firms for the year ending 2016. The survey provides helpful insight into how compensation for E&P firms may differ in structure compared to the broader market. Firms were separated into different categories by size. There were a couple notable trends that are helpful to identify in the context of pay for luck.

Roughly 80% of CEO compensation was incentive based pay (bonus + LTIC). This suggests high potential exposure to pay for luck as a large portion of salary comes from performance factors which can be influenced by observable luck measures (i.e Total Stock Return). Additionally, discretion in compensation of annual bonuses was extremely prevalent in the smallest half of E&P companies. For the bottom quartile, 68% of companies determined annual bonuses through a purely discretionary basis. Discretion in compensation setting seems to hint at less stringent corporate governance. Of the larger firms that use formulaic performance metrics for annual bonuses, 79% incorporated production growth, 55% incorporated reserve growth, and 55% included a measure of safety. Notably, since the 2014 oil price crash the proportion of firms using production and reserve growth as a performance metric has shrunk nearly 10% and has largely been replaced by the use of cost based metrics (G&A expense, LOE expense). This suggests a change in strategy in response to new market conditions; however veiled underneath this change could be a decrease in pay for luck during bad market times.

Long term incentives are structured primarily with a mix of time vesting RSUs and performance vesting awards. The primary metric for the performance vesting awards is relative total stock return with 92% of firms using it in 2017. Interestingly this is a ~15% increase in the number of firms using it since 2014, when oil prices collapsed. This is the most significant evidence that seems to suggest asymmetric pay for luck as firms are shifting towards a relative bench mark to cancel out the effects of market exposure when commodity prices have bottomed out. The fact that these 15% of firms did not use relative TSR when oil prices were booming may suggest that the executives at these firms were able to skim off some benefit from luck under the guise of performance during this time period. This factor will certainly be explored more.

5. RESEARCH QUESTIONS AND HYPOTHESES

This study will quantitatively determine if CEOs in the E&P industry are asymmetrically compensated for Luck. If a relationship is found, then further analysis will be undertaken to determine the driving factor behind this asymmetry.

Research Questions:

- Are exploration and production CEOs asymmetrically compensated based on firm performance that is attributable to sector returns?
- If there is asymmetry in compensation due to Luck, what factors are driving it?

Hypotheses:

- Hypothesis 1: Market capitalization changes due to sector returns (referred to as Luck) have a significant relationship with E&P CEO's compensation.
- Hypothesis 2: E&P CEO's annual compensation will be found to be asymmetrically more sensitive to Luck in years of good luck than bad luck.
- Hypothesis 3: The asymmetry in compensation due to Luck can be explained by either poor corporate governance or the availability of external job opportunities.

6. DATA AND RESEARCH METHODOLOGY

6.1 Data Overview

The data for this study will come from two primary sources. ExecuComp and the firm's proxy statements will provide the necessary compensation data. CRSP will provide stock price data to calculate total stock return.

ExecuComp

ExecuComp is a compensation dataset that collects data from firm's proxy statements. Proxy statements contain overviews of compensation plan structure, performance benchmarks, and executive employment contracts. ExecuComp breaks down compensation into multiple different factors including salary, bonus, options, stock awards, and details on performance plans. It also provides qualitative information about the executive at hand including age, tenure, position, and the company they work for.

The data collected is from companies in the S&P 1500 and spans back to 1992. The date range provides a long enough timeline to examine how compensation varies in multiple cyclical troughs and upturns in both natural gas and oil price. ExecuComp, however, only covers companies in the S&P 1500. Because of this it only provides data for 82 of the largest E&P companies.

CRSP

CRSP is the most accurate source of stock return information. It will be used to calculate total stock return for each firm. The data is thoroughly vetted and should be available for any E&P company necessary to analyze.

6.2 Regression Model Framework

The statistical methodology that will be employed to test pay for luck's effect on compensation will follow that introduced by Bertrand and Mullainathan and consequently followed by much of the subsequent literature. This methodology will be catered specifically to the E&P industry. The model follows a two-stage procedure.

First Stage: Predicting Firm Performance with Luck

Independent Variables: Measure of observable luck – SIC 1311 sector returns

Dependent Variables: Measure of performance – Total Stock Return

This stage of the model attempts to measure the sensitivity of firm performance with an observable measure of luck. In this case, the performance measure chosen is total stock return as it is commonly used in the industry for long term incentive plans. The independent variable is industry returns according to the E&P SIC code 1311. While commodity price may have been a more ideal measure of luck, the preceding literature uses industry returns as their observable luck measure. A necessary step in this analysis will be to benchmark the results to previous papers to compare how the E&P industry is different than the broader market, so it is necessary to use sector returns. Additionally, sector returns incorporate most of the changes in commodity prices. The output of this stage of the model is the predicted amount of firm performance that is created by sector returns. The residual amount of stock return is the predicted amount of firm performance that is created by manager skill.

Transformation before Second Stage:

The predicted amount of annual return that can be attributable to sector returns is multiplied by market capitalization to get the change in market capitalization due to sector returns. *Note that this term is simply called Luck from this point forth*. This will be inputted into the next stage of the regression as one of the independent variables.

Second Stage: Predicting Compensation with Performance created by Luck

Independent Variables: Luck

Dependent Variables: Measure of CEO compensation

This stage of the model predicts how executive compensation varies with Luck. The primary independent variable is Luck as discussed earlier. The dependent variable is CEO compensation. Total compensation, salary, annual cash bonus, stock awards, and option awards will all be tested separately to see if the effect of pay for luck is stronger in any one category.

Overview of Controls

No controls are necessary in the first stage of the regression as sector returns (the measure of luck) is all the study is concerned with. Additional controls would give a more accurate measure of the amount of return attributable to skill (measured by the residual of the model / everything that can't be explained by the observable luck measure), which will not be addressed in this study. The two primary controls in the second stage of the regression are CEO tenure and market capitalization. These have been demonstrated to be the most predictive variables of compensation. CEO tenure is in the second stage of the model explicitly as compensation tends to increase the longer a CEO is at a company. Market capitalization is controlled in the model implicitly. The predicted amount of annual return attributable to sector returns is multiplied by the market capitalization of the respective company to find the change in market capitalization attributable to general sector returns. This measure is defined as Luck. This Luck variable is then inputted into the second stage of the regression, and does not explicitly need to be controlled for again. Market capitalization has been shown in multiple studies to be a very significant predictor of compensation as CEOs of larger companies tend to be paid more.

Testing Asymmetry in Pay for Luck

In order to test if there is asymmetry in pay for luck three methodologies will be used: Naveen et al's relative industry performance regression, an adjusted version of this regression using an additional "no luck" categorization, and another adjusted version using categorization based on an absolute price distribution rather than returns.

Two Level Categorization of Bad and Good Luck

The majority of the preceding literature use SIC code industry returns as the proxy for luck. The first regression methodology used in this paper will follow the process outlined in Naveen et al. (Naveen et al. 2013). The following process is described in the context of the second stage of the model, predicting change in compensation from Luck. To measure asymmetry, a dummy variable for years of bad luck will be used. The dummy variable equals 1 for years in which industry returns are negative, and 0 when industry returns are positive. An interaction variable between performance attributable to Luck and bad luck is used to measure the partial effect on the sensitivity of compensation that a negative industry return year has relative to a positive industry return year. There is significant asymmetry in pay for luck compensation when the coefficient of this indicator variable is significantly negative. Two issues with the categorization employed in this methodology will be potentially resolved with alternate designs in the following sections.

7. SUMMARY STATISTICS

7.1 Full Sample Summary Statistics

Table A depicts the summary statistics for all the independent and dependent variables.

Table A: Full Sample Summary Statistics

	Obs	Min	1st Quartile	Median	3rd Quartile	Max	Mean	SD
Panel A: Original Sample								
Total Compensation ($000)	659	$0	$1,938	$4,215	$9,003	$112,464	$7,066	$9,376
Base Salary ($000)	659	0	432	649	971	1,750	724	388
Cash Bonus ($000)	659	0	0	161	848	76,951	876	3,836
Stock Awards ($000)	659	0	6	1,642	3,875	61,078	3,189	5,256
Option Grants ($000)	659	0	0	393	1,665	62,681	1,584	3,967
Annual Return	659	-95%	-21%	11%	42%	516%	18%	63%
Sector Return	659	-33%	-10%	19%	26%	33%	10%	20%
Luck ($000)	659	-$77,991	-$138	$290	$1,827	$63,028	$1,156	$6,990
Market Capitalization ($000)	659	12,080	878,967	2,538,686	10,631,645	141,240,883	9,382,883	16,532,187
CEO Tenure (Years)	659	0	2	6	11	38	8	7
Panel B: Winsorized Subsample								
Total Compensation ($000)	533	$273	$1,968	$3,917	$7,139	$24,263	$5,266	$4,270
Base Salary ($000)	533	0	432	625	912	1,750	691	362
Cash Bonus ($000)	533	0	0	159	725	2,900	466	667
Stock Awards ($000)	533	0	76	1,602	3,459	12,075	2,363	2,726
Option Grants ($000)	533	0	0	393	1,367	7,642	929	1,350
Annual Return	533	-74%	-20%	9%	40%	171%	13%	45%
Sector Return	533	-33%	-10%	19%	26%	33%	10%	19%
Luck ($000)	533	-$9,403	-$114	$318	$1,452	$16,256	$954	$3,147
Market Capitalization ($000)	533	38,938	921,453	2,382,200	8,436,971	96,752,340	6,646,700	10,335,553
CEO Tenure (Years)	533	0	2	6	11	38	8	7

The top and bottom 2.5% of observations for annual returns, total compensation, and Luck have been winsorized due to significant outliers. As a result, the data started with 659 observations and was cleaned down to 533.

7.2 Good and Bad Luck Subsamples

Table B: Bad vs Good Luck Subsample Summary Statistics

	Obs	Min	1st Quartile	Median	3rd Quartile	Max	Mean	SD
Panel A: Good Luck								
Total Compensation ($000)	379	$308	$1,966	$4,039	$7,127	$24,263	$5,346	$4,391
Base Salary ($000)	379	0	440	615	940	1,750	697	362
Cash Bonus ($000)	379	0	0	187	825	2,900	522	718
Stock Awards ($000)	379	0	265	1,641	3,286	12,075	2,332	2,641
Option Grants ($000)	379	0	0	410	1,345	7,641	954	1,407
Annual Return	379	-68%	2%	23%	51%	171%	28%	41%
Sector Return	379	2%	13%	25%	27%	33%	21%	10%
Luck ($000)	379	$1	$265	$782	$2,429	$16,256	$2,001	$2,857
Market Capitalization ($000)	379	38,398	100,086	2,722,890	9,395,723	96,752,340	7,376,757	11,186,796
CEO Tenure (Years)	379	0	3	6	11	37	8	7
Panel B: Bad Luck								
Total Compensation ($000)	154	$273	$2,035	$3,670	$7,159	$20,680	$5,065	$3,959
Base Salary ($000)	154	21	409	641	875	1,750	674	327
Cash Bonus ($000)	154	0	0	54	456	2,500	326	493
Stock Awards ($000)	154	0	0	1,461	3,698	12,059	2,439	2,931
Option Grants ($000)	154	0	0	261	1,434	6,306	866	1,200
Annual Return	154	-74%	-47%	-28%	-7%	53%	-25%	28%
Sector Return	154	-33%	-19%	-16%	-12%	-2%	-16%	8%
Luck ($000)	154	-$9,404	-$2,206	-$573	-$182	-$16	-$1,621	$2,210
Market Capitalization ($000)	154	62,410	690,732	1,645,999	5,503,473	50,455,189	4,850,000	7,595,351
CEO Tenure (Years)	154	0	2	5.5	11	38	7.3	7.2

Table B provides the summary statistics for the two level categorization bad luck (when sector returns are negative) and good luck (sector returns are positive) subsamples. Notably, the means of each compensation variable are not significantly different between the two subsamples.

8. RESULTS

8.1 Using Previous Studies' Categorization Methodologies (Two-Level)

As discussed earlier, the key issue with detecting asymmetry in compensation due to luck, is how bad or good luck is defined. The primary regression in this study is run defining good luck as when sector returns are positive, and bad luck as when sector returns are negative. This is the methodology predominately used in the previous literature (Garvey & Milbourne and Naveen et al.). Utilizing this comparable categorization helps benchmark the results of the regression with previous results for sanity checking purposes.

Table C: Two Level Categorization Regression Coefficients

	Dependent Variable				
	Total Comp.	Salary	Cash Bonus	Stock Awards	Option Awards
Good Luck	0.89***	0.08***	0.05***	0.32***	0.23***
Good Luck x Bad Luck	-2.07***	-0.16***	-0.06**	-1.02***	-0.34***
CEO Tenure	-7.51	4.71***	9.22***	-14.12	7.1
R^2	0.36	0.34	0.07	0.17	0.18
Observations	533	533	533	533	533

Coefficient on intercept and intercept effect of bad luck category suppressed for convenience

The first primary result of the regression is that each piece of compensation varies significantly with Luck, or market cap sensitivity due to factors beyond an executive's control. This is noted by the significant coefficient on the good luck measure (the baseline category). The second primary result is that there is significant asymmetry in compensation's sensitivity to Luck between good and bad luck years for all pieces of compensation. *Interpreting the economic relationship for total compensation is as follows: in good luck years (years with positive sector returns), an E&P CEO's total compensation increases 89 cents for every $1000 increase in market capitalization due to sector returns. Conversely, in bad luck years (years with negative sector returns) an E&P CEO's total compensation actually increases by $1.19 (.89-2.073) for every $1000 decrease in market capitalization due to sector returns*. Comparing these results to what previous papers have found is a useful way to determine how the E&P industry might be different from the broader market context.

Figure 1: Previous Paper's Regression Results (Naveen et al. 2009)

Tests of Asymmetry in Pay for Luck

The table reports results from OLS regressions of change in pay, level of pay, and change in the firm-related wealth. Compensation variables are defined in Table I. We estimate a regression of annual stock returns on the value-weighted and equal-weighted industry (2-digit SIC) returns. We (i) do not include the firm's returns in the industry returns, (ii) do not include an intercept term, and (iii) eliminate all firms that do not have a December fiscal-year end to ensure that the performance measures for all firms are over the same time period and hence comparable. *Luck* is the predicted value multiplied by the lagged market capitalization of the firm and *Skill* is the residual value multiplied by the lagged market capitalization of the firm. *Bad Luck* is an indicator variable that equals 1 when *Luck* ≤ 0, and equals 0 otherwise. *Bad Skill* is an indicator variable that equals 1 when *Skill* ≤ 0, and equals 0 otherwise. *cdf Variance of Luck* and *cdf Variance of Skill* are estimated using rolling 5 year windows. "GM" refers to Garvey and Milbourn (2006) and "GMS" refers to Gopalan, Milbourn, and Song (2010). Intercept, year, and executive fixed effects are included in the model. t-statistics are based on robust standard errors. ***, **, and * represent significance at the 1%, 5%, and 10% levels.

	Dependent Variable		
	Change in Pay: GM (1)	Level of Pay: GMS (2)	Change in firm-related wealth (3)
Luck	1.35** (2.5)	2.02*** (4.3)	72.77*** (10.0)
Skill	2.03*** (6.5)	1.37*** (5.7)	85.23*** (15.2)
Luck × Bad Luck	**-0.19**** **(-2.5)**	**-0.28***** **(-2.6)**	**-0.002** **(-0.0)**
Skill × Bad Skill	0.01 (0.2)	-0.18*** (-3.7)	-0.80 (-1.6)
Luck × cdf Variance of Luck	-1.30** (-2.4)	-1.96*** (-4.1)	-71.12*** (-9.7)
Skill × cdf Variance of Skill	-2.01*** (-6.4)	-1.25*** (-5.2)	-83.02*** (-14.7)
cdf Variance of Luck	-400.26 (-1.0)	2,172.63*** (4.3)	6,268.00 (1.1)
cdf Variance of Skill	-93.70 (-0.3)	1,073.09*** (2.6)	1,840.79 (0.3)
CEO Tenure	-0.78 (-0.0)	283.66*** (2.6)	3,031.11 (1.5)
Observations	10,824	11,002	9,620
R^2	0.02	0.13	0.29

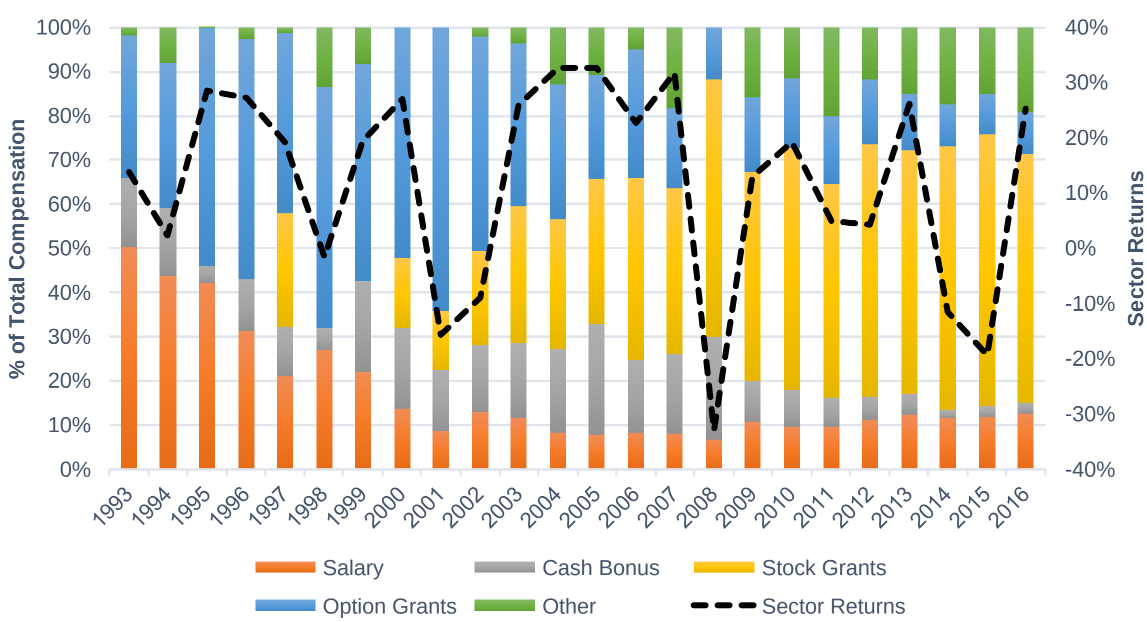
The first model that was run in this study is similar to the one run by Gopalan, Milbourne, and Song (2010) which analyzed asymmetry in the absolute level of total compensation. The economic relationship they discovered was that "when Luck is up (increase in market cap of $1000), the pay for the CEO of a median-risk firm increases by $1.04 (=2.02–

0.5×1.96), but when Luck is down (decrease in market cap of $1000), it decreases only by 76 cents (=1.04 - .28) (Naveen et al. 2009). The Luck coefficient in good luck years for the E&P firms is similar to that in GMS (.89 vs 1.04 respectively). The major diversion is how sensitivity changes in bad luck years for E&P firms. GMS found that across the market (data including all industries), during a bad luck year, sensitivity to Luck decreased relative to good luck years, however the directional relationship with Luck was still positive: when Luck decreased, compensation decreased (in GMS, the coefficient is still positive in bad luck years). However, in this study's E&P data, total compensation's sensitivity to Luck completely reverses direction in bad luck years (the coefficient becomes negative). Rather than simply becoming less sensitive to Luck, compensation actually increases when bad luck lowers market capitalization. Moreover, this bad luck coefficient is quite large as well. An E&P CEO's compensation actually increases more for a $1000 decrease in market cap due to sector returns, than it does for a $1000 increase in market cap due to sector returns ($1.19 vs $0.89).

8.2 Sensitivities based on Type of Compensation

It has been shown to this point that there is significant asymmetry in total compensation due to the observable measure of luck, sector returns. What this implies is that compensation committees are consciously crafting CEO's compensation contracts to vary based on sector returns, or something highly correlated with sector returns. Thus, it is important to determine what part of total compensation (salary, cash bonus, stock awards, option awards) is being manipulated the most to create this asymmetric relationship. Referencing Table B, the order of sensitivity in good luck years for the parts of compensation rank from high to low as follows: stock awards (.322), option awards (.227), salary (.071), and cash bonus (.0519). The order of sensitivity in bad luck years from high to low is as follows: stock awards (-.70 = .322 – 1.018), option awards (-.11 = .227 - .336), salary (-.08 = .071 - .155), and cash bonus (-.01 = .0519 - .0598). The key takeaways from these results is that stock and option awards are the most sensitive to Luck in good luck years, while stock awards are by far the most inversely sensitive part of compensation in bad luck years (-.70 vs next highest value option awards at -.11). Before concluding that stock awards are what is being manipulated to drive inverse sensitivity, it is necessary to consider other factors that may be affecting these coefficients. The magnitudes of these sensitivity coefficients are affected by two key factors: The portion of total compensation they make up, as well as the extent to which they are being manipulated by compensation committees depending on whether or not a year is good luck or bad luck, which is the key factor of interest for this study. In order to gauge compensation manipulation properly, the portion of the total compensation make up must first be taken into account. The structure of total compensation has changed significantly between 1992 and 2016. The primary change related to this study is the shift from option based compensation to stock based compensation after the early 2000s. This structural shift is evident in Figure 1.

Figure 2: Mean Compensation Structure vs Sector Returns



Because of this structural shift in compensation makeup from options to stock awards, determining sensitivity based on the entire range of data from 1992 to 2016 does not paint a clear picture when analyzing asymmetry for specific types of compensation (whereas it does for total compensation). To take this into account the same regression was run over two subsets of data split by time. The first subset is for firm years from 1992 to 2004. The second subset is from 2005 to 2016. The distinction was made because 2005 was the first year in which stock awards became a larger portion of total compensation than option awards.

Table D: Fiscal Year Subset Regression Coefficients

	1992-2004			2005-2016		
	Total Comp.	Stock Awards	Option Awards	Total Comp.	Stock Awards	Option Awards
Good Luck	0.65***	0.13*	0.14**	0.90***	0.34***	0.24***
Good Luck x Bad Luck	-2.72***	-0.32	-0.66***	-1.91***	-0.87***	-0.41***
CEO Tenure	-54.85**	-23.65*	-11.41	44.09	10.05	17.47*
R^2	0.27	0.06	0.08	0.38	0.18	0.31
Observations	157	157	157	376	376	376

Coefficient on intercept and intercept effect of bad luck category suppressed for convenience

The results of these subset regressions reveal that between 1992-2004 options awards were the most sensitive part of compensation from Luck in both good and bad luck years. In good luck years, both stock awards and option awards had similar sensitivities. In bad luck years, option rewards revealed significantly more inverse asymmetry than stock awards, which lost significance in the model. The trend reversed in the 2005-2016 regression subset. Stock awards became more sensitive in good luck years than option awards (.34 vs .24), and more inversely sensitive in bad luck years (-.87 vs -.41). It should be further noted that total compensation was significantly inversely asymmetrical in both timeframe subsets. Thus, this concept of inverse compensation asymmetry that seems unique to the E&P industry has been present throughout the 1992-2016 timeframe. It did not start happening at some point within. However, due to secular shifts in how compensation is structured, the particular piece of compensation that committees manipulate to create this asymmetry did change through time. Between 1992 to somewhere between 2004-2006, asymmetry was primarily created through option awards. Beyond 2004-2006, asymmetry was primarily created through stock awards.

8.3 Sanity Checking Results

Visually Analyzing Trends in Compensation

The results show that within the E&P industry compensation's sensitivity to Luck becomes a significantly inverse relationship in bad luck years. This is a novel finding that has not been found in past studies (the relationship was still positive in bad luck years, just less sensitive). Because of this, sanity checking through data visualization is helpful. In the following graphs, the key aspects to look for are whether the median measure of compensation increases in years when returns are negative. The mean observations are skewed by significant outliers.

Figure 3: Total Compensation vs Sector Returns

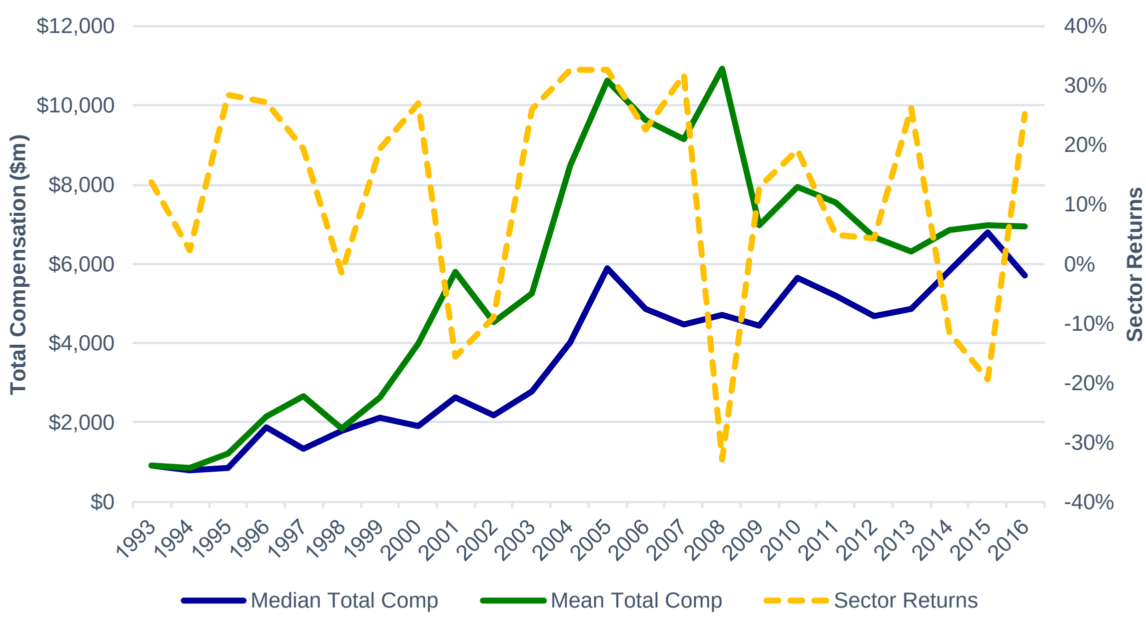


Figure 2 reveals that median total compensation in the E&P industry has been increasing over time. In recession years (01-02, 08) total compensation remained stable despite significantly negative sector returns. What is even more notable however, is that after the oil crash of 2014 which resulted in significantly negative sector returns, median compensation increased between 2014 and 2015. This seems to support the finding of inverse asymmetry.

Figure 4: Stock Grants vs Sector Returns

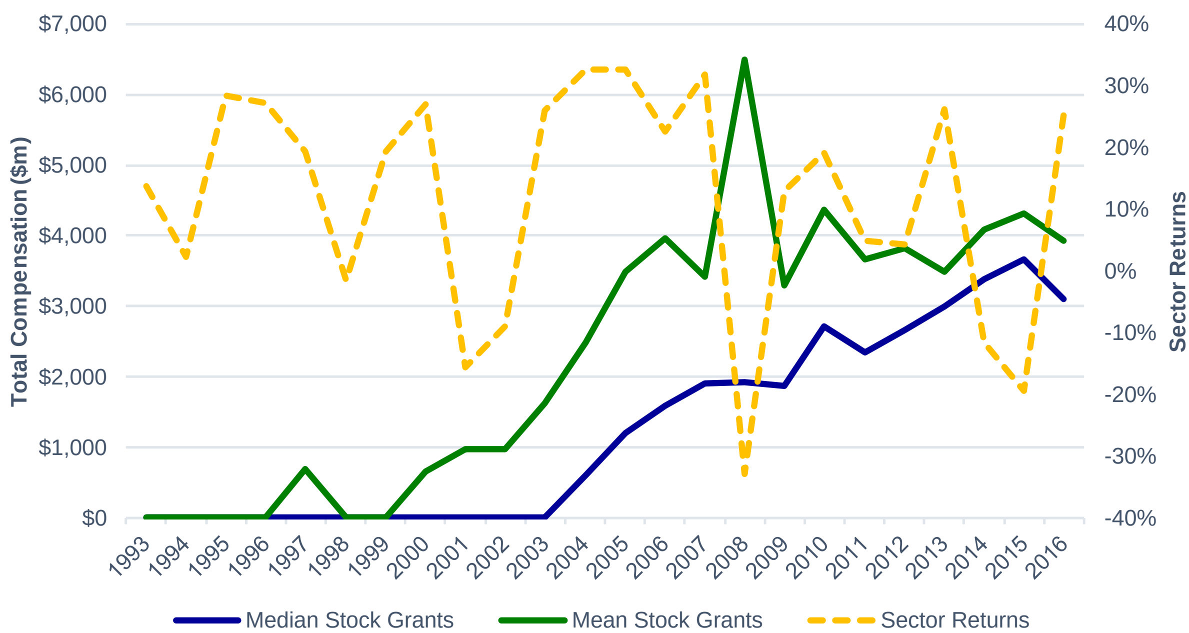
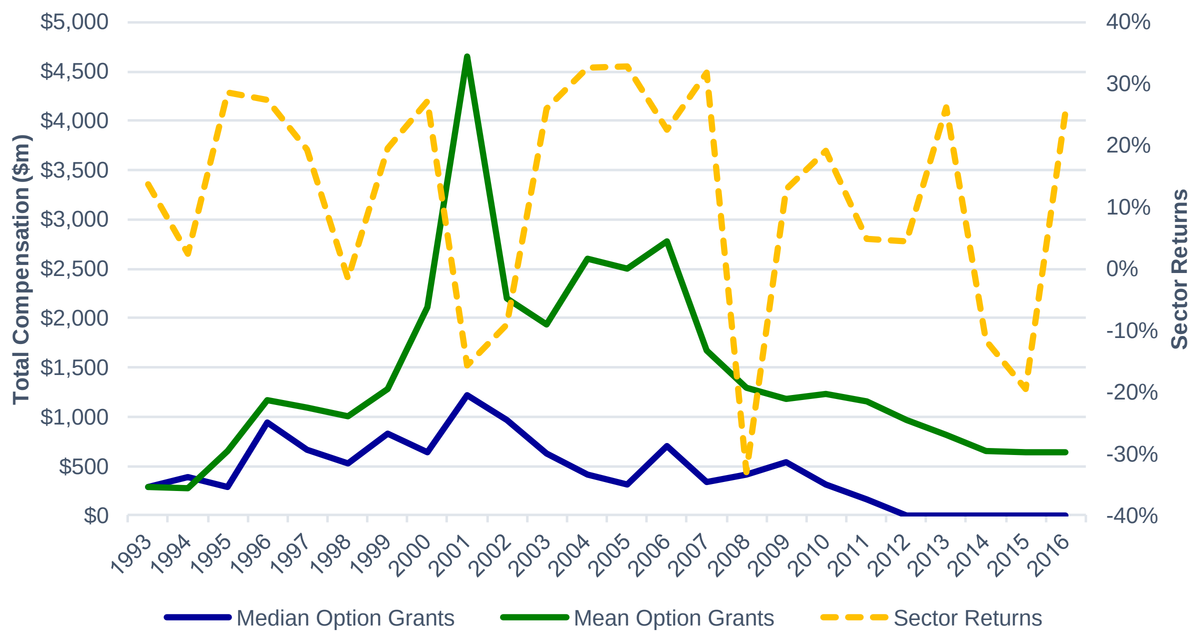


Figure 3 reveals a similar conclusion. The focus for stock grants should be post 2004. In 2008 the value of median stock grants remained the same despite significantly negative stock returns. Similarly, median stock grants increased between 2014 and 2015 despite the sector return decrease resulting from the oil price crash.

Figure 5: Option Grants vs Sector Returns



The focus on option grants should be pre-2004. The major negative sector return pre-2004 happened during the technology bubble in 2001. The median value of option grants spiked up between 2000 and 2001 despite the significantly negative corresponding sector return. This again supports the conclusion of inverse asymmetry found in the regression.

Taking out Recession Years from the Regression

Of the 24 years in this dataset, only six are considered bad luck years (negative sector returns). These years are 1998, 2001, 2002, 2008, 2014, and 2015. Two out of these six years were (2001 and 2008) major economic recessions and were not idiosyncratic to the E&P industry. During these recession years there could have been unique compensation dynamics at play. Thus, it is plausible that these recession years could be driving the inverse asymmetry that was discovered. In order to disprove this the regression was run excluding firm years from both 2001 and 2008. Table E shows the results.

Table E: Excluding Recessions Categorization Regression Coefficients

	Dependent Variable				
	Total Comp.	Salary	Cash Bonus	Stock Awards	Option Awards
Good Luck	0.89***	0.07***	0.05***	0.32***	0.23***
Good Luck x Bad Luck	-2.29***	-0.16***	-0.05	-1.23***	-0.34***
CEO Tenure	-4.23	4.67**	9.22**	-7.22	5.55
R^2	0.38	0.34	0.07	0.22	0.19
Observations	484	484	484	484	484

Coefficient on intercept and intercept effect of bad luck category suppressed for convenience

The table shows that the inverse asymmetry is still highly significant, not only in total compensation, but almost all other compensation components. The interaction term for cash bonus was the only one to lose significance. Thus, the impact of the recession can be ruled out as a confounding factor for the inverse asymmetry.

8.4 Results using Other Luck Categorization Methodologies

The luck categorization methodology in the prior section was based on the categorization utilized in previous papers for the purposes of benchmarking results. However, this many not be the most economically accurate categorization. Thus, the regression was run under two other categorization methods to see if the inverse asymmetry result holds.

Three Level Luck Categorization

Using a categorization method that uses a breakeven point of 0 sector returns (negative = bad luck, positive = good luck) may not be accurate because years that are slightly positive or slightly negative likely have similar compensation dynamics. Asymmetry is created when a compensation board consciously decides to change the amount of compensation they give to an executive based on the market conditions of the specific year. It is hypothesized that boards are unlikely to make significant changes, if any changes at all, for years in which the effect of good luck and bad luck is insignificant. For example, a year in which industry returns are 1% is likely pretty much equivalent in the board's mind as a year in which returns are -1%. The bandwidth of this lack of action may extend out a couple percentage in either direction.

Adding a third category of "no luck" would be helpful in representing this factor. Years within a certain percentage bandwidth from 0% industry returns will be considered "no luck" years, while years of extreme change in either direction will be considered bad luck or good luck. It is hypothesized that the inclusion of these insignificant industry return years in bad luck and good luck done in previous studies may be dampening the significance of the asymmetry that may truly be present. Using this categorization will likely isolate the years in which boards consciously make pay for luck decisions to the bad and good luck categories, while allocating years in which action is likely not taken to the no luck category.

For the following three level categorization regression, bad luck was characterized as years in which sector returns are below -15%, no luck when sector returns are between -15% and 15%, and good luck when sector returns are greater than 15%.

Table F: Three Level Categorization Regression Coefficients

	Dependent Variable				
	Total Comp.	Salary	Cash Bonus	Stock Awards	Option Awards
Good Luck	0.85***	0.07***	0.05***	0.33***	0.20***
Good Luck x No Luck	-0.85***	-0.08***	-0.04	-0.42***	-0.06
Good Luck x Bad Luck	-1.76***	-0.13***	-0.07*	-0.82***	-0.26***
CEO Tenure	-9.18	4.58**	9.12**	-14.56	6.71
R^2	0.25	0.25	0.08	0.11	0.14
Observations	533	533	533	533	533

Coefficient on intercept and intercept effect of bad luck and no luck category suppressed for convenience

The three level regression output does not necessarily support the hypothesis that a three level categorization reveals more asymmetry in compensation due to Luck. For total compensation, in good luck years, an E&P CEO's total compensation increases 85 cents for every $1000 increase in Luck. In no luck years an E&P CEO's total compensation does not change (0 = .85-.85) with Luck. In bad luck years, an E&P CEO's total compensation increases 91 cents for every $1000 *decrease* in Luck. This compares to total compensation increasing 89 cents in good luck years, and increasing $1.19 in bad luck years with the two level categorization mentioned earlier. Thus, the sensitivity in both good and bad luck years has actually somewhat declined despite using more extreme classifications of both good and bad luck.

While this initial hypothesis of enhanced asymmetry was not supported, perhaps a more interesting, unexpected conclusion resulted in the no luck category. That is that *in no luck years, compensation has very little sensitivity to Luck.* For total compensation the coefficient is 0 (.85 - .85), for salary it is -.01 (.07 - .08), for cash bonus .01 (.05 -. 04), for stock awards -.09 (.33 - .42), and for option awards .14 (.20 - .06). This lack of sensitivity seems to imply that compensation committees do not sensitize a CEO's compensation much with sector returns when sector returns are not extreme in nature. When they are, it seems these committees employ this strategy to greater effect as the inverse asymmetry between good and bad luck years is still present.

Using Absolute Prices instead of Returns to Categorize Luck

The second issue in previous literature's methodologies regards using sector *returns* instead of absolute price levels to categorize years of good and bad luck. Doing this does not reflect the reality of how compensation boards make decisions about pay for luck. For example, consider how this model takes into account commodity price shocks. The year in which a negative price shock happens will be considered a year of significant negative industry returns and will rightly be allocated into the bad luck subsample. However, the years following, in which there might be moderate price recovery after the initial shock would be years of positive industry returns because the returns are calculated off a much lower benchmark. These subsequent years will be categorized by the model as years of good luck, simply because the industry returns are positive after a significantly negative year. In reality, the compensation committees are likely not thinking that these subsequent years are “good luck.” In fact, it is just the opposite. Despite positive industry returns in these years they are likely making pay for luck decisions more in accordance with bad luck years as they will still be recovering from the price shock. Yet, the relative performance model will still consider them good luck years. It is hypothesized that the results of previous models in the literature may be inaccurate for cyclical industries because of this consideration.

To alleviate this issue, a new methodology of good and bad luck categorization is proposed. Rather than using the *return* on the SIC 1311 sector, absolute levels of commodity prices are used: a mix of oil and natural gas prices. First, a distribution of WTI oil prices and Henry Hub natural gas prices over the data set time frame will be created (1992 -2016). These are real prices that are adjusted for inflation so earlier years do not have a bias to be lower. The real oil and gas prices are standardized into Z scores, so oil which has a higher price does not carry arbitrarily more weight in the metric than natural gas. These Z scores are then averaged together to get the standardized price metric. Years above the third quartile according to this metric will be categorized as good luck years. Years below the first quartile will be categorized as bad luck and the middle 50% of the data as no luck. Using this absolute price metric to categorize years will presumably cancel out the rebound effect that mistakenly categorizes some of the years in the dataset using the returns based system. Using the same commodity price shock example again, when the initial shock happens it is correctly categorized as a bad luck year because the absolute price drops significantly, likely to below the first quartile in the distribution.

The difference from the previous methodology is that in the following years, even though there will likely be a price rebound (implying positive sector returns), the years will still be categorized as bad luck because despite the positive return from the lower benchmark year, the absolute value of the average commodity price is still very low. This will result in the follow-on years after the shock being classified as bad luck as well. Thus, this methodology properly captures a realistic concept of luck for cyclical industries.

Table G: Year Categorization by Absolute Price Methodology

1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1	0	0	0	0	1	0	0	1	1	1	1	1
2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
2	2	2	2	1	2	2	1	1	1	1	1	

2 = Good Luck, 1 = No Luck, 0 = Bad Luck

The table above depicts the categorization of each year according to this methodology. It should be noted that the entirety of the bad luck years are pre-2000, while all of the good luck years are post-2005, even though the prices were adjusted for inflation.

Table H: Absolute Price Categorization Regression Coefficients

	Dependent Variable				
	Total Comp.	Salary	Cash Bonus	Stock Awards	Option Awards
Good Luck	0.65***	0.05***	0.06***	0.20***	0.19***
Good Luck x No Luck	-0.48***	-0.04***	-0.03	-0.21***	-0.11***
Good Luck x Bad Luck	-0.54	.01	-0.03	-0.20	-0.10
CEO Tenure	21.31	6.30***	11.75**	5.611	7.05
R^2	0.13	0.13	0.08	0.05	0.11
Observations	533	533	533	533	533

Coefficient on intercept and intercept effect of bad luck and no luck category suppressed for convenience

The primary takeaway from the regression results for the absolute price categorization is that the bad luck interaction variable became insignificant. This is likely due to poor economic categorization that resulted from this methodology. As mentioned before, all the bad luck years are clustered in the 1990s. Thus, the external validity of using this metric for bad luck may not be quite strong. The no luck interaction variable, however, was significant. It showed a similar lack of sensitivity that aligns with what was found in the previous three stage categorization regression result. This gives further confidence to the conclusion that in year with little luck based market returns, CEO's compensation benefits very little from luck.

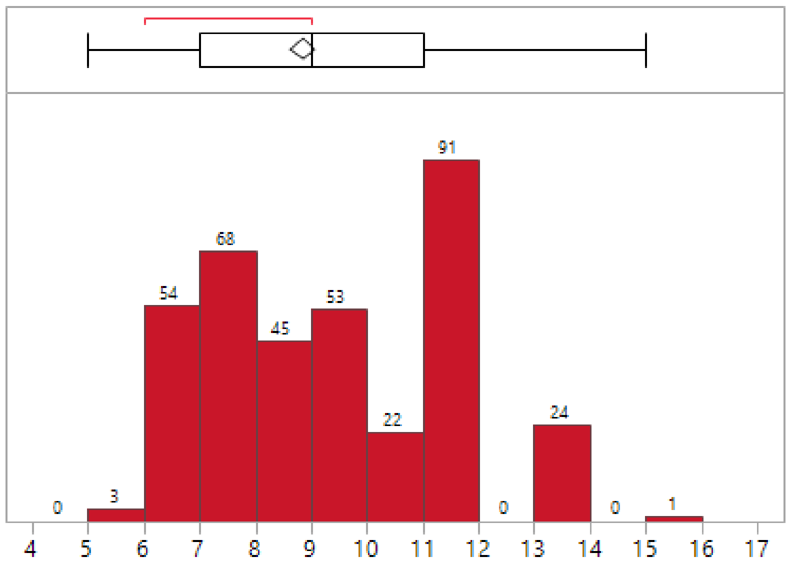
9. EXPLAINING DISCOVERED ASYMMETRY IN PAY FOR LUCK

9.1 Corporate Governance Subsamples

Now that it has been established that this inverse compensation asymmetry due to luck exists in the E&P industry, it is important to understand what is driving it. The two predominant explanations in the previous literature were poor corporate governance and the presence of external job opportunities for CEOs. In the poor corporate governance scenario, CEOs of firms have effective control over their own compensation contracts through strong relationships with the board. This allows them to manipulate their compensation in years of bad luck to still benefit. To test whether E&P firms with poor corporate governance are driving these results, the regression was run on firms that had bad corporate governance as well as firms that had good corporate governance.

The categorization of bad and good governance was created using the Gompers et al., corporate governance score. This governance score counts the number of provisions that restrict shareholder rights. It ranges from 1-24 with lower being more favorable for shareholders (good governance), and higher being unfavorable (bad governance). The author's primary finding was that a portfolio of firms with extremely good governance (democracy portfolio: governance score < 5) had significantly higher stock market returns than firms with very bad governance (dictatorship portfolio: governance score > 14) (Gompers et al. 2003). The goal in categorizing these E&P firms was to mimic the democracy and dictatorship portfolio categorization as closely as possible. However, an issue arose in the fact that the governance score range in the dataset of E&P firms was not as extreme as Gomper et al.'s data as can be seen in Figure 5 below. An additional issue was the fact that the governance score data was only available up until 2006.

Figure 6: Governance Score Distribution



Unit of Analysis: Firm Years

Because of the lack of extremity in the data variation, a more moderate categorization was used. Good governance firm years were classified as those with governance scores of less than 8. Bad governance firm years were classified as those with governance scores of greater than 10.

Table I: Governance Subsamples Regression Coefficients

	Dependent Variable: Total Compensation	
	Bad Gov	Good Gov
Good Luck	0.67***	0.59***
Good Luck x No Luck	0.40	0.57*
Good Luck x Bad Luck	-0.91***	-1.18***
CEO Tenure	-71.67	-42.45
R^2	0.31	0.28
Observations	116	125

Coefficient on intercept and intercept effect of bad luck and no luck category suppressed for convenience

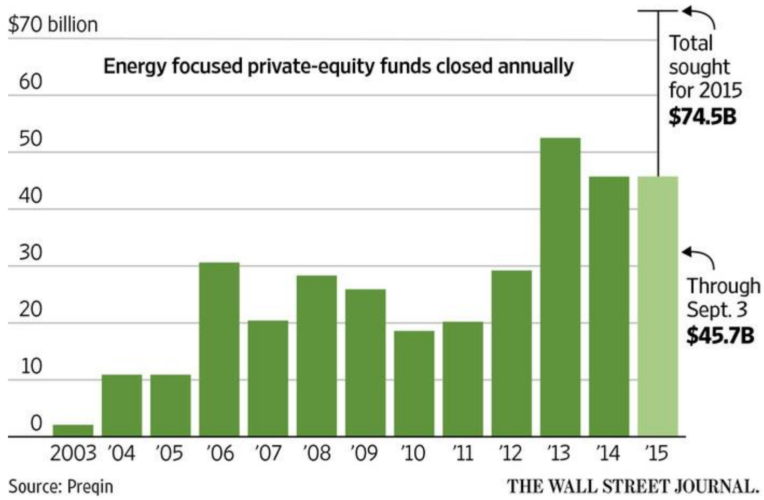
The primary takeaway from this governance subsample regression is that the inverse asymmetry relationship we have been noticing in all of these regressions is still present in the good governance subsample. If poor corporate governance was really driving this asymmetry, the interaction variable of Good Luck x Bad Luck would theoretically lose significance for firms with good governance. In fact there is very little difference in the sensitivities of total compensation to Luck between the bad governance and good governance subsamples. This seems to imply that governance does not play a very significant role in pay for luck for E&P firms. There must be some other confounding factor that is driving the asymmetry, the most likely of which are the presence of external job market opportunities for E&P CEOs.

9.2 Potential Job Market Explanation

As mentioned in the literature review, the presence of external job market opportunities for CEOs is a significant determinant of compensation asymmetry due to luck. Moreover, they found that a CEO's compensation in industries that are internally homogeneous, or have very little differentiation from firm to firm, have higher asymmetry in pay for luck. This is because the CEO's skillset is more transferable to other companies, which leads to a greater number of external job opportunities, which leads to better compensation dynamics in order to retain them at the firm (Cremers and Grinstein 2013). The exploration and production industry is the very definition of a homogenous industry. Firms produce commodity products that are the same at every company. Consequentially, the process of managing operations at an E&P firm is relatively the same from firm to firm. This means that E&P CEOs have plenty of potential jobs if they were to seek employment elsewhere.

Another very significant factor that effects E&P CEO's external job opportunities is the tremendous inflow of private capital into the E&P industry that started after the major technological shock of the fracking revolution. The implementation of fracking mean that vast quantities of reserves that were deemed inaccessible before could now potentially be drilled. Private investors, particularly private equity funds, realized this and started raising capital to deploy into start-up exploration and production companies. The significant inflow of capital can be seen in the following figure.

Figure 7: Capital Raised for Energy Private Equity Funds per Year



Private equity energy funds were practically non-existent in 2003 with only ~1 billionraised. After fracking started to be adopted the capital raised increased exponentially. The total amount sought for 2015, just 12 years later was ~75 billion. When this capital is deployed in new start-up E&P companies, management teams are needed to run operations. Private equity funds poach management from other larger E&P firms. The incentive schemes these private equity funds offer to CEOs to get them to lead one of these private companies are incredibly attractive. If the company is successful, the options and stock grants a CEO will receive make the upside exponential, most often far greater than the potential upside they have at an established company.

In order to keep their management teams from being poached by private equity funds, publicly traded, established E&P companies must significantly improve their compensation dynamics. One of these dynamics that they implement into the CEO's contract is likely what we are observing through this study: inverse asymmetry. It effectively guarantees that the CEO's compensation will continue to increase no matter if the E&P sector loses money or gains money. In a volatile industry, this is a very attractive job characteristic.

Thus, the fact that an E&P CEO's skillset is easily transferrable to other companies paired with the enormous increase in demand for E&P CEOs from private capital seem to contribute to significantly more external job opportunities for E&P CEOs relative to CEOs in other industries. This significant number of external job opportunities is the most likely explanation for why the asymmetry in compensation due to luck is much more drastic in the E&P industry than other industries.

10. DISCUSSION

These findings are significant to both academic researchers focused on compensation as well as actual compensation committees in the E&P industry. For academic researchers, the study is a focused deep dive into an industry that is affected the most by factors of luck (commodity price). All previous studies have focused on the broader market and how compensation varies with luck in the aggregate across all industries. Focusing on the E&P industry highlights just how significant this asymmetry can become. Because job market opportunities are so high for E&P CEOs, the asymmetry relationship is such that their compensation actually increases when the market cap of their company decreases from lucky factors. This type of inverse relationship in bad luck years has not been observed in previous studies. Further avenues of research could dive into the job market explanation for this relationship more fully. Due to a lack of access on CEO job market data, this relationship could not be quantitatively supported. A researcher with access to this data could help delineate the magnitude of the impact the job market has on compensation asymmetry as well as other interesting questions such as how lucrative private equity pay packages are compared to those offered by larger, public companies.

The findings in this study are also useful for E&P compensation committees as it provides an aggregate industry-wide benchmark of how a CEO's compensation varies with luck. When crafting the compensation arrangement for their respective CEO, these committees must be cognizant of including this asymmetry compensation dynamic (compensation is always rising no matter the market state) as other companies can outcompete for talent by offering it. If they do not, the CEO will likely leave for other opportunities. They must balance this, however, with not overpaying their CEO at the expense of shareholders. The quantitative finding of how sensitive the *average* E&P CEO's compensation is to sector returns in good and bad luck years provides a very useful benchmark to go off of when designing these contracts.

11. CONCLUSION

The question was posed at the beginning of this paper of whether or not compensation sensitivity due to luck was necessary, as these luck factors are out of a CEO's control. Moreover, an even more challenging question was whether asymmetry in compensation due to luck was necessary. The findings of this study seem to definitively point out that both sensitivity, and asymmetry in sensitivity are both necessary in order to retain CEOs. It is easy to adopt a cynical mindset that the asymmetry is simply a result of compensation committees rewarding closely tied CEOs at the expense of shareholders. This could very likely be the case if looking at one individual poorly governed company. However, this stark asymmetry in compensation due to luck is an aggregate trend across the *entire* industry. While there may certainly be outlier compensation committees that are corrupt in nature, the average committee which this study effectively analyzes is presumably made up of rational individuals who are acting in the best interest of shareholders. Thus, this trend almost assuredly benefits shareholders in an indirect manner. It allows for retention of key, talented CEOs who are necessary for a company to do well.

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