THE EFFECT OF MACROECONOMIC FORCES ON CEO TURNOVER-PERFORMANCE SENSITIVITY

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Abstract

This paper discusses CEO turnover-performance sensitivity to macro-economic shocks through oil price fluctuations on multiple industries then focuses on oil dependent and non-oil dependent industry groups. First part of the results shows that oil price volatility weakens the negative association between CEO turnover and firm performance sensitivity in a sample of all industries, because boards of directors find difficulties to filter out performance noise caused by economic uncertainty, and fear to make wrong decision of firing competent CEOs. The second part of the results shows how differently oil price volatility effects CEO turnover performance sensitivity in oil dependent industries and non-oil dependent industries, where oil price volatility weakens the negative association between CEO turnover and firm's performance sensitivity more in non-oil dependent industries than oil dependent industries. One explanation is that oil dependent companies involve in oil price hedge to reduce economic uncertainty of oil prices. Another explanation is that boards in non-oil dependent industries rely less on financial performance when there are factors beyond CEO's control such as customers delaying their purchases when oil price volatility is high.

Key words: Oil price volatility, CEO turnover, performance sensitivity, economic uncertainty

1. Introduction and Research Question

Chef Executive Officers (CEO) are key players when it comes to the successfulness of a business. Competent CEOs can turn a losing business into a successful one, and incompetent CEOs can bring down a business from making profits to losses. An average CEO runs a company for 7 to 10 years (Robert, 1997). This sensitive role cannot be gone unmonitored, one of board of directors objectives is to monitor the CEO to decide on his/her future based on several criteria such as firm performance (Cornelli et al, 2010). Accounting performance and stock price play major role in CEOs leaving their position. Furthermore, when firm's performance and stock price decrease, the chances that the CEO leaves the company voluntarily or forced increase (Brickley, 2003). However, macro-economic forces can play role in firms' performance. One factor that affects the world's economy is oil price changes by raising inflation and increasing interest rates (Hamoudeh, et al, 2010). Also, operating costs in some industries heavily rely on oil price, which negatively effects firm's performance (Lee et al, 2013). Since oil price effects firm's performance, which effects CEO turnover, this paper discusses the link between oil price, firm performance, and CEO turnover in below research question.

What is the effect of oil price volatility on CEO turnover-performance sensitivity?

I first study the effect of oil price fluctuation as a moderator on CEO turnover-performance sensitivity on a sample of 31,909 North American firm year observations of all industries from 1992 to 2020, then I break the sample into oil dependent and non-oil dependent subsamples. Oil dependent industry group includes industries that rely on oil in their input/supply such as energy, materials, industrials, transportation, warehousing, petroleum refinery and chemical industries (Lee & Ni 2002; Phan, et al 2020). Non-oil dependent group includes industries other than the mentioned ones such as automobile, Households, apparel, etc that do not rely on oil in their input or supply.

High oil price volatility causes customers to delay their purchases, however a competent CEO can reduce the uncertainty effects on performance with his/her understanding of the industry (Phan, et al 2020). On the other hand, CEOs performance becomes noisy during economic distress, which makes it difficult for boards of directors to properly evaluate CEOs (Bushman et al, 2010). This paper tests CEO turnover-performance sensitivity to oil price volatility, with evidence that oil price volatility significantly weakens the negative association between CEO turnover and firms' performance in the full sample. In other words, oil price volatility effects how boards evaluate their CEO's performance, where boards rely less on performance during high oil price volatility. One explanation is that boards have difficulty in removing noise that is caused by economic destress when evaluating CEOs (Bushman et al, 2010). Another explanation is that boards fear to make wrong choice of firing a competent CEO for performance factors beyond the CEO's control (Frye & Pham, 2020).

The second part of the results shows how differently oil price volatility effects CEO turnover performance sensitivity in oil dependent industries and non-oil dependent industries. Oil price volatility weakens the negative association between CEO turnover and firm's performance more in non-oil dependent industry group than oil dependent industry group. The reason is that oil dependent companies involve in price hedging to protect themselves from oil price fluctuations (Chun et al, 2019). For non-oil dependent industries, boards tend to rely less on financial performance when there are factors beyond the CEO's control, such as when customers delay their purchases at time of oil high oil prices causing reduction in sales (Phan, et al, 2020).

Prior literature by Ferderer (1996), Elder & Serleties (2009), and Phan et al (2020) focused on the effects of oil price volatility on firms' performance, while this paper contributes to the literature by providing an extension to prior literature by focusing on CEO turnover performance sensitivity to oil price volatility. In addition, this paper goes further and breaks the sample into oil dependent and non-oil dependent industries to understand the effects of oil price volatility on CEO turnover on both industry groups. A limitation of this paper is the low R^2, which means that the independent variables do not fully explain CEO turnover.

2. Literature Review

2.1. CEO Turnover-performance Sensitivity

Firm performance is one of the most important indicators of the CEO's ability as well as CEO's turnover, where CEO turnover is sensitive to different performance criteria. Bushman et al (2010) identified two types of risks that effect CEO turnover based on firms' performance. One type of risk is "idiosyncratic risk" related to CEO's ability based on firm performance, which is in CEO's control, while the other type of risk is "systematic risk" that is not in CEO's control (Bushman et al, 2010). CEO turnover-performance is more sensitive to risks when performance factors are in CEO's control than when they are out of CEO's control because understanding CEOs potential becomes less effective when there is noise that is out of CEOs hand (Bushman et al, 2010). Another research of CEO turnover- performance sensitivity by Gao et al (2017) studied different aspects of CEO turnover sensitivity to performance such as Return on Asset (ROA) and how sensitive CEO turnover to performance in public versus private firms. Turnover performance sensitivity in public firms is significantly higher than private firms because public firms make decisions based on short term visions and fire CEO early while private firms do not. On the other hand, subsequent CEO performance increases in private firms more than public firms (Gao et al 2017).

Paper by Cornelli et al (2010) identified "soft information", which is defined as the information that cannot be verified or backed up with numbers such as making wrong decisions, and "hard information", which is the information that can be numerically verified such as performance, as main drivers of CEO turnover. The paper concluded that "hard information" has more weight than "soft information" in CEO turnover, yet board of directors tend to act upon both information (Cornelli, et al, 2010). Most industries have stable economy that justifies bad luck for a year or two. However, some industries performance or profit completely relay on outside factors (Jenter

& Kanaan 2015). Another criteria effects CEO turnover is cost of replacing CEO. Parrino (1997) shows evidence that cost of replacing a CEO with a skillful one is also associated with CEO turnover where the probability of CEO turnover increases when the replacement cost is low.

Corporate governance including separation of ownership and control also plays role in CEO turnover sensitivity to performance. Goyal & Park (2002) examined CEO turnover performance sensitivity in set up where CEO is the same as the board chairman using "Market-adjusted stock returns","analysts earning forecast errors", and "industry-relative earnings" as main performance measures. The results show that sensitivity of CEO turnover to performance is lower when the CEO is the same as the chairman because board would not be able to effectively monitor CEO (Goyal & Park, 2002). On the other hand, Li (2018) studied the moderating effect of family ownership on CEO turnover performance sensitivity with evidence from Taiwanese market that CEO turnover is more sensitive to performance as the non-family ownership increases. The same paper by Li (2018) also researched the moderating effect of weak governance transparency and cashflow with family ownership on CEO turnover performance sensitivity with evidence that these moderating effects are positive in non-family-controlled companies. In terms of independent board of directors' structure, Duh et al (2014) provided evidence on how CEO turnover performance is sensitive to changes in the independency of board post Sarbanes Oxley Act in 2002. They found that some firms decreased the board independency in order to meet the minimum 50% independent board requirement of SOX 2002, which resulted in significant decrease in CEO turnover performance sensitivity (Duh et al, 2014)

2.2. Effect of Oil Price Volatility on Firm Performance

Oil prices are not set by the oil companies, they are set by market supply and demand. The supply of oil is controlled by the Organization of Petroleum Exploring Countries (OPEC) which consist of the world's leading oil producing countries. One of the main objectives of OPEC is to monitor and enforce production between countries to keep supply stable (Hamilton, 2009). Oil prices faced a lot of sharp increase and decrease in the 20th century due to multiple reasons effecting the supply and demand such as wars and other macroeconomic reasons (Ji, 2012).

Prior literature studied how oil price volatility creates different types of economic distress. Oil prices have been affecting the world's economy since the world wars. Prior literature concluded that there is evidence linking oil price volatility with industrial growth where oil price volatility plays important role in growth forecast (Ferderer, 1996). More studies by Elder & Serleties (2009), who focused their research on the impact of oil volatility on Canadian economy found evidence that increase in oil volatility is associated with decline in growth in economic actives such as production.

Another angle where previous literature focused on is the link between oil price volatility and firm performance. Literature by Phan et al (2020) documented that crude oil price volatility negatively

effects firms' performance in most industries. Oil price volatility does not only effects performance, but stock market as well. Stock returns reacts highly to volatility in oil prices, especially if oil is used as the main output such as oil companies as well as companies that use oil refined products as in input such as airlines (Bagirov & Mateus, 2019).

3. Hypotheses Development

Prior literature found significant impact of oil price volatility on firm performance, where macroeconomic factors such as cost of production and interest rate both increase while value of the dollar and the overall economic power decrease when oil prices increase (Hamoudeh, et al, 2010). Prior studies also confirm that oil price volatility, which is a factor beyond CEO's control, creates economic distress to all industries by affecting firm's performance (Lee & Ni, 2002; Phan, et al, 2020). Although the pressure from oil price volatility on the economy is beyond the control of CEOs, competent CEOs can reduce such effects in two ways. First, competent CEOs better understand their industry, technology and manage employees more efficiently (Demerjian et al, 2012), therefore mitigating the risk of losing investing opportunities of delayed purchases and payments due to uncertainties in oil prices show strong CEO ability (Phan, etal, 2020). Second, higher ability managers can apply different methods to overcome the high volatility in oil prices (Phan, et al, 2020). Board of directors may compare CEO to his/her peer performance in time of economic uncertainty, however they fail to fully account for all of the industry peer consequence, therefore board of directors rely on CEO ability and performance at time of economic uncertainty (Jenter & Kanaan,2015). Due to the mentioned reasons, I expect that CEO turnover-performance sensitivity to increase when oil price volatility increase

An alternative prediction is that firm performance is less reliable when economic uncertainty is high as members of board of directors disregard factors that are beyond the CEO's control in firms' performance when evaluating the CEO's competency as per Standard Economic Theory (Lee et al, 2013). One reason is that as economic uncertainty increase, board of directors tend to excuse CEOs for bad performance to a point that the board may even allow incompetent CEO to stay in office during economic distress, because board of directors' fear to make wrong choice (Frye & Pham, 2020). Second, As confirmed by Bushman et al, 2010, CEO performance monitoring becomes a challenge for board of directors at time of economic distress due to the noise economic distress bring, where filtering the noise becomes a challenge, therefore firing CEO based on performance becomes a challenge as well.

H1: CEO turnover-performance sensitivity is positively associated with oil price volatility.

The second hypothesis tests how oil price volatility effects CEO turnover-performance sensitivity in different industries. Lee & Ni (2002) analyzed oil prices shocks in different industries in term of supply and demand. Lee & Ni (2002) results show that high oil price volatility decreases products supply in industries that use oil as input such as petroleum refinery, industrial, and chemical industries. Gogineni (2010) also found evidence that stock returns in industries that rely

on oil in their operations, especially air transportation and warehousing, are significantly sensitive to oil prices. On the other hand, oil price volatility does not only effect industries that directly use oil in their input, but also other industries that rely on consumer's power such as automobile, Households, and apparel industries who experience decrease in demand because consumers delay their purchases due to uncertainty in oil prices (Lee & Ni, 2002).

Since oil price volatility decreases firm's performance, I expect oil price volatility to effect CEO turnover-performance sensitivity in industries that rely on oil as in input as uncertainty of oil prices creates destress in supply. On the other hand, I expect that oil volatility to effect CEO turnover-performance sensitivity in industries that do not use oil as an input as well but with less magnitude than industries that use oil as input because industries that use oil in their operations show higher performance sensitivity to oil volatility than those industries that do not directly buy oil, therefore CEOs in oil dependent industries can be excused for weak performance during economic uncertainty (Lee & Ni 2002; Gogineni 2010; Phan, et al 2020). As a counter argument, industries that heavily rely on oil (airline, logistics, refineries, industrial, mining, chemical, and oil warehousing) usually involve in oil price hedging to reduce the effects of oil price volatility where hedging becomes very important at time of great oil price volatility (Chun et al, 2019). Quality of the hedge and avoidance of losses greatly depends on management and CEO ability, therefore board of directors may hold CEO accountable for bad risk management strategy, while non-oil dependent industries cannot reduce the risk of oil price volatility.

H2: CEO turnover-performance sensitivity is stronger with oil price volatility for firms in oil-dependent industries than for forms in non-oil dependent industries.

4. Data

The data ranges from 1999 to 2020, to observe different macro-economic shocks throughout the 21 years. For oil prices, I use West Texas Intermediate (WTI) daily crude oil prices from Fred Economic Data. For financial information, I use Compustat North America database. For CEO information, I use ExecuComp database to extract information about CEO. To make sure that the sample does not include CEOs who are in acting assignment or temporarily covering for another CEO, I am restricting the tenure of CEO of a minimum of one year. I also use BoardEx database to get information about independent board of directors. In order to link Compustat with BoardEx, I use the provided link in Ward database of Global Company Key(Compustat unique key) and Board ID (BoardEx unique ID) which causes drop of number of observation due to unfound link between the two databases from 96,952 to 70,340 observations. Then I remove CEO tenure of less than one year, which further drops number of observations by 18,830 observations. After further removing observations of missing values in variables of interest in this research, number of observations is 36,048.

I then conduct further outlier analysis of the variables of interest. I select to use percentile method to remove outliers in the 1st and 99th percentile, rather than winsorize the data because winsorizing would replace the extreme outliers with less extreme values which may affect the moderating effect of the oil prices on firm performance that can cause large change in performance. After removing outliers, the final number of observations in this paper is 31,909 firm year observations.

5. Methodology

Following work of Huson et al (2001), Goa et al (2017), and Phan et al (2020), this research shows impact of oil prices on CEO turnover, therefore the main dependent variable here is CEO Turnover. CEO Turnover means when the CEO of a certain company is changed in a given year. The change can be ether CEO leaving voluntarily, forced, or retired. The main independent variable in this study is oil price volatility, where average crude oil price of the year is the measure of oil price. Another important variable is the firm performance. To test the sensitivity of oil prices and firm performance, I use oil prices volatility as a moderator to firm performance. I also use firm characteristics, CEO characteristics, and board of directors' characteristics as control variables for in the below model

$$CEO\ Turnover_{t,i}=\alpha+\beta_1\ Volatility+\beta_2 ROE_{t,i}+\beta_3\ (Volatility * ROE_{t,1})+\beta_4\ Growth+\beta_5\ Assets_{t,i}+\beta_6\ Leverage_{t,i}+\beta_7\ Age_{t,i}+\beta_8\ Tenure_{t,i}+\beta_9\ OWN\%_{t,i}+\beta_{10}\ INDBD_{t,i}+Industry\_FE+Year\_FE \quad (1)$$

The dependent variable CEO Turnover is measured by assigning 1 if there is a change in CEO of year *t* in company *i* or 0 if there was no CEO change. Oil price volatility (Volatility)is measured by calculating standard deviation of oil prices of year *t*, the higher the standard deviation the higher volatility of oil prices in year *t*, therefore the higher economic uncertainty. Firm performance is measured by Return on Equity (ROE) of each firm *i* in year *t* which is net income divided by average equity of a given year. Another firm performance measure is revenue growth (Growth), which can be measured by percentage of increase in revenue compared with the company's previous year's revenue. For firm characteristics, I control for firm size by using number of assets in variable (Assets) in year *t* at company *i*, where high number of assets indicate larger companies and low number of assets indicate smaller companies. Another firm characteristic control variable is leverage (Leverage) using debt-to-equity ratio as a measure of the debt size compared to the investment made by stockholders calculated by dividing total debt over total stockholders' equity. For CEO characteristics, I control for percentage of CEO Ownership of the company (OWN%) , CEO age (Age) at time of fiscal year *t* for company *i*, and CEO tenure (Tenure) at time of year *t*. In terms of Board characteristics, I simply control for percentage of independent board members (INDBD) of each company in year *t* . I am including industry fixed effects to capture industry related effects across the examined 170 industries, as well as years fixed effects across the sample period of 21 years.

I use the full sample including companies from different industries to calculate coefficient of how sensitive CEO turnover performance to oil prices volatility in equation (1). Then I decompose the

sample into smaller samples with companies from different industries grouped as oil dependent and non oil dependent samples using equation (1).

Table1. Oil Dependent Industry Group

Oil Dependent Industries	
Specialty Chemicals	Semiconductor Equipment
Commodity Chemicals	Construction & Engineering
Diversified Chemicals	Construction Machinery & Heavy Trucks
Independent Power Producers & Energy Traders	Marine
Gas Utilities	Electrical Components & Equipment
Oil & Gas Refining & Marketing	Electric Utilities
Oil & Gas Drilling/Support Activities	Heavy Electrical Equipment
Integrated Oil & Gas	Electronic Components
Aerospace & Defense	Agricultural & Farm Machinery
Building Products	Metal & Glass Containers
Oil & Gas Equipment & Services	Industrial Gases
Air Freight & Logistics	Auto Parts & Equipment
Airlines	Distributors
Industrial Machinery	Automobile Manufacturers
Industrial Conglomerates	Motorcycle Manufacturers
Health Care Equipment	Aluminum
Diversified Commercial & Professional Services	Railroads
Electronic Equipment & Instruments	Industrial REITs
Construction Materials	Coal & Consumable Fuels
Trading Companies & Distributors	Diversified Metals & Mining
Alternative Carriers	Oil & Gas Storage & Transportation
Electronic Manufacturing Services	Multi-Utilities
Communications Equipment	

Note: Oil dependent subgroup includes energy, materials, transportation, warehousing, petroleum refinery, chemical, and all industries under industrial sector (Phan, et al 2020, Lee & Ni 2002). Industrials sector includes wide range of industries that are involved in distribution, construction, aerospace & defense, building, and manufacturing of any equipment regardless of the industry (Johnston, 2021). Industries categorization is based on "Industry Group Description" in Compustat database

Table1 shows all 49 industries in oil dependent group based on "industry group description" in Compustat database. The oil dependent subgroup includes energy, materials, transportation, warehousing, petroleum refinery, chemical, and all industries under industrial sector (Lee & Ni 2002; Phan, et al 2020). Industrials sector includes wide range of industries that are involved in distribution, construction, aerospace & defense, building, and manufacturing of any equipment regardless of the industry (Johnston, 2021).

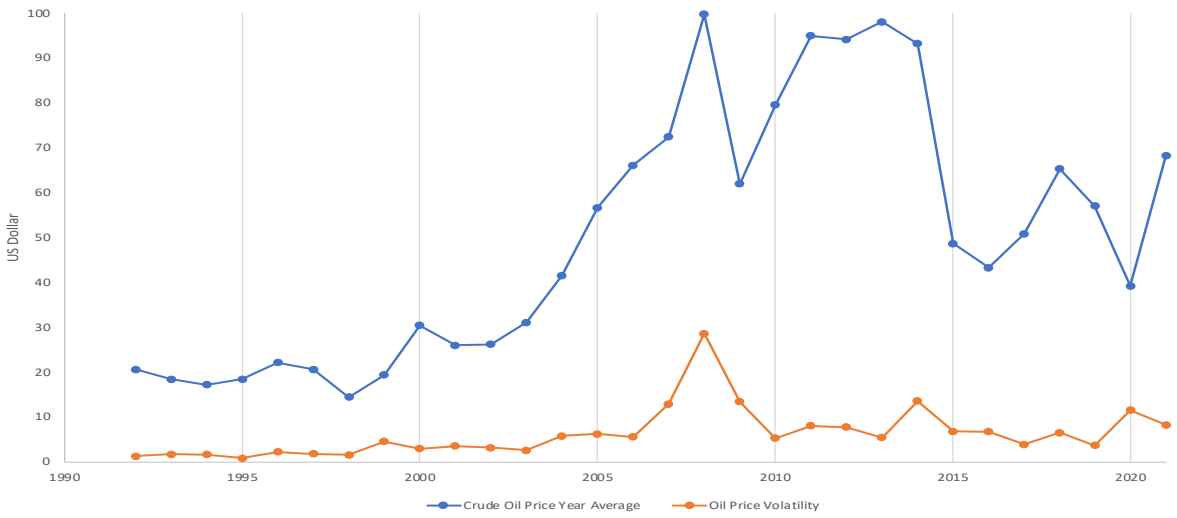

Figure1:Crude Oil Prices & Volatility:West Texas Intermediate (WTI): 1992- 2021
Adapted source: U.S. Energy Information Administration, Crude Oil Prices: West Texas Intermediate (WTI),2022

For non-oil dependent sample, I simply take the remaining 123 industries and group them as non-oil dependent. The non-oil dependent industry group includes wide range of industries such as banking, healthcare, automobile sales, etc, I then compare coefficients to conclude how sensitive CEO turnover to oil prices across oil dependent and non-oil depended groups.

6. Descriptive Statistics

Figure 1 shows West Texes Intermediate crude oil price in US Dollars, where the top blue line indicates average annual oil prices based on daily price in each year, while the bottom orange line represents volatility of the oil prices during each year based on standard deviation of daily crude oil prices in that year. Average oil prices have been fluctuating up and down as indicated in the blue line, however the overall trend shows increase from 20 US Dollars in 1992 to 68 US Dollars in 2021 with average oil price of 49 US Dollars in the last 29 years. In terms of high oil prices, oil prices reached all time annual average peak of 100 US Dollars in 2008 jumping from 72 US Dollars in

2007. This trend was then repeated with oil price being above 90 US Dollars in a course of 4 consecutive years from 2011 to 2014. In terms of low oil prices, 1998 shows the lowest price of 18 US Dollars, however it is worth to mention that 2020 reported the lowest average oil price of 39 US Dollars the last 15 years. The bottom orange line represents oil price volatility in every year. The average volatility of all the 21 years is 6.2 standard deviation.

For example, in the period from 1992 to 1998, the oil prices were stable with volatility below 2.2 standard deviation. On the other hand, 2008 shows the highest oil price fluctuation of 28 standard

deviation, meaning that in 2008 the average distance of the daily oil prices is 28 US Dollars from the year's average of 99.6

Table 2. Full Sample Descriptive Statistics

Variable	N	Mean	St. Dev.	Min	Pctl(25)	Pctl (75)	Max
Shares Owned - As Reported	31,909	2,208.4	26,805.7	0	0	1,000.9	1,270,096
Percentage of Ownership (Own)	31,909	1.8	5.1	0	0	1.3	88
CEO Turnover	31,909	0.1	0.3	0	0	0	1
Tenure	31,909	8.4	7.6	1	3	12	53
Age	31,909	55.9	7.3	39	51	60	79
Assets	31,909	8,939.0	19,260.5	3.2	756.4	7,389.0	202,352.0
Debt	31,909	6,270.1	15,169.6	13.7	320.5	4,815.8	162,932.0
Net Income (Loss)	31,909	338.6	1,369.4	-98,696.0	19.5	277.7	23,150.0
Revenue	31,909	5,152.7	12,930.9	0.0	517.8	4,262.0	313,335.0
Previous Year Revenue	31,909	5,490.3	14,151.0	0.1	561.7	4,429.0	402,318.0
Revenue Growth (Growth)	31,909	0.1	0.2	-0.5	-0.01	0.2	1.2
Stockholders Equity	31,909	2,668.9	5,418.9	-694.8	359.8	2,290.0	57,083.0
ROE	31,909	0.1	0.2	-2.0	0.05	0.2	1.7
ROA	31,909	0.04	0.1	-3.1	0.01	0.1	0.7
Leverage	31,909	2.2	2.6	-4.2	0.6	2.5	15.8
Number of Directors	31,909	8.5	3.0	2	6	10	33
Number of Independent Directors	31,909	7.5	2.7	0	6	9	30
Percentage of Independent Directors (INDBD)	31,909	0.9	0.1	0.0	0.8	1.0	1.0
Oil Price- Year Average	31,909	63.5	23.8	19.3	43.3	93.2	99.7
Oil Price Volatility (Volatility)	31,909	8.2	5.8	2.6	5.3	11.6	28.6

US Dollars. Another example is the low volatility in 2019 which means that oil prices were stable during that year. Although 2020 recorded the lowest oil prices in the past 15 years, it recorded the third highest volatility, because daily oil prices fluctuated downwards with distance of 11.5 US Dollars from the average oil price of 39 US Dollars in 2020.

Table 2 shows descriptive statistics of the entire sample. For CEO characters, the variable (Own) in Table 2 represents CEO ownership of the company during the year, where the average CEO ownership is 1.8% while CEOs ownership at the 75th percentile is 1.3% and maximum of ownership of 100%. In terms of CEO tenure, the minimum CEO's tenure is 1 year and average CEO coverage is 8.4 years, while 12 years tenure is the 75th percentile of the sample. CEO age (Age) in Table 2 also shows some informative information, where the average CEO age is 55 and

CEO age between the 25th and 75th percentile of the sample is from 51 to 60, which shows that most CEOs are above 50 years old.

Table3. Subsample Oil Dependent

Variable	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
Shares Owned - As Reported	10,197	990.6	6,250.8	0	0	707.3	245,346
Percentage of Ownership (Own)	10,197	1.3	3.8	0	0	1.0	58
CEO Turnover	10,197	0.1	0.3	0	0	0	1
Tenure	10,197	7.5	6.8	1	3	10	48
Age	10,197	56.1	6.7	39	52	60	79
Assets	10,197	7,545.7	14,842.7	10.2	728.4	6,441.0	194,520.0
Debt	10,197	4,974.8	10,612.1	13.7	282.6	4,080.7	154,649.0
Net Income (Loss)	10,197	308.2	940.6	-16,198.0	16.8	271.8	13,328.0
Revenue	10,197	5,096.8	10,740.6	9.8	652.6	4,622.8	157,730.0
Previous Year Revenue	10,197	4,919.0	10,485.9	4.6	616.7	4,421.0	166,089.0
Revenue Growth (Growth)	10,197	0.1	0.2	-0.5	-0.02	0.1	1.2
Stockholders Equity	10,197	2,570.9	4,844.5	-691.1	378.5	2,237.5	56,654.0
ROE	10,197	0.1	0.2	-2.0	0.04	0.2	1.7
ROA	10,197	0.04	0.1	-3.1	0.02	0.1	0.6
Leverage	10,197	1.7	1.7	-4.1	0.6	2.1	15.6
Number of Directors	10,197	8.7	2.8	2	7	11	33
Number of Independent Directors	10,197	7.7	2.6	0	6	9	30
Percentage of Independent Directors (INDBD)	10,197	0.9	0.1	0.0	0.8	1.0	1.0
Oil Price- Year Average	10,197	63.2	23.8	19.3	43.3	93.2	99.7
Oil Price Volatility (Volatility)	10,197	8.2	5.8	2.6	5.3	11.6	28.6

For firms' performance in Table 2, the sample provides data with wide range of companies with different financial positions. In terms of revenue growth, the average revenue growth (Growth) of companies in the full sample is 10% with revenue growth differs from -1% in the 25th percentile to 20% growth in the 75th percentile, therefore the average distance between revenue growth variables is 0.2 (20%). Other performance measure where I am studying the moderating effects of oil price on is Return on Equity (ROE). The mean Return on Equity in the sample is 0.1 and the 75th percentile of this variable is 0.2 compared to 0.05 in the 25th percentile.

In terms of board of directors' independency, the average number of independent directors is 8 compared to average of 1 dependent directors with most companies have 6 to 9 independent directors between the 25th and 75th percentile. Therefore, the percentage of independent directors

in variable INDBD shows that the average percentage of independent directors across the sample is 90% while most companies in the sample have more than 80% of the board as independent.

Table4. Subsample Non-Oil Dependent

Variable	N	Mean	St. Dev.	Min	Pctl(25)	Pctl (75)	Max
Shares Owned - As Reported	21,712	2,780.3	32,197.1	0	0	1,189.8	1,270,096
Percentage of Ownership(Own)	21,712	2.1	5.7	0	0	1.5	88
CEO Turnover	21,712	0.1	0.3	0	0	0	1
Tenture	21,712	8.9	8.0	1	3	12	53
Age	21,712	55.8	7.6	39	50	60	79
Assets	21,712	9,593.3	20,985.6	3.2	771.1	7,825.6	202,352.0
Debt	21,712	6,878.4	16,856.8	13.8	340.0	5,209.7	162,932.0
Net Income (Loss)	21,712	352.9	1,529.7	-98,696.0	20.5	281.0	23,150.0
Revenue	21,712	5,178.9	13,840.7	0.0	468.6	4,130.0	313,335.0
Previous Year Revenue	21,712	5,758.6	15,570.5	0.1	539.3	4,429.1	402,318.0
Revenue Growth (Growth)	21,712	0.1	0.2	-0.5	-0.01	0.2	1.2
Stockholders Equity	21,712	2,714.9	5,668.1	-694.8	351.1	2,312.5	57,083.0
ROE	21,712	0.1	0.2	-2.0	0.05	0.2	1.7
ROA	21,712	0.04	0.1	-1.6	0.01	0.1	0.7
Leverage	21,712	2.5	2.9	-4.2	0.7	2.8	15.8
Number of Directors	21,712	8.5	3.1	2	6	10	31
Number of Independent Directors	21,712	7.4	2.7	0	6	9	26
Percentage of Independent Directors (INDBD)	21,712	0.9	0.2	0.0	0.8	1.0	1.0
Oil Price- Year Average	21,712	63.7	23.8	19.3	43.3	93.2	99.7
Oil Price Volatility (Volatility)	21,712	8.2	5.8	2.6	5.3	11.6	28.6

Since this paper studies the moderating effect of oil price volatility in both oil dependent and non-oil dependent industries, it is important to understand the statistics of each industry group. Oil dependent group includes observations from airline, logistics, refineries, all types of industrial industry, mining, chemical, and oil warehousing. Table 3 shows that from the full sample, 10,197 firm year observations are oil dependent with statistical results close to the full sample data, including mean of 7.5, 56, 10%, 0.1, and 90% for tenure, age, revenue growth, ROE, and percentage of independent directors, respectively. On the other hand, Table 4 shows a subsample of the non-oil dependent industry group which includes all industries other than the ones mentioned for oil dependent. Table 4 shows almost similar descriptive statistics results as the oil dependent with average of 8.9, 55, 10%, 0.1, and 90% for tenure, age, revenue growth, REO, and percentage of independent directors respectively

7. Results

7.1 Full Sample Regression Results

Table 5 shows logistic regression results of the full sample of 31,909 firm year observations of CEO turnover performance sensitivity to oil price volatility with standardized independent variables. The reason I use logistic model rather than Ordinary Lease square (OLS) is because the dependent variable, CEO Turnover, is binary meaning that it takes value of 0 of there is no turnover and 1 if there is a turnover, therefore the results are interpreted using odds. To include fixed effects, I follow prior literature by Kanna et al (2015) by using conditional logistic regression, which is similar to logistic regression with option to include fixed effects in a match case control data (Kuo et al, 2018). Column one (1) shows beta coefficients of logistic regression results with CEO turnover as dependent variable similar to equation (1) but without fixed effects. Column two (2) shows conditional logistic regression beta coefficients with industry and year fixed effects. As confirmed by prior studies, CEO turnover is highly and significantly sensitive to revenue growth (Growth), Return on Equity (ROE), percentage of independent directors (INDBD), years the CEO has been in office (Tenure) and CEO ownership percentage in the company (OWN) with negative correlation between CEO turnover and these variables in both tests.

For example, number of years a CEO stays in office in variable (Tenure) shows negative and highly statistical association with CEO turnover with confidence level of 99%, meaning that for each additional year a CEO stays in office, the chances of CEO turnover significantly decrease by 17% ($1-e^{(-0.135}$)as indicated in column (2). Table 5 shows that oil price volatility (Volatility) alone has negative correlation with CEO turnover, however the correlation is not significant when adding industry and years fixed effects in column 2. This suggests that changes in oil prices alone does not trigger change in CEO.

In terms of firm performance, Return on Equity (ROE) variable alone is negatively and significantly correlated at 99% confidence level with CEO turnover with beta coefficient of 0.026 as indicated in Table 5 column (2), meaning that as ROE decreases by a whole unit, the odds of CEO turnover increase by 16%($1-e^{(-0.179)}$). Another performance measure is revenue growth (Growth) in Column two (2) which shows that revenue growth significantly and negatively correlated with CEO turnover with coefficient estimate of -0.222, meaning that as revenue growth decrease by one unit (100 percent decrease), the odds of CEO turnover increase by 80% ($1-e^{(-1.276)}$).

For the interest of this paper, I am more interested in finding how CEO turnover performance sensitivity reacts to oil price volatility. The interaction between firms' performance (ROE) and oil price volatility (Volatility) is captured in variable Volatility*ROE. By adding oil price volatility as a moderator to the association between ROE and CEO turnover, the association with CEO turnover changes signs from negative to positive with lower coefficient than ROE, where Volatility*ROE variable is positively and significantly correlated at confidence level of 99% with CEO turnover. In other words, oil price volatility reduces CEO turnover-performance sensitivity

Table 5**.** Logistic, and Conditional Logistic results of CEO turnover performance sensitivity to oil volatility

	CEO Turnover	
	logistic	***conditional logistic***
Variable	***(1)***	***(2)***
Volatility	0.036*	0.576
	(0.021)	(0.404)
ROE	-0.173***	-0.179***
	(0.018)	(0.018)
Volatility*ROE	0.051***	0.048***
	(0.015)	(0.015)
Growth	-0.191***	-0.222***
	(0.022)	(0.024)
Assets	0.006	0.007
	(0.020)	(0.022)
Leverage	-0.031	0.040
	(0.021)	(0.029)
Age	0.526***	0.540***
	(0.023)	(0.024)
Tenure	-0.177***	-0.135***
	(0.023)	(0.024)
OWN	-0.377***	-0.437***
	(0.042)	(0.044)
INDBD	-0.162***	-0.247***
	(0.018)	(0.022)
Observations	31,909	31,909
R^2	0.050	0.034
Max. Possible R^2		0.438

Note: Table 5 shows logistic regression results of the full sample of 31,909 firm year observations of CEO turnover against the effects of oil price volatility and performance sensitivity. Column one (1) shows beta coefficients logistic regression results with CEO turnover as dependent variable without fixed effects. Column two (2) shows conditional logistic regression beta coefficients with industry and year fixed effects. CEO Turnover=1 if CEO was changed in a given yaer and 0 if no turnover happened. Oil price volatility is the standered deviation daily West Texes Intermediate crude oil price. Volatility *ROE variable represents performance sensitivity in terms of oil volatility times ROE.

p<0.1; p<0.05; p<0.01

from turnover odds of 16% to 4% when including oil price volatility as a moderator between firm performance and CEO turnover. Therefore, board of directors include oil price volatility and economic uncertainty when deciding on CEO's future, rather than just evaluate CEOs solely based on firms performance, thus H1 can be rejected.

7.2 Oil Dependent vs Non-Oil Dependent Groups Regression Results

Table 6 includes comparison of oil dependent industries vs non-oil dependent industries with standardized independent variables. Column one (1) shows beta coefficients results of logistic regression as per equation (1) but without fixed effects while column three (3) shows beta coefficients of conditional logistic results including fixed effects for oil dependent companies as shown in equation (1). Results for non-oil dependent companies are shown in column two (2) in form of logistic regression without fixed effects while column four (4) shows the results of conditional logistic regression with fixed effects for non-oil dependent observations. Like full sample test, both oil and non-oil dependent panels in Table 6 show negative and high significance association at 99% confidence level between CEO turnover and percentage of independent directors (INDBD), percentage of ownership (Own), and ROE. On the other hand, Tenure variable in Table6 shows different association with CEO turnover in term of significance in the two industry groups when I include fixed effects in columns 3 and 4. For instance, correlation between tenure and CEO turnover for oil reliant companies does not show significant results with beta coefficient of -0.046 as per column (3), on the other hand the same variable shows strong significant negative association between tenure and CEO turnover at significance level of 99% for non-oil dependent companies with beta coefficient of -0.161 as per column (4), meaning that the odds of CEO turnover in non-oil dependent companies decrease by 14% ($1-e^{(-0.161)}$) for each additional year the CEO stays in office, compared to non-significant odds of 0.04% ($1-e^{(-0.046)}$) for oil dependent companies as indicated in the conditional logistic model in column 3. In term of oil price volatility, the direct association between oil price volatility and CEO turnover stays positive an not significant in columns (3) and (4) when adding fixed effects, therefore CEO turnover does not rely on oil price volatility in nether industry group

In term of firm performance, both industry groups show strong and significant negative association between revenue growth and CEO turnover at confidence level of 99% in Table 6, meaning that the odds of CEO turnover is 23% ($1-e^{(-0.269)}$)for non-oil dependent companies in column (4) compared to 13% ($1-e^{(-0.141)}$)for oil dependent companies in column (3) when revenue growth drops by a whole unit(-100%) .In terms of ROE, both industry groups also show high and significant negative association between CEO turnover and ROE at confidence level of 99%. For the non-oil dependent industries, the chance CEO is changed increases by 21% ($1-e^{-0.230}$) when ROE drops by one unit as shown in column (4). Similarly, the odds of CEO turnover in oil dependent companies are 14% ($1^{-(-0.155)}$) when ROE drops by a whole unit as per column (4). The performance results indicate that both industry groups rely on firm performance when deciding on their CEO's future.

Table 6. Logistic, and Conditional Logistic results CEO turnover performance sensitivity to oil volatility of oil dependent and non-oil dependent group

	CEO Turnover			
	logistic		***Conditional Logistic***	
Variable	**Oil Dependent (1)**	**No-Oil Dependent (2)**	**Oil Dependent (3)**	**No-Oil Dependent (4)**
Volatilty	0.061*	0.025	1.301	0.279
	(0.036)	(0.025)	(0.878)	(0.458)
ROE	-0.231***	-0.146***	-0.230***	-0.155***
	(0.032)	(0.022)	(0.034)	(0.022)
Volatility*ROE	0.073***	0.041**	0.071**	0.039**
	(0.028)	(0.018)	(0.029)	(0.017)
Growth	-0.118***	-0.238***	-0.141***	-0.269***
	(0.036)	(0.029)	(0.041)	(0.030)
Age	0.696***	0.462***	0.711***	0.472***
	(0.044)	(0.027)	(0.045)	(0.028)
Tenure	-0.064	-0.212***	-0.046	-0.161***
	(0.044)	(0.028)	(0.045)	(0.029)
OWN	-0.614***	-0.327***	-0.659***	-0.388***
	(0.113)	(0.044)	(0.121)	(0.047)
Assets	0.070*	-0.013	0.065	-0.010
	(0.041)	(0.023)	(0.047)	(0.025)
Leverage	0.063	-0.047**	0.073	0.025
	(0.053)	(0.023)	(0.059)	(0.033)
INDBD	-0.157***	-0.155***	-0.279***	-0.231***
	(0.034)	(0.022)	(0.041)	(0.027)
Observations	10,197	21,712	10,197	21,712
R^2	0.070	0.045	0.048	0.031
Max. Possible R^2			0.449	0.433

Note: Table 6 shows logistic regression results of CEO turnover against the effects of oil price volatility and performance sensitivity in subsamples of oil dependent and non-oil dependent groups. Column (1) shows beta coefficients results of logistic regression similar to equation (1) but without fixed effects, while column (3) shows beta coefficients of conditional logistic results including fixed effects for Oil Dependent companies as in equation (1). Results for non-oil dependent companies are shown in columns (2) in form of logistic regression similar to equation (1) but without fixed effects, while column (4) shows the results of conditional logistic regression with fixed effects for non-oil dependent observations as per equation (1).

p<0.1; p<0.05; p<0.01

CEO Turnover=1 if CEO was changed in a given yaer and 0 for no turnover. Volatility is the standered deviation of daily West Texes Intermediate crude oil price. Volatility *ROE variable represents performance sensitivity in terms of oil volatility times ROE.

Looking at oil volatility as a moderator between CEO turnover and firm performance, oil price volatility is a strong moderator in both in oil dependent industry group and non-oil dependent group, where Volatility*ROE variable is positively correlated with CEO turnover at confidence level of 95% in column (3) for oil depended and in column (4) for non-oil dependent groups in Table 6. Additionally, oil price volatility weakens the association between CEO turnover and performance more in non-oil dependent industry than oil dependent industry. In other words, the odds of CEO turnover based on performance when account for oil price volatility in oil dependent industries drops to 7% ($1-e^{(-0.071)}$) compared to 4% for non-oil dependent group. Therefore, board of directors consider oil price volatility more in non-oil dependent industries than oil dependent when deciding the fate of CEO based on performance. Hence, H2 can be rejected because CEO turnover performance sensitivity to oil prices is weaker in oil dependent industries than non-oil dependent. One explanation is that Oil dependent industries involve in oil price hedging to reduce the effects of oil price volatility (Chun et al, 2019). Another explanation is that boards of directs in non-oil dependent industries tend to excuse CEOs for financial performance out of the CEO's control, such as drop in products demands due to delay in purchases by costumers in times of high oil prices, which is out of control of CEO (Phan, et al, 2020).

8. Conclusion

Oil prices play major role in everyone's day-to-day activities, when oil prices are high, economic distress increase including inflation and interest rate (Hamoudeh, et al, 2010). Oil prices do not only affect the economy but also effect individuals, for example when oil price increases, price of gasoline for cars increases as well, which puts direct economic pressure on individuals who own cars. Oil prices also effect corporates through firms' performance. This paper studies the link between CEO turnover and oil volatility, where oil price volatility is a moderator between CEO turnover and financial performance answering the research question of what the effect of oil price volatility on CEO turnover-performance sensitivity is. The results are broken down into two main findings, one is the effect of oil price volatility on CEO turnover-performance sensitivity in a full sample of all industries, and second findings of subsamples of oil dependent group and non-oil dependent group. Like prior studies, the full sample shows significant association between CEO turnover and firm performance, CEO age, CEO's ownership percentage, CEO's ownership percentage, and independent directors' percentage. In terms of CEO turnover performance sensitivity to oil price volatility, this paper shows evidence that oil price volatility is a significant moderator for the association between CEO turnover and firms performance (ROE), meaning that oil price volatility weakens the association between CEO turnover and firm performance. On explanation is that oil price volatility creates noise for board of directors when evaluating CEOs based on performance (Bushman et al, 2010), while the other explanation is that boards of directors fear to make wrong choice by firing CEO for uncontrollable events caused by economic

uncertainty (Frye & Pham, 2020). The second part of the results shows how differently oil price volatility effects CEO turnover performance sensitivity in oil dependent industries and non-oil dependent industries, where oil price volatility weakens the association between CEO turnover and performance more in non-oil dependent companies than oil dependent companies. One explanation is that oil dependent companies are involved in hedging activities to reduce the effects of oil price volatility, while non-oil dependents do not engage in such activity (Chun et al, 2019). Second, oil price volatility creates economic uncertainty for non-oil companies when customers tend to delay purchases during high oil prices (Phan, et al, 2020). Therefore CEOs are not blamed for forces out of their control based on the Standard Economic Theory, which concludes that board of directors do not account for forces out of CEO's control when evaluating CEO's performance (Lee et al, 2013).

The findings of this paper contribute to the existing literature by examining the sensitivity of oil price volatility on CEO turnover-firms performance across 170 industries. Also, this paper examines how CEO turnover is affected in oil dependent industries versus non-oil dependent industries in term of firm's performance, CEO characteristic, and board characteristic. Finally, this paper explores new domain of how sensitive CEO turnover-performance in oil dependent and non-oil dependent industries to oil price volatility.

A limitation to this paper is the test results has a low R^2, which suggests that more variables can be added to improve the sample representation. Since this paper focuses on industries that use oil as input rather than output, oil producing companies were excluded from the sample, leaving opportunity of future research on how oil price volatility can affect CEO turnover-performance sensitivity.

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Appendix

Variables Description

Table 6. Variables Description

Variable	Description
CEO Turnover	The dependent variable is measured by assigning 1 if there is a change in CEO of year t in company j or 0 if there was no CEO change
VOLATILITY	Oil price volatility is measured by calculating standard deviation of daily West Texes Intermediate crude oil price in US Dollars of year
GROWTH	Revenue growth iw calculated as percentage of revenue growth in year t from previous year (t-1). Value 1 means 100% increase.
ROE	Return on Equity calculated by dividing net income in year t by the same year's total shareholders' equity
AGE	Age of CEO at year t
IND	Percentage of independent directors at the board in year t. The number is presented as percentage. Value 1 means 100% of the board are independent.
TENURE	Number of years CEO is in office at year t
OWN	CEO's percentage of ownership in company j at year t. the number is presented in percentage. Value 100 means company is 100% owned by CEO
VOLATILITY:GROWTH	A moderator variable of CEO turnover and revenue growth sensitivity to oil prices volatility
VOLATILITY:ROE	A moderator variable of CEO turnover and return on equity sensitivity to oil prices volatility

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