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Crude Oil Prices, Financial Stability, and Stock Market Crashes: Evidence from MENA Countries

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Abstract

Energy is one of the most basic requirements of modern economic life in the world. The international oil prices and stock markets have important relationships with each other. This paper examines the impact of crude oil price growth on stock market crashes at different levels of financial stability. This paper uses logistic regression and STATA to conduct analysis of data. Using a sample of MENA region countries from 1988 to 2017, we find that crude oil price growth negatively impacts stock market crashes only during the average level of financial stability. The impact is insignificant at either a higher or lower level of financial stability. These results are also robust to controlling for a financial crisis period.

Keywords: crude oil prices, financial stability, sovereign credit ratings, stock market crashes.

1. Introduction

Since the last few decades, the world has noticed different peaks and crashes in crude oil prices. The academic literature in this regard started by seminal work of Hamilton (1983) and later researcher investigating the association of crude oil market and financial market activities highlighted that stock market returns are negatively explained by movements in oil prices (Jones and Kaul, 1996; Kling, 1985; Sadorsky, 1999, etc.), but then it moved towards disentangling the oil shocks as if they have been created in forces from demand-side or supply-side (Kilian and Park, 2009; Kilian, 2009; Hamilton, 2009, etc.). Still, now, crude oil has an essential role in world economies, and it has also been an important matter for economists. Thus, researchers have continued to put their focus with numerous studies at a sectoral, country-specific, regional and global level (Zhu et al. 2011; Ftiti et al. 2016; Dutta et al. 2017; Hu et al. 2018; Kang et al. 2017; Luo and Qin, 2017; Xiao et al. 2018;

Tursoy and Faisal, 2018; Ji et al. 2018; Hamdi et al. 2019). This list is, of course, not complete by any means but provides sufficient argument to highlight the importance of oil markets among finance and economics professionals. On similar lines, Wang et al. (2013) highlight that the nature of this relationship is highly sensitive that whether a country's position in the oil market is a net exporter or a net importer. Similarly, investors react differently to financial markets during different phases of business cycles and different levels of economic and financial stability (Piccini, 1980).

The somewhat different, but conceptually related stream of literature in terms of external shocks and financial market behavior has shown the importance of financial and economic stability for the link of economic shocks and financial market behavior. The basic intuition behind this argument is that countries with different financial and structural systems somewhat behave differently to economic shocks and surprises (Berg et al. 2011) and key function of a financial system is to facilitate and enhance economic processes; to price, manage, and allocate risks; and to help the economy absorb and dissipate shocks from both within and outside the economic system (Schinasi, 2005). Moreover, in terms of oil shocks, it has been documented that macroeconomics consequences are different between structurally diverse countries (Guerrero-Escobar et al. 2019; Peersman and Robays, 2012). So taking this intuition as the foundation of our argument, we posit that financial markets of countries will behave differently to shocks in crude oil prices, and the nature of these responses is vulnerable mainly to the financial stability of a nation.

Yet reviewing the relevant literature and considering the argument presented so far, we have noticed a sheer silence regarding the linkages of crude oil price growth and crashes in the stock market, while keeping in context, the financial stability of a country. The financial stability of a country is an important aspect, which needs to be taken into account while examining different perspectives of stock market activities. Motivated from the previous argument, our primary contribution is to fill this surprising void. Accordingly, we probe the impact of crude oil growth on stock market crashes at different levels of financial stability. To do our analysis, we employ a panel of Middle East and North African (MENA) countries. Also, to account for financial stability, we take the level of sovereign credit ratings of a country.

The theoretical channel through which crude oil prices impact and bring fluctuations in stock market activities is well established. Crude oil price fluctuations can be considered as exogenous shocks to macroeconomic indicators, which trickles down to the financial system and financial markets. Theoretically, the economic theory holds that price of any financial asset is determined by its expected discounted cash flow. So, oil prices, being an important factor of production, can affect the stock market through effecting these cash flows unless a complete substitution is available for this factor of production. Hence the changes in oil prices will effect input prices and contribute directly to changes in inflation. These changes will consequently affect investor expectation about the stock market (Hamilton, 1996; Sadorsky, 1999; Arouri and Nguyen, 2010). The more indirect theoretical relationship is explained as oil prices impact stock markets through inflation and

macroeconomic variables. Bjorland (2009) and Jiminez-Rodriguez and Sanchez (2005) suggests that oil prices will have an effect on a country's income and it will consequently affect the expenditures and investments, which in turn have repercussions for productivity and employment (Filis et al. 2011) and ultimately affect the economy and the stock markets. On the similar lines, Bernanke (2016) postulated an argument that stock markets and oil markets have moved similarly in the recent years, based on that one can make a judgment that fluctuation in oil prices bring changes in investors sentiments about future economic conditions, which have a trickle-down effect on stock returns. Due to these arguments, an extensive literature has been devoted to scrutinizing the association between oil price shocks and the stock market. In that case, crude oil prices impact the monetary policy instruments, inflation, and other economic variables, the effects of which are highlighted in stock market activities in both developing and developed economies.

In terms of research gap, this paper attempts to resolve the debate and tension in literature regarding the either positive or negative effect of crude oil prices on stock market activities. For example, Jones and Kaul (1996) theoretically justify negative link between crude oil prices and stock market returns. Similar results are documented by Sadorsky (1999); Hammoudeh and Li (2005); etc. On the other side, El-Sharif et al. (2005); Narayan and Narayan (2010); etc. documented positive relationship between oil-stock nexus. We attempt to resolve this debate by arguing that context of country matters a lot in the direction of this relationship between crude oil and stock market, as pointed out by Kilian and Park (2009); Cong et al (2008); Kilian (2009); etc. So accordingly, we reexamined this relationship keeping in context the financial development of the country.

The findings of this research will be useful for policy makers to act appropriately to changing oil prices to absorb its negative effect. The findings will be also be useful for traders trading in derivative instruments to appropriately hedge their futures contracts. Finally, global investment managers can benefit from this paper to appropriately weigh their portfolio according to changes in international oil prices and their impact on stock markets.

Generally speaking, a stable financial system of a country helps in the efficient allocation of resources and absorbing shocks, thus preventing them from having a disruptive impact on the financial system. Similarly, during financial instability, asset prices deviate from intrinsic values and, in extreme cases, may even lead to stock market crashes (Schinasi, 2005). Accordingly, we contribute to the existing literature in the following ways: (1) Despite the plethora of studies examining the nexus of crude oil and the stock market to date, there is no empirical evidence examining the impact of crude oil price growth on stock market crashes. Stock market crashes are different and more valuable to study as compared to volatility because volatility can have both positive and negative effects on the stock market. But crashes always have negative repercussions on the stock market; (2) Second, most of the previous studies fail to incorporate the financial development and stability of the financial system of the country into their analysis. The financial system of a country has crucial importance in risk allocation and absorption of economic shocks. This paper fills this void and incorporates financial stability in the panel of countries as an essential determinant to consider in this relationship; (3) Third, our analysis employs a

multivariate framework with the inclusion of additional regressors. Apart from crude oil growth and the stock market, this paper includes Fama-Franch three return factors into the analysis to get better estimates; and (4) We conduct our analysis by employing the data by three major sovereign credit rating agencies namely: Standard & Poor's, Moody's, and Fitch. The distinction is necessary between these rating agencies, to assess any difference between their impacts. Overall, our results suggest that the growth of crude oil prices negatively impact stock market crashes at an average level of financial stability. The effect is insignificant at the either low or high level of financial stability.

In the remaining parts of the research paper, we provide a summary and review of previous related studies in section two. The third section discusses and describes a data set and methodology, and in section four, we present estimation results. Section five provides a brief discussion along with concluding.

2. Literature Review

The existing literature seems to be slanted in investigating the association between crude oil prices and stock market, while keeping in the context the financial stability of a country. The literature on the nexus of crude oil and the stock market is pioneered by Hamilton (1983). After that a large chunk of those researcher put their emphasis on investigating shocks in crude oil markets and their repercussion on economic indicators along with the stock market. Later in this stream, literature seems to deviate and disentangled into a few major themes. Most of the research papers have employed time series analysis and literature is quite scattered in different directions with no conclusive and concrete evidence.

In the early researches done in this stream, most of them documents the presence of a significant negative link between them. Jones and Kaul (1996) reported the evidence along with Sadorsky (1999) and others, which provide reasonable support for this notion. In the following researches, Hammoudeh and Li (2005) used daily data in their analysis and highlighted that crude oil price growth negatively impacts world capital markets. On similar lines, Ghouri (2006) showed West Texas Instrument Cushing negatively explains US monthly stock positions. Miller and Ratti (2009) investigated the long-run link of the international stock market and world prices of crude oil and report that surge in oil prices negatively explain stock market indices. Employing a novel Markov-Switching EGARCH technique to probe this issue, Aloiu and Jammazi (2009) used the data of Japan, UK, and France from 1989 to 2007 and documented the series of two episodes over the sample period and also reveal the same negative relationship. On similar lines, Chen (2010) analyzed monthly returns from the price index of S&P's. By using different measures of oil price shock and Markov-Switching, they suggested that the probability of occurrence of bearish behavior in the stock market gets increases after an increase in prices of crude oil. Moreover, some studies have also tested this connection in the context of emerging economies. While exploring this relationship, Basher and Sadorsky (2006) controled for local as well as international risk factors and document the negative link between these two variables. On similar lines, Hammoudeh and Choi (2007) used the Sample of Asia-Pacific countries, and data of GCC countries are employed by Nandha and Hammoudeh (2007).

Both of these studies document significant evidence and show that a decrease in stock prices is caused by crude prices increase, and the opposite is valid for a decline in crude oil prices. Kang et al. (2017) explored the interaction of economic policy uncertainty and structural oil shocks on real stock returns and found that structural oil shocks significantly explain real returns. A change in economic policy amplifies this relationship.

In contrast to earlier studies, evidences started to emerge documenting that the stock market and crude oil shocks are significantly and positively related. In this regard, stocks of the oil and gas sector of the UK are analyzed by El-Sharif et al. (2005) and revealed the presence of the positive effect of volatility in oil prices on the value of shares within the energy sector. Narayan and Narayan (2010) provided evidence that stock prices, oil prices, and nominal exchange rates are cointegrated in the Vietnam stock market. Arouri and Rault (2012) use bootstrap panel cointegration techniques and revealed that stock prices are favorably increased by oil surge in oil prices in GCC countries.

After that, few authors also provided evidence that no conclusive nexus exists between crude oil and financial market activities. Al Janabi et al. 2010 analyzed oil and gold price shocks in equity markets of GCC and report no significant association for both gold and oil prices, which is evident by the Granger causality test. Similarly, structural oil shocks in 8 countries are probed by Apergis and Miller (2009), which highlighted that oil marker shocks do not explain international stock markets in significant ways. Analyzing stocks of an alternative energy sector, Henriques and Sadorsky (2008) also did not find results regarding the explanation of stock returns for shocks in the oil market.

The debate on the nexus of crude oil prices and the stock market did not stop there. Many documentations came across that the nature of this relationship largely depends upon various other factors. Pioneer studies in this regard are Kilian and Park (2009) and Kilian (2009). These papers analyzing the connection of the stock market and crude oil shocks documented that reaction of stock returns is sensitive mainly to shocks as being driven by supply or demand forces. Similarly, Cong et al. (2008) showed that the impact on different indices is non-identical, which largely depends upon the various condition of the Chinese market. Moreover, the nature of the country as either net oil importer or net exporter also play a role in sensitizing this relationship. On similar lines, Park and Ratti (2008) documented being a net importer or exporter of crude is very sensitive concerning this relationship. Similarly, Wang et al. (2013) provided evidence that nature, along with strength and even the duration of this relationship, depends upon oil-exporting or oil-importing nature of an economy. Moreover, it also relies on the importance of oil for that country.

Since the significance of crude oil in world economies cannot be denied, it is still attracting interest among research communities. Recently, Hu et al. (2018) did an asymmetric time-varying analysis in the Chinese stock market. The findings of their research suggested that only oil shocks on demand-side have a significant impact on the Chinese stock market, while supply-side shocks do not bear any effect. Similarly, Dutta et al. (2017), while exploring this relationship, concluded that uncertainty in the oil market has a substantial spillover on actual oil market volatility. Moreover, stock returns show evidence of response

to fluctuation in the implied oil volatility index. Examining the co-movement of the stock market and oil prices, Ftiti et al. (2016) documented the presence of this behavior only in the short and medium-term. Also, these movements are more predominant from the shocks of the demand side. On the similar footings, Ji et al. (2018) used data of BRICS countries and document positive and time-varying relationship, specifically stock returns are mainly responsive to demand shocks. They are generally insensitive to oil supply shocks. Tursoy and Faisal (2017) compared gold and oil price shocks, both in the long and short run. They provided evidence of the opposite effect as a negative link is found in terms of gold prices and stock prices, while oil prices and stock returns bear a positive relationship. In terms of more recent papers, Gkillas et al. (2020) examined the nexus between oil shocks and volatility. Using a sample from 1988 to 2015 and employing non-parametric causality-in-quantiles test, they document that oil shocks are very informative in predicting volatility jumps in S&P500. Tuna et al. (2021) analyzed the causality of oil prices and both Islamic and conventional stock markets. Using the asymmetric causality test, they show that oil prices are an efficient predictor of stock market performance by providing the evidence of causality for both Islamic and conventional stock markets for both positive and negative oil shocks.

On the basis of above mentioned debate, it is evident that the relationship between crude oil prices and stock market activities is analyzed with the assumption that underlying variables exhibits a linear and symmetrical adjustment process. However, there are a lot of other factors that need to take into account, like net importer or exporter of crude oil, supply/demand forces, the country's institutional level, etc. This paper significantly caters the shortcomings of the stream that documented the linear relationship and ignore that the context of the country strongly matters while studying the relationship between crude oil prices and stock market. Also, most of the previous work in this stream has used time series of a single country. Only a handful of studies has used panel data to analyze this relationship. This paper also fills this void and do panel data analysis at international level using 11 MENA region countries.

3. Data and Methodology

In this research, we study 10 countries of the Middle East and North Africa, commonly known as the MENA region, employing data from 1988 to 2017. The selected countries are Bahrain, Egypt, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Turkey, and United Arab Emirates. Table 1 provides the list of our sample countries. Multiple sources are utilized to gather data for this study. For data on crude oil prices, the Datastream database has been used. The same is the case with the data for stock market crashes.

Table 1: List of Sample Countries

Bahrain	UAE	Egypt	Iraq	Israel	Jordan	Kuwait
Lebanon	Oman	Qatar	Saudi Arabia		Turkey	

Along with that, the Fama-French library has been used to gather data for return factors. For macroeconomic and control variables, relevant information from World Bank World Development Indicators has been obtained. Respective websites of credit rating providers are used to collect data for sovereign credit ratings.

The robustness of our analysis is achieved by using multiple proxies for both crude oil prices and sovereign credit ratings. Two proxies were employed for international crude oil prices and three major sovereign credit ratings were used to gauge the level of financial stability. To further bolster the reliability of the analysis, we first analyse the full sample. Then further to rule out the possible effect of mortgage financial crises, we divide our sample into two time periods and analyse them separately.

To make a proxy for world oil prices, we employ two renowned indicators, namely, "West Texas Intermediate" (WTI) and "London Borough of Brent" (Brent). To do the analysis, daily data of oil prices is gathered from the Datastream database. From daily price data, we calculate the growth rate of oil prices. Besides, this paper uses Fama French stock return US factors, such as: the "excess market return over the risk-free rate" (Mkt-RF), "Small Minus Big" (SMB), and "High Minus Low book to market value" (HML). These factors are fetched from the online library of Fama and French and are generally used for stock return, as done in Fama and French (2012).

"A sudden, dramatic decline in stock prices across the cross-section of the stock market" is usually considered as a stock market crash. The threshold of calculation of stock market crashes is both time and market dependent. The daily closing value of the total market index is used to calculate crashes. In this case, we take a 5% downfall in the stock market index as a proxy of a crash following Gulko (2002) and Wang et al. (2009). For that proxy, a growth rate in the price index is calculated daily. If the downfall in the value of the index is below 5% on any given day, that day will be counted as a crash. Those days in which stock markets were closed, such as on weekends and other holidays, the subsequent opening day has been taken as the next working day, and crashes are calculated using that day. In this scenario, our dependent variable of a stock market crash is created, which has the value of 1 if the index crash on that day and will remain 0 otherwise.

$$\psi = \log\left(\frac{p_i}{L.P_i}\right) * 100 \tag{1}$$

Where ψ is a percentage growth of the price index.

$$SMC = \begin{cases} = 1 \; if \; \psi < -5.0 \\ = 0 \; if \; \psi \geq -5.0 \end{cases} \tag{2}$$

To proxy for the financial stability of a country, we employ a level of sovereign credit ratings in this paper. In this regard, it is well accepted that the sovereign credit ratings of a nation can be reasonably used to reflect financial stability and sovereign risk of a country (Kaminsky and Schmukler, 2002 and Kiff et al. 2012, etc.). Data for credit ratings is collected from three major credit rating agencies (CRAs). These CRAs are Standard & Poor's, Moody's Investors Service, and Fitch Ratings. For the notations used by these

CRAs, the highest rating is denoted as AAA by S&P, Aaa by Moody's and AAA by Fitch. Similarly, D, RD, and DD/D correspond to lowest ratings by S&P, Moody's and Fitch, respectively. Moreover, roughly the top half scores of each rating agency are regarded as investment grades and lower half as speculative grade, as depicted in Table 2.

Table 2: Sovereign Credit Rating System

Characterization of Debt and Issuer		**Ratings**			**Linear Transformation**
		S&P	**Moody's**	**Fitch**	
Highest Quality	Investment Grade	AAA	Aaa	AAA	22
High Quality		AA+	Aa1	AA+	21
		AA	Aa2	AA	20
		AA-	Aa3	AA-	19
Strong Payment Capacity		A+	A1	A+	18
		A	A2	A	17
		A-	A3	A-	16
		BBB+	Baa1	BBB+	15
		BBB	Baa2	BBB	14
		BBB-	Baa3	BBB-	13
Likely to Fulfil Obligation	Speculative Grade	BB+	Ba1	BB+	12

The rating categories themselves do not provide any significant information about a particular class. To do an econometric analysis, these categories need to transform into some numerical value. To facilitate the empirical investigation using these ratings, sovereign ratings are linearly transformed following Cantor and Packer (1996). In this particular methodology, the discrete number system is used to code for the information content of credit ratings that works as a code of the decision of rating agencies. So that a linear scale is formed that contains group ratings in 22 categories, for example, for S&P, 22 is assigned to AAA, 21 to AA+, 20 to AA, and so on 1 to D, as depicted in Table 2.

The summary of the variable list along with their definition, and sources is given in Table 3.

Table 3: Description of Variables

Variable	Definition	Source
Stock market crash	5% downfall in the stock market index	Datastream database
Mkt-RF	Stock market excess return over the risk-free rate	US factors from the online library of Fama and French
SMB	Small minus big return factor	US factors from the online library of Fama and French
HML	High minus low book to market ration return factor	US factors from the online library of Fama and French
Crude Oil_Growth	The growth rate of crude oil prices of either WTI or Bent	Datastream database
SCR	Level of sovereign credit ratings of S&P, Moody's and Fitch	Respective websites of credit rating agencies.

Table 4 provides us with the summary stats of sample data. In our sample, the average country in our sample has a 0.001 stock market crash on a single day. Similarly, the Mkt-Rf of our sample countries is 0.034, with the range of -8.95 of minimum to 11.35 of maximum. Likewise, the average country in our sample has the size premium of 0.0023 and book to market ratio premium of 0.0084. Moving towards the summary of crude oil prices, WTI has a much more extensive range as compared to London Brent with an average value of 0.0044% growth in WTI and 0.00398% growth in London Brent daily. Moving towards the level of sovereign credit ratings, the range for S&P and Fitch is 7 to 20, and Moody's has a scale of 6 to 20. In other words, the range of ratings for S&P is –B to AA. For Moody's, it ranges from Caa1 to Aa2, and credit ratings for Fitch range from –B to AA. This can be reconciled by having a look in Table 3 that provides a numerical range of sovereign credit ratings and their linear transformation information. Moreover, in our sample, an average country has a numerical rating value of just above 13, and they nearly make them be in investment grade.

Table 4: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Stock market crash	55,014	0.009307	0.096022	0	1
Mkt-RF	95,232	0.034492	1.083078	-8.95	11.35
SMB	95,232	0.002399	0.574542	-5.09	3.83
HML	95,232	0.008446	0.580112	-4.22	4.83
Crude Oil_Growth (WTI)	99,426	0.044569	2.465674	-33.1045	30.97072
Crude Oil_Growth (Brent)	99,426	0.039815	2.239733	-30.317	19.87716
SCR (S&P)	58,683	13.47385	4.140224	7	20
SCR (Moody's)	62,224	13.80157	3.969442	6	20
SCR (Fitch)	39,527	13.46629	4.398877	7	20

Notes: The stock market crash is a 5% downfall in stock market index Mkt-RF is the excess return over the risk-free rate. SMB and HML are Fama-French factors of the small minus big and high minus low book to market ratio, respectively. Crude Oil growth is the growth rate of crude oil prices in percentage terms. SCR is the level of sovereign credit ratings of S&P, Moody's and Fitch.

Since our dependent variable is dummy, we will be using logistic regression in our analysis. A logit regression describes the relationship between a dichotomous dependent variable that can take the value of 1 or 0 otherwise. In our case, it will take a value of 1 if there is a stock market crash on a single day and take a value of 0 otherwise. Next, let X_j be a collection of k independent variables, which can be qualitative or quantitative.
So our dependent variable will have a binomial distribution with one tail, with a probability of p_i.
The general model of logistic regression is as follows:

$$y = \begin{cases} 1 \; with \; probability \; p \\ 0 \; with \; probability \; 1-p \end{cases} \tag{3}$$

Given the fact that we want to model p as a function of regressor x, there is no loss of generality in setting the outcome values to 1 and 0. For our observed outcome, the probability mass function, y, can be written as $py(1-p)1-y$. In that case the $E(y) = p$ and $var(y) = p(1-p)$
The regression model, in this case, can be modeled by parameterizing p to depend upon the index function $X`\beta$, β denotes a vector of the unknown parameter, and x refers to the k*1 vector of regressors. So we can write a conditional probability function in a standard binary model as follows:

$$p_i = Pr(y_i = 1|x) = F(X_i`\beta) \tag{4}$$

Where F(.) is a specialized parametric function of $X`\beta$, usually a cumulative distribution function on (infinity) because this ensures that bounds are satisfied.

For logistic regression, we can write $F(X_i`\beta) = e^{X`\beta}/(1 + e^{X`\beta})$
The regression equation in our analysis is as follows:

$$SMC_{it} = \alpha_{it} + \beta_1(Mkt - RF)_{it} + \beta_2 SMB_{it} + \beta_3 HML_{it} + \beta_4 SCR_{it} + \beta_5 CO\_Grth_{it} + \beta_6 SCR_{it} * CO\_Grth_{it} + \varepsilon_{it} \quad (5)$$

Where *i = 1… N* represents a stock market of each country, and *t = 1… T* denotes indexing of time in years. The dependent variable, SMC, is the number of stock market crashes per year per country. Mkt-RF, SMB, and HML are stock return factors of Fama-French, SCR is the level of sovereign credit ratings, CO_Grth is the growth rate of crude oil prices, and ε denotes an error term distributed independently across time and country.

4. Results

We will use logistic regression to estimate our model due to the binary nature of the outcome variable. Table 5 provides the estimation results of equation 5. First, we estimate equation (5) using the oil prices of WTI along with three major sovereign credit ratings individually. Panel A of Table 5 gives the estimation result of this analysis. After that, we estimate the equation (5) using oil prices of London Brent along with three different sovereign credit ratings, and Panel B in the table (5) gives results for that. Our dependent variable is a stock market crash, which bears the value of 1 if there is a 5% downfall in the stock market index in two consecutive days and a value of 0 otherwise. In the table (5), model (1) provides results using credit ratings by S&P, model (2) uses Moody's rating, and model (3) contains results using ratings by Fitch. The same pattern is repeated in panel B, with Brent prices, in which model (1) uses ratings from S&P, (2) is for Moody's and (3) contains ratings from Fitch. In the case of S&P and Moody's ratings, our total sample of countries is ten. In comparison, the sample is nine countries in the case of Fitch ratings.

First of all, we will have a look at the coefficients of Fama-French three return factors, namely Mkt-RF, SMB, and HML. Looking at panel A, Mkt-RF has a negative sign in all cases of panel A, which simply translates into that excess return over risk-free rate is negative in the context of middle eastern markets. The size premium also shows negative signs in all models of panel A, which is intuitive that smaller companies, due to the riskiness of their operations, have higher returns. However, SMB is insignificant. The HML factor has different signs in different models and slightly significant only in the case of Fitch ratings in the model (3).

Next, we move towards our variables of interest, which are crude oil price growth and sovereign credit ratings. Model (1) is for S&P in which crude oil growth has a negative sign, but it is insignificant. S&P rating also has a negative sign at 5% significance, and their interaction term also negatively impacts stock market crashes. In model (2) for Moody's ratings, we observe almost similar results, except that the interaction term of crude oil growth and sovereign credit rating is insignificant. Next, we move towards a model (3), which uses Fitch ratings. In this case, we find different results from the first two models. Crude oil growth, Fitch Ratings, and their interaction terms are all insignificant in that case.

Prices of London Brent is used in Panel B to proxy for crude oil prices. The estimation outcomes are more or less similar to panel A, with few exceptions in significance levels

and magnitudes. First, we look at the coefficients of Fama French factors. In all models of panel B, Mkt-RF has a negative sign, which shows that the excess return of the market above the risk-free rate in our sample is negative. SMB has a negative sign, but insignificant. Along with that, HML has a mixed pattern in different models, and it is insignificant as well.

Moving to the coefficients of crude oil growth and sovereign credit ratings, outcome bolsters the findings of Panel A. In model (1) for S&P, crude oil growth is insignificant, the S&P sovereign credit rating is negatively significant, and their interaction term is also negative and significant. In model (2) for Fitch ratings, only the coefficient of sovereign credit rating is significant with a negative sign. Both crude oil growth and its interaction term with credit ratings are insignificant. In model (3) for Moody's, we observe that all of these variables are having different signs, and all are insignificant as well.

In terms of interactive models, we know the coefficients of variables are not directly interpretable. So, we cannot draw an inference based on z statistics because model parameters do not provide direct reasoning in the case of an interactive model. To derive a conclusion about our main explanatory variables, we have to look at the margins plot of marginal effects and confidence interval in Fig. 1. The upper row provides margins plot of panel A, and the lower row is for panel B. Our results provide a fascinating insight regarding the interactive association of oil price growth and crashes in the stock market at different thresholds of financial and economic stability. First, we look at the margins plot of panel A, which uses WTI to proxy crude oil prices.

From the margins plot, it is apparent that the nature of the association between crude oil growth and stock market crashes changes for a level of financial stability. More specifically, our results highlight that no significant linkage exists between oil price growth and the stock market at a lower threshold of financial stability. A similar outcome is documented for a higher threshold level of financial stability, as proxied by higher levels of sovereign credit ratings. Our estimations provide a significant association of crude oil growth and stock market crashes with a negative impact on the middle range of financial stability of a country. At this average level of financial stability, we can observe that growth in crude oil prices has a significant favorable effect on stock markets as it leads to a decrease in crashes in the stock market in the MENA region countries. The same pattern is apparent in all three margins plots using three different sovereign credit rating agencies in the first row. Next, we move towards the lower row of margins plots, which are from panel B, using Brent as a proxy of oil price. Overall, similar results are available using the prices of Brent, with a slight difference in the margins plot using credit ratings of Fitch.

Table 5: Regression Results

	Panel A (WTI)		
	Model 1	Model 2	Model 3
Mkt-RF	-0.215***	-0.187***	-0.215**
	-0.062	-0.065	-0.095
SMB	-0.028	-0.051	-0.069
	-0.072	-0.06	-0.085
HML	0.007	-0.05	0.142*
	-0.115	-0.119	-0.074
Crude Oil_Growth	-0.006	-0.04	0.044
	-0.032	-0.051	-0.084
S&P_Rating	-0.173**		
	-0.085		
S&P_Rating*Crude Oil_Growth	-0.008**		
	-0.004		
Moody' s_Rating		-0.235***	
		-0.038	
Moody' s_Rating*Crude Oil_Growth		-0.004	
		-0.005	
Fitch_Rating			-0.204
			-0.164
Fitch_Rating*Crude Oil_Growth			-0.015
			-0.009
Constant	-3.586**	-2.477***	-3.412
	-1.426	-0.941	-2.806
Observations	38,081	42,599	22,600
Number of countries	10	10	9
	Panel B (Brent)		
	Model 1	Model 2	Model 3
Mkt-RF	-0.216***	-0.189***	-0.226**
	-0.057	-0.062	-0.093
SMB	-0.029	-0.051	-0.07
	-0.071	-0.061	-0.084
HML	-0.003	-0.057	0.128*
	-0.111	-0.115	-0.076
Crude Oil_Growth	0.075	0.037	0.041
	-0.075	-0.089	-0.077
S&P_Rating	-0.178**		
	-0.083		
S&P_Rating*Crude Oil_Growth	-0.018**		
	-0.009		
Moody' s_Rating		-0.241***	
		-0.033	
Moody' s_Rating*Crude Oil_Growth		-0.012	
		-0.009	
Fitch_Rating			-0.2
			-0.161

Fitch_Rating*Crude Oil_Growth			-0.014
			-0.01
Constant	-3.562**	-2.413***	-3.431
	-1.426	-0.908	-2.777
Observations	38,081	42,599	22,600
Number of countries	10	10	9

Notes: This table provides the results of our main regression.
Panel A shows the results of WTI crude oil prices.
Panel B gives results using Brent oil prices.
Our dependent variable is stock market crashes. For variable definition and description, please refer to Table 2 and 3.
Standard errors are shown in parentheses.
***, **, * denotes significance at 1%, 5% and 10% respectively

We can analyse our results as follows. The central intuition behind our results is that investors show some reluctance to make investment decisions in stock markets at low levels of financial stability so that we document no significant effects. Investors rather wait for clear signs of improvements in financial stability to react towards them. In terms of a high level of financial stability, all potential sources of betterment in the stock market have already been exploited, so that we get insignificant results at that level as well. At an average level of financial stability, people are very responsive to any change in the economic indicators, so that's why the growth of crude oil prices quickly and significantly gets incorporated in the financial markets of the country.

Contextualising the findings of this paper, the results have mainly bolstered the argument that investors are very active in those markets that are on the average level of financial development. The major function of financial stability is to absorb economic shocks and countries with different financial structure behave differently to financial shocks (Berg et al. 2011). Same is the case with oil shocks that they effect differently to structurally diverse countries (Guerrero-Escobar et al. 2019; Peersman and Robays, 2012).

Overall, our results seem to fit into the stream of literature that holds that the nexus of the crude oil market and stock markets are sensitive to many other factors. Such results are documented by Kilian and Park (2009) and Kilian (2009), who differentiate between demand and supply shocks. Wang et al. (2013) segregate their analysis regarding net oil exporter or importer. The findings of this analysis also bolster the notion that, when it comes to the impact of economic shocks on the country, financial stability matters a lot (Schinasi, 2005). Based on that, we posit that crude oil growth leads to a decrease in crashes in the stock market of a country. However, that relationship hinges mainly on the situation of the financial stability of the country. Moreover, the empirical evidence presented implies that investors can benefit from global diversification strategies by incorporating financial stability of the country while making investment decisions based on crude oil price movements.

Further contextualizing results with respect to MENA region countries, our results fit into the general conclusion hold that crude oil prices and stock market returns are negatively

related. Further, in terms of overall financial development of MENA regions, these countries are not as developed as US and European countries and not as underdeveloped as third world countries. So, they are at an average level of financial stability and development. Further rationale for the results can be attributed to investor's behavior, as they hesitate to invest either in highly developed markets that have utilized their full potential and those markets that are very fragile to justify any investment. So, our results are very much in line with level of financial stability of MENA region countries.

Crisis Vs. Non-crisis period:

In the next part of the analysis, we do a robustness test by splitting our sample into two time periods to control for potential bias in our results, which may have caused by including the crisis period. We take a crisis period as a period of 2007 and 2009. First, we show estimations of the non-crisis period, and then we move towards the analysis of the crisis period.

Table 6 contains the estimations of the non-crisis period. Panel A gives the results using the oil prices of WTI, and panel B provides estimates for using Brent oil prices. Model 1 offers results using sovereign credit ratings of S&P, model 2 uses ratings from Moody's and model 3 uses ratings from Fitch. First, we look at the coefficients of Fama-French factors. Similar to the main model, Mkt-RF has a negative sign, which depicts that the market excess return above the risk-free rate is negative. The coefficients for SMB and HML are also having sign and significance similar to the primary model. Next, we analyze the factors of sovereign credit ratings and crude oil growth. In model 1, which uses ratings from S&P, our results show the same pattern as that of the primary model. In model 2, which uses Fitch's ratings, our results are again similar to main regressions with a slight difference in the coefficients. Model 3, which uses Moody's credit ratings, also shows the same pattern similar to the primary model. Next, we move to Panel B, which uses crude oil prices of London Brent. In all three models of panel B, Fama-French, the results are similar to that of the main model, as Mkt-RF is negative and significant.

Along with that, SMB and HML also show results similar to that of the primary model. Moving towards the coefficients of sovereign credit ratings and crude oil price growth, we observe a somewhat different pattern. The crude oil growth is significant and negative in all models. Moreover, the coefficients of ratings by S&P and Moody's are negative and meaningful, but ratings of Fitch have a negative sign. In terms of their interaction terms, models 1 and 2 shows insignificant interaction terms, while the interaction term of Fitch ratings and crude oil growth in model 3 negative and significant.

To draw inference regarding the interactive behavior of crude oil growth and sovereign credit ratings on stock market crashes, we will look at the margins plot of table 6, available in Fig No. 2. Upper row provides margins plot of panel A, which uses WTI as crude oil price, and lower row contains margins plots of panel B, which uses Brent as crude oil prices. Overall, our results provide robustness to our main models in terms of the interactive impact of crude oil growth and sovereign credit ratings on stock market crashes. Looking at the upper row, we almost see a similar pattern that at either very low or very high level of sovereign credit ratings, the impact of crude oil growth on stock market

crashes is insignificant. There is a slightly different result if we use ratings of Fitch, which shows the effect is also significant at a higher level of credit ratings. Now we move towards the lower row, which shows results using Brent for oil prices. In this case, we also document similar results to that of the main results, which is that impact of crude oil growth on stock market crashes is negative and significant only at an average level of financial stability. This impact is insignificant at either higher or lower level of financial stability depicted by sovereign credit ratings.

Table 6: Non-Crisis Period

	Panel A (WTI)		
	Model 1	Model 2	Model 3
Mkt-RF	-0.235***	-0.215***	-0.245**
	-0.079	-0.078	-0.114
SMB	-0.139	-0.161	-0.169
	-0.135	-0.107	-0.167
HML	-0.06	-0.157	0.064
	-0.166	-0.167	-0.149
Crude Oil_Growth	0.03	-0.015	0.086
	-0.063	-0.074	-0.105
S&P_Rating	-0.233**		
	-0.112		
S&P_Rating*Crude Oil_Growth	-0.011*		
	-0.006		
Moody' s_Rating		-0.317***	
		-0.072	
Moody' s_Rating*Crude Oil_Growth		-0.005	
		-0.007	
Fitch_Rating			-0.187
			-0.188
Fitch_Rating*Crude Oil_Growth			-0.017*
			-0.01
Constant	-2.792*	-1.54	-3.381
	-1.638	-1.245	-3.049
Observations	32,337	36,731	19,124
Number of Countries	9	10	8
	Panel B (Brent)		
	Model 1	Model 2	Model 3
Mkt-RF	-0.236***	-0.213***	-0.246**
	-0.082	-0.078	-0.119
SMB	-0.138	-0.159	-0.164
	-0.136	-0.107	-0.168
HML	-0.059	-0.153	0.065
	-0.171	-0.167	-0.156
Crude Oil_Growth	-0.063***	-0.055***	-0.053**
	-0.015	-0.013	-0.021
S&P_Rating	-0.228**		

	-0.111		
S&P_Rating*Crude Oil_Growth	-0.003		
	-0.002		
Moody' s_Rating		-0.315***	
		-0.07	
Moody' s_Rating*Crude Oil_Growth		-0.002	
		-0.001	
Fitch_Rating			-0.179
			-0.183
Fitch_Rating*Crude Oil_Growth			-0.005**
			-0.002
Constant	-2.835*	-1.557	-3.432
	-1.629	-1.231	-2.991
Observations	32,337	36,731	19,124
Number of Countries	9	10	8

Notes: This table provides the results of the non-crisis period.
Panel A shows the results of WTI crude oil prices.
Panel B gives results using Brent oil prices.
Our dependent variable is stock market crashes. For variable definition and description, please refer to Table 2 and 3.
Standard errors are shown in parentheses
***, **, * denotes significance at 1%, 5% and 10% respectively

Table 7: Crisis Period

	Panel A (WTI)		
	Model 1	Model 2	Model 3
Mkt-RF	-0.168**	-0.169**	-0.163**
	-0.071	-0.071	-0.07
SMB	0.189	0.189	0.179
	-0.149	-0.149	-0.206
HML	0.069	0.069	0.158**
	-0.145	-0.146	-0.08
Crude Oil_Growth	-0.103	-0.107	0.156
	-0.096	-0.096	-0.173
S&P_Rating	-0.133		
	-0.185		
S&P_Rating*Crude Oil_Growth	0.001		
	-0.006		
Moody' s_Rating		-0.027	
		-0.23	
Moody' s_Rating*Crude Oil_Growth		0.001	
		-0.006	
Fitch_Rating			-0.629
			-0.448
Fitch_Rating*Crude Oil_Growth			-0.033
			-0.023
Constant	-3.669	-5.17	1.392

	-2.282	-3.213	-3.862
Observations	5,744	5,868	3,476
Number of Countries	8	8	5
	Panel B (Brent)		
	Model 1	Model 2	Model 3
Mkt-RF	-0.117**	-0.117**	-0.167**
	-0.055	-0.055	-0.074
SMB	0.139	0.14	0.221
	-0.153	-0.153	-0.263
HML	-0.012	-0.011	0.129
	-0.139	-0.139	-0.099
Crude Oil_Growth	-0.04	-0.054	0.023
	-0.078	-0.083	-0.074
S&P_Rating	-0.164		
	-0.189		
S&P_Rating*Crude Oil_Growth	-0.013**		
	-0.006		
Moody' s_Rating		-0.07	
		-0.223	
Moody' s_Rating*Crude Oil_Growth		-0.011*	
		-0.006	
Fitch_Rating			-0.518***
			-0.066
Fitch_Rating*Crude Oil_Growth			-0.019*
			-0.011
Constant	-3.398	-4.715	0.48
	-2.293	-3.03	-0.474
Observations	5,744	5,868	3,476
Number of Countries	8	8	5

Notes: This table provides the results of the crisis period.
Panel A shows the results of WTI crude oil prices.
Panel B gives results using Brent oil prices.
Our dependent variable is stock market crashes. For variable definition and description, please refer to Table 2 and 3.
Standard errors are shown in parentheses
***, **, * denotes significance at 1%, 5% and 10% respectively.

Next, we analyze the crisis period, which we have taken a period of 2007-2009. The estimation result of this period is available in table 7. Panel A shows results using oil prices of WTI, and panel B provide results using oil prices of Brent. In terms of Fama-French factors. We have similar effects in this case as well, both to the non-crisis period as well as the full time period model. Succinctly, Mkt-RF has a negative sign and significant in all models. Surprisingly, both SMB and HML premiums are positive, but insignificant in all models. For our variables of interest, crude oil price growth and sovereign credit ratings, coefficients of them are insignificant in all models along with their interaction terms. The

margins plot of table 7 is available in Fig No. 3. The upper row provides margins plot of panel A, and the lower row is for panel B. Overall, these results offer a similar pattern to both non-crisis period and full-time period model except few anomalies. Looking at the upper row margins plot, they provide the same pattern of interactive impact of crude oil growth and sovereign credit ratings on stock market crashes to that of the primary model, that is, the effect of crude oil growth on stock market crashes is insignificant at either higher or lower level of financial stability. The impact is negatively significant only at an average level of financial stability. In terms of sensitivity analysis, the overall outcome of these estimations bolsters the findings of our baseline regression. The results are robust in both crisis and non-crisis periods. Similar robust outcomes are documented while using different proxies of crude oil growth and sovereign credit ratings in table 6 and 7.

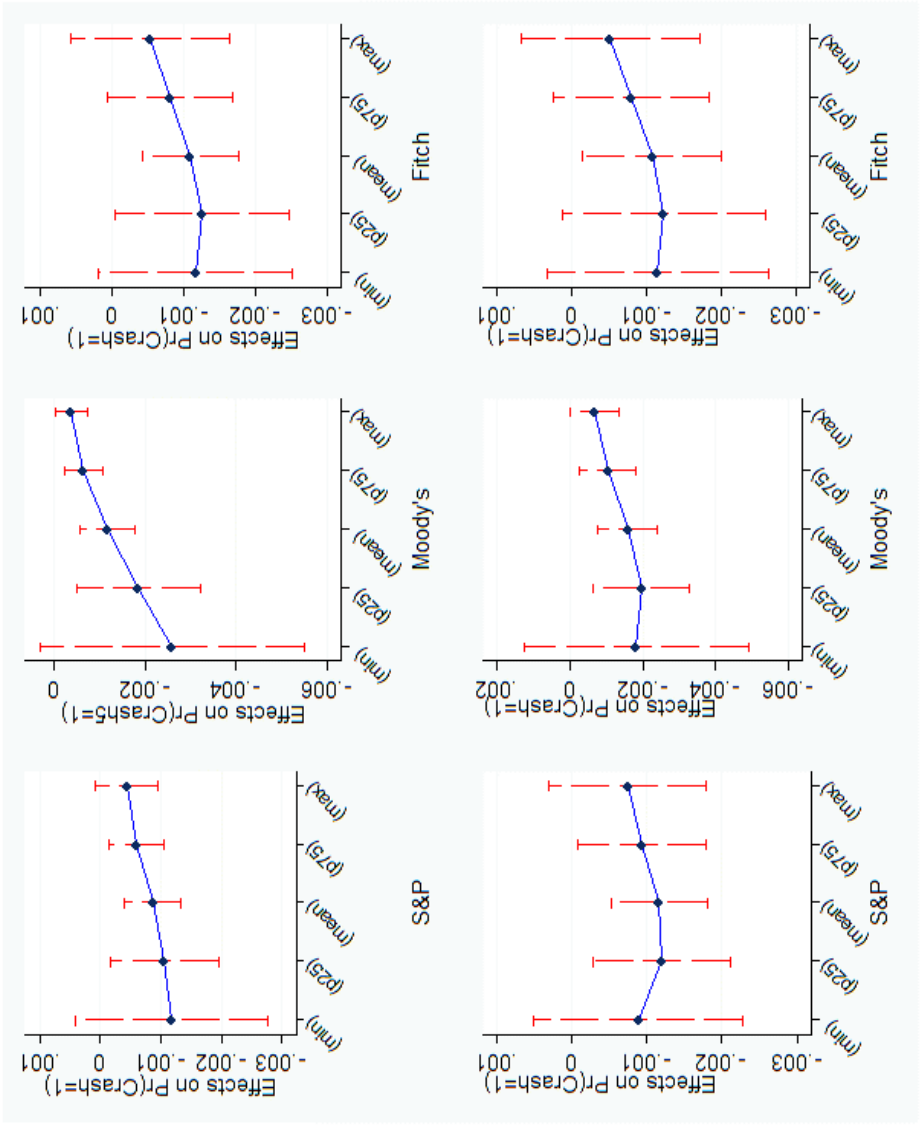

Figure 1: Marginsplot of Table 5

Notes: This figure gives the margins plot of table 5, which corresponds to the main model. The first row provides margins plot for Panel A, and the Second row contains margins plot for Panel B. These margin plots provide the marginal effect of crude oil growth on stock market crashes at a different level of financial stability. The first column of plots corresponds to the credit of S&P, second corresponds to Moody's and the third is for Fitch ratings.

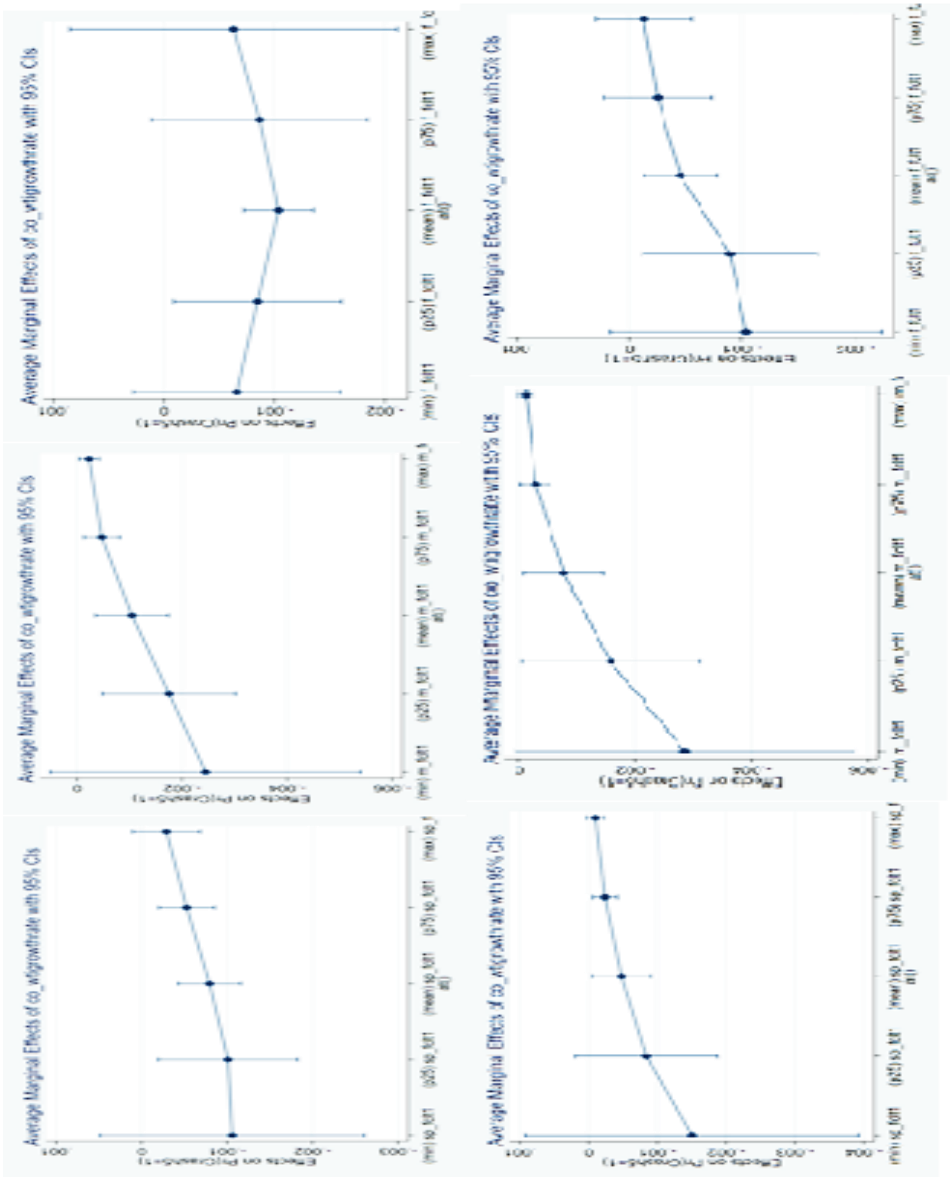

Figure 2: Marginsplot of Table 6

Notes: This figure gives the margins plot of table 6, which corresponds to the analysis of the non-crisis period. The first row provides margins plot for Panel A, and the Second row contains margins plot for Panel B. These margin plots provide the marginal effect of crude oil growth on stock market crashes at a different level of financial stability. The first column of plots corresponds to the credit of S&P, second corresponds to Moody's and the third is for Fitch ratings

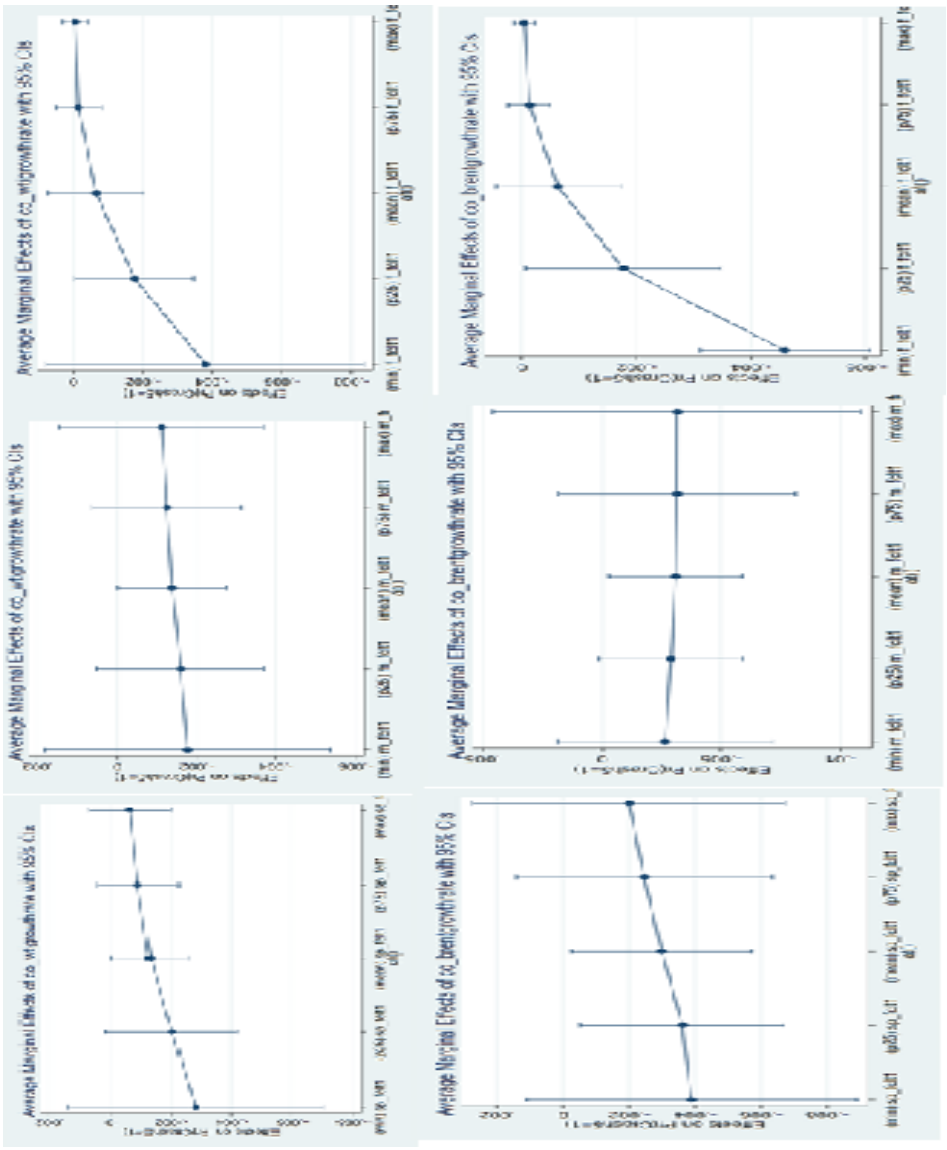

Figure 3: Marginsplot of Table 7

Notes: This figure gives the margins plot of table 7, which corresponds to the main model. The first row provides margins plot for Panel A, and the Second row contains margins plot for Panel B. These margin plots provide the marginal effect of crude oil growth on stock market crashes at a different level of financial stability. The first column of plots corresponds to the credit of S&P, second corresponds to Moody's and the third is for Fitch ratings.

Overall, our results can be summarized as; the impact of growth in crude oil prices on stock market crashes is mostly sensitive to the level of financial stability of a country. Specifically, stock market crashes are negatively impacted by crude oil growth, but only at an average level of financial stability. This impact is insignificant at an either low or high level of financial stability. Our results contribute to multiple interrelated strands of research, ranging from the nexus of the oil market and financial market, the role of economic stability in absorbing economic shocks, and investor's behaviors during different economic scenarios.

Related literature regarding the findings of our paper holds that crude oil prices impact investor behavior, which in turn influence their investment decisions. In this case, Sariannidis et al. (2016) show that the perception of risk among investors is reduced by lowering oil prices. Similarly, Ding et al. (2017) highlighted the fact that fluctuation in oil prices explains significant variations in investor sentiments in the Chinese Stock. On similar lines, He and Zhou (2018) document those both linear and nonlinear changes in investor sentiments are explained by oil specific demand shocks. Related research is done by Shahzad et al. (2019). Linking our work in this stream of literature, our results provide exciting insight regarding the perception of crude oil growth and translating this growth into stock market crashes.

Our results also add to literature to literature that has documented that the financial system of the country determines the nature and intensity of external shocks on the functioning of capital markets of countries. The financial stability of a country helps and facilitates the economic processes, manages risks, and absorbs economic shocks (Berg et al. 2011).

Specifically linking the results to oil-stock literature, our results holds that many other factors are necessary to be considered while analyzing this relationship. In this case, Moshiri (2015) finds that impact of crude oil on countries is not only affected by the country's position as either oil exporting and oil importing, but the level of financial stability is also sensitive to these results. This difference in behavior can also be rationalized by different levels of institutional quality, particularly government effectiveness. Similar evidence is provided by Allegret et al. (2014), which document that current account balances are positively explained by fluctuations in oil prices while keeping in the context that these results are highly vulnerable to the level of financial development of oil-exporting countries. Specifically, more sensitivity is shown by current account positions to oil price variation in financial less stable states and the strength of this relationship diminishes with financial deepness. So our results documents that the average level of financial stability facilitates the crude oil growth to have a decreasing effect on stock market crashes. Putting differently, investor reaction to the crude oil growth largely depends upon the financial development of a country, and this reaction is reflected only at an average level of financial stability.

5. Conclusion

There has been extensive documentation of evidence concerning the association of the crude oil market and the stock market in the last couple of decades. While most of the publications focus on establishing and proving the granger causality between oil market

shocks and financial market activities, we deviate from previous streams of literature and re-examine the link between crude oil price growth on stock market crashes, explicitly taking into consideration the financial stability of the country, in a panel context. This paper focuses explicitly on 10 MENA region countries and analyzes the data from 1988 to 2017. To proxy for crude oil prices, we use two renowned oil price indicators, namely WTI and London Brent. Also, data for sovereign credit ratings are fetched from three major sovereign credit rating agencies. Due to the binary nature of the outcome variable, we use logit regression to do statistical analysis. The estimation results provide evidence that crude oil growth explains significant variation in stock market crashes.

The result of this study provides useful insight regarding the response of stock market crashes to the interactive impact of growth in crude oil prices and sovereign credit ratings. Overall, our results provide evidence of a negative effect in this regard. Specifically, this relationship shows significance at an average level of financial stability, proxied by sovereign credit ratings. The significance of this relationship diminishes at either a very low or higher level of financial stability. These results are robust even after using different proxies for crude oil growth, ratings from various rating agencies, and controlling for potential bias due to the crisis period. Our findings contrast with most of the earlier studies which believe the straightforward oil-stock nexus (Jones and Kaul, 1996; Miller and Ratti, 2009; El-Sharif et al. 2005; Narayan and Narayan, 2010; etc.). Our results are mainly in line with those researchers who hold that this nexus depends upon various other factors (Cong et al. 2008; Park and Ratti, 2008; Kilian and Park, 2009; etc.). So, overall, the findings put emphasis on using the level of financial development of a country while analyzing this nexus.

5.1 Theoretical contribution

Two theoretical arguments exist regarding the oil-stock nexus. In this regards, Jones and Kaul (1996) provide theoretical justification for negative relationship. They argued through cash flow hypothesis that oil is an important determinant in production, So, the increase in prices consequently affects cash flow, earnings, dividends and hence the stock market (Rafailidis and Katrakilidis, 2014). On the contrary, however, Kilian and Park (2009) hold that demand or supply shocks determines the direction of this nexus. This paper provides evidence that is very much close to those argued that financial development of a country matters a lot in this nexus (Wang et al. 2013; Allegret et al. 2014; Moshiri, 2015; etc.). This paper has logical reasoning behind the findings, as financial development and stability of a country is very crucial in behavior of country to different economic shocks (Schinasi, 2005). Also, structurally different country behave differently to macroeconomic changes in the world (Guerrero-Escobar et al. 2019; Peersman and Robays, 2012).

5.2 Contrition of the Study

This study contributes to standing literature regarding crude oil growth and the stock market in many aspects. First, it reconciles the debate regarding the association between crude oil prices and stock market and holds that various economic and market conditions are very critical and sensitive while exploring this relationship, as indicated by Kilian

(2009), Kilian and Park (2009), Wang et al. (2013), etc. Accordingly, this paper bolsters the stream of literature that holds this relationship is very sensitive to the financial development of a country (Allegret et al. 2014; Moshiri, 2015; etc.). In this particular case, we argue that the financial stability of a country is a significant determinant to account for while analyzing the impact of exogenous external shocks, due to which, we accordingly did our analysis. To further strengthen our results, we focus only on MENA region countries and employ credit rating data from the three major agencies and two renowned oil price indicators. More important, most of the previous studies have opted for time series analysis. We deviate from this tradition and conducted panel data analysis in an international setting. This new direction will help pave the path for further research using panel data in crude oil debates. The other major contribution of this paper is the use of panel data for analysis, which will provide more robust results as compared to the time series.

5.3 Implications, Policy Recommendations and Limitations

The result of this paper entails some important recommendations and practical implications related to oil related risk management. Policy makers can use these findings to make decisions appropriately, to mitigate the effect of fluctuations in international oil prices. Policy makers can use futures contract and other instruments to mitigate the impact of oil price uncertainty. The findings also suggest an implication for global portfolio diversification as portfolio of stock in financially stable countries can be better during the time period of high prices. Similarly, stock selection in those countries which are at an average level of financial stability could be a better choice during the decline of oil prices.

The major limitation of this study can be attributed to its use of only MENA region countries. In future studies, analysis can be extended to compare oil exporting and oil importing countries. Also, some other variables of country level financial stability can be used to check for robustness. Moreover, this paper analyses overall stock market. Extension of this research can be done on firm/stock level, and can be analyzed the behavior of different industries towards crude oil prices.

In summary, our results suggest that crude oil growth is favorable for stock markets as it leads to a decrease in stock market crashes, but only at an average level of financial stability. Our results reinforce the related literature in showing that the relationship between crude oil and the stock market depends upon different contexts. These findings will lead to more efficient investment decisions for investors and other market participants.

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