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The Effect of Oil Price, Oil Price Shocks and Oil Sales Shocks on Earnings Management in Downstream Oil Industries Exchange Companies

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ABSTRACT

This study has used the dynamic self-regression vector panel method to investigate the effect of oil prices, oil price shocks and oil sales shocks on accrual earnings management in downstream oil industry stock exchange companies during the years 2014 to 2022. For this purpose, 37 companies were surveyed. First, using the Garch method, fluctuations in oil price and oil sales variables were extracted. Then, the relationship between the variables was determined using a dynamic panel. Finally, based on the vector self-regression panel, the shock of the impact of each of the effective variables on accrual earnings management was investigated. Based on the results of the Garch method, oil prices and oil sales had an Arch effect. Therefore, using this model, the conditional variance of each series was extracted under the heading of fluctuation. Then, based on the dynamic panel method, it was found that oil price has a negative effect on accrued earnings management and oil price shock and oil sales momentum have a positive effect on accrued earnings management. Finally, this result was obtained based on vector auto-regression method, if the variables of oil price, oil price shock and oil sales shock increase by a standard deviation, the accrual earnings management variable will show negative, positive and positive reactions, respectively. Also, according to the results, oil prices have the highest explanation for changes in accrual earnings management.

Keywords: Accrual Earnings Management; Oil Price; Oil Price Shocks; Oil Sales Shocks; Downstream Industries

1. Introduction

The fall in oil prices in 2014 created a wave of shock across the oil industry. From June 2014 to January 2015, the price of Brent crude oil fell from about $ 115 to $ 46 per barrel. The sharp decline was primarily due to increased US Shale oil production and OPEC's decision to maintain production levels on the grounds that low oil prices have more long-term benefits than they would like to lose market share. (McCain, 2015). In a turbulent situation, the reliability of financial statements is essential for stakeholders. However, information asymmetries between producers and users of financial information allow for opportunistic change, thus reducing the quality of financial reporting (Arthur et al., 2015). Basu et al. (2013) stated that financial reports are the most important source of information for investors, analysts and creditors. Awareness of the industry's tendency to perform earnings management activities in critical situations is very valuable for all users of this type of financial information. Studies show that earnings management articles traditionally focus on the factors and consequences of financial information manipulation, while keeping the macroeconomic environment stable or assuming that it is not effective, whereas in the post-financial crisis, this assumption challenged. Empirical studies have shown that significant changes in economic conditions affect companies' willingness to manage earnings, but no theoretical agreement has been reached on how or where to earning management. Directly, the recession does not have the same effect on every industry and so it has the potential to have conflicting motivations. The aim of our study is to focus on the industry that suffered the most from the fall in oil prices in 2014. Indeed, Kjærland et al. (2020) state that reporting motivations should be more homogeneous and homogeneous than in other studies of earnings management studies.

Intuitively, there are reasons to support more and less earning management assumptions in an industry in crisis. More oversight by legislators, financial analysts, and other stakeholders creates incentives to take lower risks and prepare more accurate financial statements. Conversely, volatile environments may also encourage more earnings management. Decreases in actual performance may be offset by revenue-increasing accounting practices to maintain reported performance (Filip and Raffournier, 2014). However, if significant losses are inevitable, a big bath strategy can be encouraged whereby companies exacerbate poor results and so with the reversal of accruals, they increase next year's income. While most studies have reported impact, empirical evidence on how macroeconomic crises affect earnings management behavior is inconclusive and there is no consensus on the direction of the work (Rusmin et al., 2012; Philip and Rafornier, 2014; Persakis and Iatridis, 2015). Given the historic proximity of the 2014 oil price crisis, no earnings management research has been conducted on this event. While the previous events are similar, there are important differences. First, the financial crisis literature examines almost all sectors of the economy. By analyzing the oil industry independently, one can isolate the reaction to the dramatic change in production prices for the companies that suffered the most (Kjærland et al., 2020).

On the other hand, the occurrence of the first and second oil shocks (sudden rise in oil prices) in the 1970s had very significant detrimental consequences on the economic variables of countries, especially oil-exporting countries, and it can be said that today, with the increase in oil prices, the issue of the relationship between oil prices and changes in economic variables has been considered by many countries and economic policy makers. Given that the most important source of government revenue in the Iranian economy is still oil and about 60% of government revenues in the Iranian economy are obtained through oil and gas exports, so the role of oil revenues is still the main source of financing government expenditures. It is effective and important in recent years, with rising oil prices, the government in Iran has injected revenues from oil sales into the economy by adopting different fiscal and monetary policies. Iran's special position in the field of energy in the Middle East, the world and also the strategic importance of hydrocarbon resources in the world economy and given that government expenditures in the Iranian economy in the annual budget by oil revenues in the previous regime and after the victory of the Islamic Revolution in different governments Financing The role of oil in the country's economy has gradually emerged since 1320. The share of the oil sector in government budgets increased in the following decades, and following the first oil shock in the early 1350s, following the increase in oil prices and the influx of its revenues into the country, this share increased sharply and public sector investment in

production Public and private goods and services became heavily dependent on oil revenues. The country's industries were also formed by relying on oil revenues. Production technology, raw materials and intermediates of the country's industries were provided from these revenues. This has led to the country's economy in recent years, given the oil sanctions imposed on the Iranian economy, which was based on the revenues of the oil sector, and as the structure of the country's foreign trade shows that the major share of the country's exports is oil exports, so that the highest percentage of exports of goods is oil exports. The dependence of the trade structure on oil is of a severe dependence type, so that the structure of the country's economy has been highly sensitive to fluctuations in oil prices (Ismail Nia et al., 2012).

Iran is also one of the richest oil-rich countries with 11% of the world's oil reserves. In fact, oil and the revenues from its production and sale have severely affected the performance and efficiency of the entire economy. Therefore, oil revenues have a strategic role in the structure of Iran's economy. On the other hand, Iran, as the second largest producer among OPEC oil exporting countries, is an important and main supplier to the global energy market which can both affect and be affected by the global oil market (Central Bank Economy Indicators, Fourth Quarter, 2008). Another noteworthy point is that all oil industry experts and energy economists agree that a country's oil and petrochemical industry can be one of the most attractive areas for both domestic and foreign investors if it is highly profitable based on economic principles. But Iran lacks a cohesive downstream industry, despite having vast God-given resources for oil and gas. Downstream petrochemical industries have many advantages that if developed, this industry will become one of the main drivers of economic growth. These benefits include less investment, more employment, more added value, more variety of products and exports, and less risk than upstream industries. Therefore, the present study aimed to investigate the effect of oil prices and oil price shocks and oil sales shocks on earnings management in downstream oil exchange stock exchange companies in the Iranian capital market. Most research on earnings management has looked at other related issues and variables. Therefore, the present study can fill this gap due to the lack of experimental research, which can be the difference between the present study and other previous studies and in addition to the importance of doing so, it also proves the thematic innovation aspect of the research. In the continuation of this article, first the theoretical foundations and research background are reviewed. In the third part, the research model is introduced and the estimation method is described. In the fourth section and finally in the fifth section, discussion and conclusion take place.

Literature Review

Oil Prices and Earning Management

Healy and Wahlen (1999) definition of earning management is the most common definition. Earnings management occurs when managers use judgment in financial reporting and transaction structure to change financial statements to mislead some stakeholders about a company's core economic performance. Or affect contract results that depend on reported accounting figures. This definition includes two distinct ways to change financial reporting. Accrual earnings management occurs when management opportunistically applies accounting standards to earnings management in the desired direction. Manipulation of actual activities occurs when management changes the timing or structure of operations, investments, or financial transactions. Unlike accrual earnings management, these activities have direct and non-optimal business consequences (Zhang, 2012). Ronen and Yaari (2008) also provide a comprehensive definition of earnings management that distinguishes between the two main activities for manipulating real versus accruals, and show that such activities are not necessarily always bad. According to them, earnings management is a set of management decisions that do not lead to the reporting of the most real short-term earnings and maximum value that these measures are considered as earnings management. Earning management can be beneficial: Show long-term value and can even be deadly: hide short-term or long-term value. Neutral: Reflect short-term actual performance. Earning management arises from production or investment measures before the realization of accounting revenues or choices which affects revenues items and their interpretation after the realization of real revenues (Zamanianfar, 2020). In a comprehensive review, Graham et al. (2005) found that both methods are used to manipulate earnings. Most previous articles have examined the different

motivations for earnings management. These incentives are classified by Fields et al. (2001) into three main groups: contractual arrangements, asset pricing, and third-party decisions. Examples of these incentives for earnings management include managerial reward schemes, tax cuts, managerial purchases, offering stock for the first time and meeting or exceeding analysts' expectations. Studies show that a common feature of incentives is to keep the macroeconomic environment stable. However, macroeconomic events can act as incentives themselves. Healy (1985) states: If the profit is so small that the desired profit is not met, regardless of which accounting method is chosen, managers have incentives to further reduce current profits by delaying revenue or accelerating diversion. "Taking a bath" is known as a strategy. When taking a bath is used as a method of earning management, the information space deteriorates and operational performance becomes ambiguous. However, if the asset market value is less than the book value, the reduction can improve the information environment and reduce information asymmetry (Hope and Wang, 2018). Louz et al. (2003) examined earnings management in different countries and found that the level of investor support strongly influences earnings management behavior and Norway is among the countries with the lowest level of earnings management. Filip and Raffournier (2014) found that although Norwegian companies followed the pattern of most European countries, they managed lower earning after the 2008 financial crisis.

Also, oil as the most important energy source in the world and one of the important factors of production always has a special place in the global economy. Especially after the great oil shocks of the 1970s, which led to the recession in the Western world. Hamilton (1983) shows that all of the US recession since World War II has been driven by rising oil prices. Any increase or decrease in oil prices will lead to a change in oil revenues, which in turn will affect the economy. Today, oil prices are recognized as one of the most important fundamental components in financial markets, in which the stock market has a special place (Zeynoddini et al., 2020). In fact, theoretically, oil prices and related shocks could affect stock market returns or stock prices through expected returns. One of the logical reasons for using oil prices as one of the fundamental components in stock market analysis can be considered in the valuation of stock prices by the discounted value of future cash flows (both cash dividends and price increases). Which are affected by macroeconomic events. For example, rising oil prices in exporting countries mean higher incomes for those countries. Increased demand for capital and consumer goods can be considered as a rational assumption in using more revenue which is expected to have inflationary effects in monetary and financial terms. Now, this may force the central bank (as the custodian of monetary policy) to raise interest rates; Therefore, shareholders' receipts as the present value of future cash flows will decrease further (Bhar and Nicolova, 2009). In fact, different sectors of the economy from the perspective that oil and its products have an input or output aspect for that sector; they react to oil shocks. In the case of companies with oil output, rising oil prices lead to increased liquidity flows; while for companies where oil is considered as input, the cash flow decreases. For this reason, understanding the characteristic dynamics of fluctuations between crude oil and different industries is considered important and helps to better understand investors for portfolio hedging and better risk management measures (Abounoori and Ziyaoddin, 2020). On the other hand, empirical studies on the impact of different economic environments are ambiguous. Agarwal et al. (2007) studied Japanese banks in the context of three distinct economic environments: high growth, stagnant growth, and severe recession. The results showed that banks used loan loss reserves to earning management during periods of high economic growth and stagnant growth, but not during periods of recession. Similarly, Jenkins et al. (2009) report that accounting conservatism and the value-relevance of earning relationship are greater during recessions because companies report more conservatively during recessions to avoid the risk of litigation and scrutiny. Ze-To (2012), who surveyed companies on the New York Stock Exchange and the US stock market for the period 1989 to 2007, presents conflicting findings. His evidence shows that companies manage earnings during both economic growth and recession. Although there is no prior theoretical basis for the impact of the fall in oil prices in 2014, other events such as the Asian financial crisis, the Mexican currency crisis, and the 2008 global financial crisis are similar. Because they show big negative shocks to the economy. This study provides indications of the expectations of earnings

management activity after the oil price shock. Davis-Friday and Gordon (2005) found that the correlation of profits did not decrease during the Mexican currency crisis. In contrast, Graham et al. (2000) and Ho et al. (2001) state that the earnings relevance declined during the Asian financial crisis. Ahmad-Zaluki et al. (2011) identified revenue-increasing earnings management for start-up companies during the Asian financial crisis. In the context of the Malaysian financial crisis, Saleh and Ahmed (2005) identified revenue-reducing earnings management for companies in financial crisis.

In addition, the global financial crisis of 2008 is certainly a crisis comparable to the 2014 oil shock crisis. Because it has happened recently and most studies have been done in European environments. Numerous studies have examined the effects of the 2008 crisis on financial reporting practices. For example, Persakis and Iatridis (2015) have examined the impact of the global financial crisis on earnings quality in listed companies in developed countries based on the level of investor support. Their results show that profits fell during the crisis, especially in countries marked by moderate and weak shareholder support. In a study of Asian shipping companies, Rusmin et al. (2012) found smoothing behavior in seven Asian countries and found empirical evidence that corporate executives opportunistically pave profits beyond revenue targets and participate in big bath. Habib et al. (2013) examined the management earnings management practices of crisis-stricken companies and examined whether these practices had changed during the crisis. The results show that managers of companies in crisis are more involved in managing profit-reducing earnings than other managers of companies with financial health. However, the theoretical foundations are contradictory. Filip and Raffournier (2014) concluded that there is a significant reduction in earnings smoothing and improved quality of accruals during periods of crisis. This trend has been confirmed for most of the 16 EU countries surveyed. In addition, similar findings have been reported by Kousenidis et al. (2013) examining whether and to what extent the 2008 financial crisis affected the reported earnings quality of companies listed in EU countries with poor financial stability has it affected or not. The results show that on average the quality of earnings has improved during the financial crisis. Arthur et al. (2015) compare the quality of corporate earnings in 14 European countries during the period 2005 to 2007 and during the period of the financial crisis 2008 to 2010. The results show that during the financial crisis, companies tended to provide higher quality financial reports than before the crisis. Cimin (2015) presents similar findings in a study of non-financial institutions accepted in EU countries. Differences in research design may partly explain why the crisis literature is ineffective. Some studies have used a country-to-country approach (Persakis and Iatridis, 2015), while others have integrated all countries into one sample (Arthur et al., 2015). Differences in reporting culture, investor support, and the economic environment may affect how crisis management changes earnings management behavior, and accordingly, these differences may lead to conflicting outcomes.

Research Background

Lin and Wu (2022) have investigated the effect of three types of classical oil shocks on earnings management. They also considered the role of implicit oil fluctuations in this regard and tested the possible heterogeneity between energy-related and non-energy-related sub-samples. Experimental results show that there are variable effects between heterogeneous oil price shocks on earnings management. In particular, oil supply shocks motivate companies to manipulate more accrued and real earnings, and companies are more likely to manage accrual earnings downward. In addition, the estimated results show that oil price shocks have no effect on the management of accrual earnings of energy-related companies. Instead, they influence unrelated energy companies. Kjærland et al. (2020) examine the relationship between oil price shocks in 2014 and earnings management of oil companies listed on the Oslo Stock Exchange. The results show a significant increase in earnings management after the fall in oil prices. Companies were also found to have adjusted for unusual income and accruals as their revenue declined and were identified during the third and fourth quarters of 2014. They attribute this finding to the taking a bath strategy. This study promotes an understanding of the impact of macroeconomic shocks on earnings management behavior and has expanded earnings management articles in the industry. Bagirov and Mateus (2019) examined the relationship between oil prices, stock market and financial performance of European oil and

gas companies and in this study, VAR (1), Garch (1,1) models were used during the period 2005 to 2014. Analyzes show that in most cases, the reaction of stock markets to changes in crude oil prices is different in different sectors. Eraslan and Ali (2018) examined the effect of size and stability of different types of oil price shocks on changes in stock returns of different countries by considering the instantaneous response to fluctuations. The results showed that the cautious demand generated after the shocks of the demand side compared to the shocks of the supply side have a more positive and stable effect on the fluctuation of stock returns. Stain and Wang (2016) "Economic Uncertainty and Earnings Management" Using the panel data method, the relationship between firm-level economic uncertainty and earnings management among the 1,892 listed companies listed between 1996 and 2013 check out. The model they used was Kothari and they calculated the economic uncertainty using the implicit instability extracted from the Option Metrics site. The results of their study show that there is a significant negative relationship between earnings management and economic uncertainty and at a time when markets are less confident about companies' future prospects, corporate executives are reporting more negative discretionary accruals. Also in times of reduced economic uncertainty, managers tend to report more positive (earnings-increasing) accruals. Zamanianfar et al. (2021) have studied the role of earnings management in economic growth and corporate growth illusion during the period 2012-2018. Research hypotheses were tested using correlation and multivariate regression methods. The results showed that with the increase of real earnings management, economic value added and accounting value added also increase. Also, with the increase in income management, economic value added and accounting value added increase. However, no significant relationship was observed between accrual and income earnings management with accounting value added and there is a positive and significant relationship between real earnings management due to unusual operating cash flows and overvaluation and between accrual earnings management and overvaluation. Zeynoddini et al. (2020) have studied the effects of exchange rate, interest rate, inflation rate and industrial production index on the total price index of Tehran Stock Exchange in the period 1988 to 2017 on an annual basis. This relationship has been evaluated by Quantile regression method between stock index returns and macroeconomic variables. According to the results, interest rate changes have a negative effect on stock index returns and oil prices, industrial production index and exchange rate have a positive effect on the return of this index. Inflation rate has not had a significant effect on the performance of this index. Salem Dezfuli et al. (2017) investigated the effect of economic uncertainty criteria on earnings management based on accruals and real earnings management (manipulation of real activities) in companies listed on the Tehran Stock Exchange. To determine the amount of real earnings management from three criteria of abnormal optional cost, abnormal production cost and abnormal operating cash flows and to measure the uncertainty of macroeconomic variables from four criteria of GDP growth, inflation, exchange rate and interest rate using Arch and Garch indices are used the results show that the criteria of economic uncertainty (GDP growth, inflation rate, exchange rate and interest rate) have a positive and significant effect on earnings management based on accruals. In addition, research results show that criteria of economic uncertainty (GDP growth, inflation rate, exchange rate and interest rate) have a positive and significant effect on the management of real earnings (abnormal optional cost, abnormal production cost and abnormal operating cash flows). Salehi and Hamoleh Alipour (2018) have studied the effect of crude oil price shocks on the stock returns of companies listed on the Tehran Stock Exchange during the period 2012-2016. To measure oil price shocks, following the research of Khalil Gibran, Chen, Saeed and Zab (2017), three factors of oil price, oil price shocks and oil sales shocks have been used. Hypotheses were analyzed and tested by generalized least squares regression (EGLS) method with panel data approach. The results show that there is no significant relationship between oil prices and stock returns in the Iranian capital market. While there is a negative and significant relationship between oil price shocks and stock returns and a positive and significant relationship between oil sales shocks and stock returns of listed companies. Fitras and Hoshidari (2017) examined the effect of fluctuations in the price index of Tehran Stock Exchange and Dubai from the fluctuations of the global crude oil price, studied the effect of oil price shocks on the stock market of Iran and Dubai. According to his research findings, global crude oil

price shocks have had a positive and significant effect on fluctuations in the Dubai Stock Exchange index and on fluctuations in the Tehran Stock Exchange index. On the other hand, fluctuations in the Dubai Stock Exchange index have had a positive and significant effect on fluctuations in the Tehran Stock Exchange index. Shahbazi et al. (2013) the effect of oil price shocks due to crude oil supply and demand on stock returns on the Tehran Stock Exchange. In line with this goal, based on monthly data (period 1971-2010) of crude oil supply variables, Global demand for industrial goods, real crude oil prices and real stock returns on the Tehran Stock Exchange are estimated by a structural vector auto-regression (SVAR) model. Real crude oil price fluctuations have been attributed to three structural shocks: the global crude oil supply shock, the global crude oil demand shock, and the global demand shock for industrial goods. The effect of these shocks on the real stock return on the Tehran Stock Exchange is examined below. The results show that oil supply shock has no significant effect on oil prices and only shocks in oil demand and aggregate demand are factors affecting stock returns on the Tehran Stock Exchange. The results show that oil supply shock has no significant effect on oil prices and only shocks in oil demand and aggregate demand are factors affecting stock returns on the Tehran Stock Exchange. Abbasi and Shafqat (2012), in a study comparing the effect of oil price fluctuations on the stock market index in Iran as an oil exporter, during the years 2000 to 2010 with monthly data has been done. The method used in this study is VAR-GARCH. Based on the obtained results, oil price fluctuations have more stable effects on the stock market index of Iran and play a more prominent role in the long run on the stock market index.

Methodology

The method of this research is quasi-experimental research in the field of positive accounting research and in terms of purpose, it is applied research. The method of the present research is inductive and in terms of time dimension, it is post-event research. Because the historical information of the sample companies is used to test the hypotheses. The statistical population of this research includes petrochemical and refining companies listed on the Tehran Stock Exchange during the period 2014 to 2022. In this study, 37 petrochemical and refinery companies listed on the Tehran Stock Exchange were selected as a sample.

Research variables and hypotheses

Variables used in the research and their abbreviation in Table (1); it has been shown.

Table (1) Introduction of research variables

Variable	Variable position	Symbol
Oil price	independent variable	POIL
Oil price shock	independent variable	VPOIL
Oil sales momentum	independent variable	VSOIL
Accrued earnings management	The dependent variable	AEM

Collins et al. (2017) model is used to measure earnings management through accruals, which is an extension of Kothari et al. (2005) model, which is adjusted through firm growth. In this model, the sum of accruals is a linear function of changes in income, property, machinery and equipment, return on assets and changes in sales, which are as follows:

$$\frac{ACC_{it}}{A_{it}} = \alpha_0 + \beta_1\left(\frac{1}{A_{it}}\right) + \beta_2\left(\frac{\Delta REV_{it}}{A_{it}}\right) + \beta_3\left(\frac{PPE_{it}}{A_{it}}\right) + \beta_4\left(\frac{ROA_{it}}{A_{it}}\right) + \beta_5\left(\frac{\Delta Sales_{it}}{A_{it}}\right) + \varepsilon_t$$

In the above relation, ACC_{it}: sum of total accruals of company i in year t

Ait-1: Total assets of company i at the end of year t

Sales: The change in sales of company i between the years t-1 and t

PPE_{it}: Property, plant and equipment (gross) of Company i in year t

REV_{it}: The change in the sales revenue of company i between the years t-1 and t

ROA_{it}: Return on Company i's assets in year t, obtained by dividing net profit by total assets.

POIL: Oil prices

VPOIL: The virtual variable of the price of oil (if the price of oil has increased, the number 1 and otherwise the number zero).

VSOIL: The virtual variable of oil sales momentum (if oil revenue has increased, it takes the number 1 and otherwise the number zero).

The research hypotheses are as follows:

- Oil prices affect accrual earnings management.
- Oil price shocks affect accrual earnings management.

- Oil sales momentum affects accrual earnings management.

Research models

The research models for the two interruptions are as follows:

AEM = C(1,1)*AEM(-1) + C(1,2)*AEM(-2) + C(1,3)*POIL(-1) + C(1,4)*POIL(-2) + C(1,5)*VPOIL(-1) + C(1,6)*VPOIL(-2) + C(1,7)*VSOLI(-1) + C(1,8)*VSOLI(-2) + C(1,9)

POIL = C(2,1)*AEM(-1) + C(2,2)*AEM(-2) + C(2,3)*POIL(-1) + C(2,4)*POIL(-2) + C(2,5)*VPOIL(-1) + C(2,6)*VPOIL(-2) + C(2,7)*VSOLI(-1) + C(2,8)*VSOLI(-2) + C(2,9)

VPOIL = C(3,1)*AEM(-1) + C(3,2)*AEM(-2) + C(3,3)*POIL(-1) + C(3,4)*POIL(-2) + C(3,5)*VPOIL(-1) + C(3,6)*VPOIL(-2) + C(3,7)*VSOLI(-1) + C(3,8)*VSOLI(-2) + C(3,9)

VSOLI = C(4,1)*AEM(-1) + C(4,2)*AEM(-2) + C(4,3)*POIL(-1) + C(4,4)*POIL(-2) + C(4,5)*VPOIL(-1) + C(4,6)*VPOIL(-2) + C(4,7)*VSOLI(-1) + C(4,8)*VSOLI(-2) + C(4,9)

In these patterns:
C represents constant regression and variable coefficients.
C (1,1) The first regression coefficient of the first variable
C (1,2) The first regression coefficient of the second variable
C (2,1) The second regression coefficient of the first variable and ...
AEM (-1) Accrued earnings management in the previous year
AEM (-2) Accrued earnings management in the previous two years
POIL (-1) Oil prices in the previous year
POIL (-2) Oil prices in two years ago
VPOIL (-1) Oil price shock in the previous year
VPOIL (-2) Oil price shock in two years ago
SOLI (-1) Standard deviation of oil sales momentum in the previous year
VSOLI (-2) Standard deviation of oil sales momentum in the previous two years

Research findings

In order to prevent the problem of false regression, the significance of the model variables was investigated. Results of data at the level based on LLC statistics are presented in Table (2).

Due to the fact that some research variables are at a low level of persistence, therefore, the existence of panel co-integration vector between research data is investigated. Table (3) shows the presence or absence of this vector.

According to the results of Table (3), it is observed that there is a long-term relationship between research variables, so there is no need to differentiate from research data. Considering that in long-term relationship tests, the null hypothesis indicates the absence of long-term relationships between the studied variables, as a result, according to the New West test statistics (5.94), the level of significance of that hypothesis is rejected, which indicates the fact that there is a long-term relationship between the variables.

Table (2) Investigation of the mean of model variables

Variable	Statistic value	The significance level	Result
POIL	-۴۰/۲۸۳	5%	The variable is unknown
VPOIL	-۱۲/۸۳	5%	The variable is unknown
VSOIL	-۷/۰۱	5%	The variable is unknown
AEM	-۳/۰۴	5%	The variable is unknown

Table (3) Existence of long-term vectors between research variables

Newey-West automatic bandwidth selection and Bartlett kernel		
ADF	t-Statistic	Prob.
	-5.949614	0.0000
Residual variance	0.000192	
HAC variance	0.000252	

Calculation of oil fluctuations

In order to calculate the fluctuations of the oil market, it is first necessary to extract the Arma or Arima model of the OPEC oil price series in the mentioned period. To do this, the following steps were performed. Before doing anything, it is necessary to make sure that the time series of the oil price is stationary or un-stationary.

Based on the results of the oil price series is un-stationary and as a result it is necessary to use the Arima model to determine oil price fluctuations. Next, the optimal Arima interval should be determined based on Akaike (AIC) indicators. Based on the initial proposal of AC and PAC diagrams presented in the following diagram, the proposed interrupt for the model based on AC and PAC diagrams (1,2) and (3 and 2) was suggested:

Based on the results of the Akaike index, in the case where the model has the lowest Akaike, the interval (3, 1 and 2) was calculated to calculate the model. In order to ensure the optimality of the model, the disruption component of the model is calculated and the maneuverability except the disruption of the optimal Arima model is calculated, and in case of stationary, the disruption of the box-Jenkins steps is done correctly.

Finally, the Arch test was estimated, and if there is an Arch effect, we will estimate the Garch model and extract the price fluctuations.

Due to the significance of the RESID coefficient (-1) ^ 2, the effect of Arch in the temporal data is confirmed. Then the oil time series Garch model was extracted.

Due to the significance of the GARCH coefficient (-1), the existence of the GARCH model in the time series data of oil price changes was confirmed. As a result, oil price fluctuations were extracted and all the above steps were followed for the oil sales model and it was called VSOIL.

Table (4) Dickey Fuller test results

Variable	With the trend and width of the origin	With width from origin and no process	No width of origin and process
OPEC oil prices (in level)	-2.50 (0.1152)	-2.90 (0.1641)	-0.8473 (0.3474)
OPEC oil prices (with one time difference)	-40.283 (٠٠٠٠)	-7.57 (٠٠٠٠)	-7.60 (0000)

Figure (1) AC and PAC chart of OPEC oil price changes

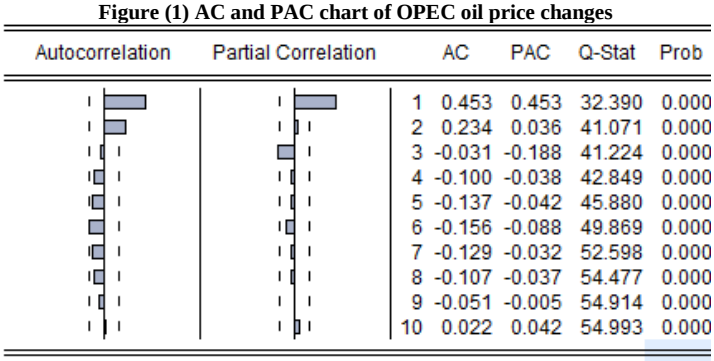


Table (5) Results of Akaike statistics in different intervals of Arima

Variable	Akaike value in interrupt (1, 1 and 2)	Akaike value in interrupt (3, 1 and 2)
Akaike statistics	(٦/٣١٨)	(٦/٣١٥)

Table (6) Results of Dickey Fuller test except optimal Arima disorder

Variable	With the trend and width of the origin
Except for disrupting the optimal model of Arima oil price changes (in level)	-12.44 (0.0000)

Table (7) Arch test results

Variable	Coefficient	Std. Error	Z-Statistic	Prob.
C	10.62854	2.878921	3.691848	0.0002
RESID(-1)^2	0.848390	0.252821	3.355699	0.0008

Table (8) Garch model results

Variable	Coefficient	Std. Error	Z-Statistic	Prob.
Model Arima section				
C	0.010813	0.284421	0.038016	0.9697
AR(1)	0.608821	0.414281	1.469584	0.1417
AR(2)	0.147202	0.352178	0.417977	0.6760
MA(1)	-0.462892	0.381883	-1.212132	0.2255
MA(2)	-0.181257	0.272657	-0.664779	0.5062
MA(3)	-0.209351	0.106864	-1.959037	0.0501
Model Garch section				
C	8.263864	2.497227	3.309216	0.0009
RESID(-1)^2	0.416008	0.129615	3.209555	0.0013
GARCH(-1)	-0.244483	0.078169	-3.127621	0.0018
GED PARAMETER	2.385282	0.586388	4.067757	0.0000
R-squared	0.161654	Mean dependent var		-0.040980
Adjusted R-squared	0.133138	S.D. dependent var		6.327110
S.E. of regression	5.890881	Akaike info criterion		6.188646
Sum squared resid	5101.265	Schwarz criterion		6.406520
Log likelihood	-462.4314	Hannan-Quinn criterion.		6.277150
Durbin-Watson stat	1.382053			
Inverted AR Roots	.79	-.19		
Inverted MA Roots	.91	-.22+.42i	-.22-.42i	

Select the estimated model

To determine the optimal model between two methods of fixed effect and random effect in dynamic panel models, F-Limer and Hausman tests were used. The statistics of Hausman and F-Limer panels in Table (9) are presented.

Table (9) Hausman and F-Limer tests

Model	Test	Test statistic	Freedom degree	Statistic value	The significance level	Test result
Accrued earnings management	F-Limer test	F	(۳۵۴ و ۳۶)	۶۰/۷۳	۰۰۰۰۰	Hypothesis zero is rejected
	Hausman test	X^2	۳	۳۲/۸۷	۰۰۰۰۰	Hypothesis zero is rejected

Estimation of research models

Estimation of the model of the first research hypothesis

In the table above, the coefficients express the effect of each independent variable on the dependent variable. For example, the first interruption of AEM has a positive effect on AEM by 0.86%. In other words, if the first interrupt of AEM increases by one unit, in the next period AEM increases by 0.86 units, assuming the neutralization of the effect of other variables. According to the research results, the increase in oil prices has reduced the management of accrued earnings and the increase in the price of oil prices and the shock of oil sales has increased the management of accrued earnings.

Table (10) Results of dynamic panel estimation of research models in fixed effects mode

		AEM(-1)	POIL
AEM	Coefficient	0.86	-0.23
	T-statistic	6.34	-4.73
	Result	Significant	Significant
Fits of goodness fit	R2	0.83	
	J-statistic	1.34	
	Result	The tools are convenient	
	h-Durbbin	2.14	

Estimation of vector regression model

Before entering the model estimation, it is necessary to determine the optimal interrupt model. After selecting the variables used in the model and the stationary test, the important issue in the VAR model is to determine the optimal interval length. In this study, due to the fact that the volume of observations is less than 100. Table (11), the Akaike information criteria (AIC), shows the optimal interrupt.

Table (11) Determining the optimal interrupt

Purpose variable	Akaike criteria	Optimal interrupt
ROA	۱۳/۹۴	۱
ROE	۶/۰۸۷	۱
NIM	۳۶/۸۰	۱
PBT	۴۳/۵۱	۱

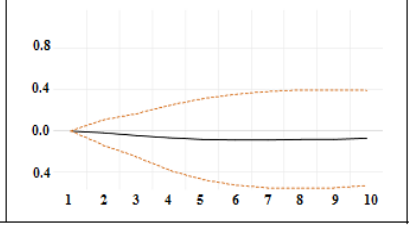
Dynamic analysis of the model according to the VAR model

In this section, dynamic economic analysis for the model according to the VAR model was performed. Since the coefficients of a vector auto-regression model are difficult to interpret, instantaneous reaction and analysis of variance functions were used to infer the results for a vector auto-regression.

Instant reaction functions

According to the results, increasing a standard deviation of oil price variables has a negative effect on accrued earnings management variable.

Table (12) Diagrams of the instantaneous reaction functions of the POIL variable

Purpose variable	Influential variables
-	AEM
POIL	

Estimation of the model of the second research hypothesis

In the table above, the coefficients express the effect of each independent variable on the dependent variable. For example, the first interrupt of AEM has a positive effect on AEM of 0.86%. In other words, if the first interrupt of AEM increases by one unit, in the next period AEM increases by 0.86 units, assuming the neutralization of the effect of other variables. According to the research results, the increase in oil prices has reduced the management of accrued earnings and the increase in the price of oil prices and the shock of oil sales has increased the management of accrued earnings.

Table (13) Results of dynamic panel estimation of research models in fixed effects mode

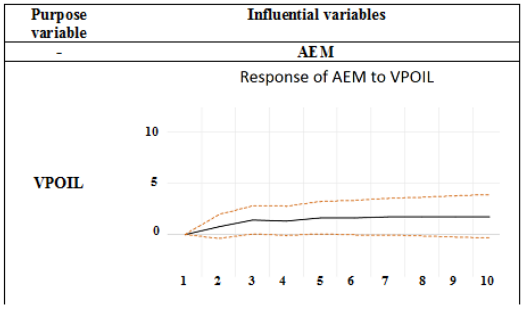
		AEM(-1)	VPOIL
AEM	Coefficient	۰/۸۶	۰/۱۲
	T statistical	۶/۳۴	۳/۹۳
	Result	Significant	Significant
Goodness indicators fit	R2	۰/۸۳	
	J statistic	۱/۳۴	

		AEM(-1)	VPOIL
	Result	The tools are convenient	
	h-Durbbin	۲/۱۴	

Instant reaction functions

The above graphs show that if the variables affecting accrual earnings management increase by a standard deviation, accrual earnings management generally increases. Based on the results of increasing a standard deviation of the oil price momentum variable has a positive effect on the accrual management variable.

Table (14) Diagrams of VPOIL variable instantaneous response functions



Estimation of the model of the third research hypothesis

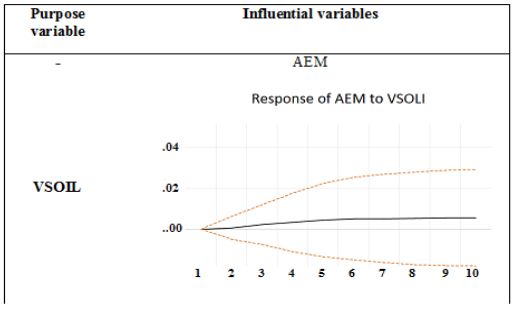
Table (15) Results of dynamic panel estimation of research models in fixed effects mode

		AEM(-1)	VSIOL
AEM	Coefficient	۰/۸۶	۰/۲۴
	T statistical	۶/۳۴	۴/۸۱
	Result	Significant	Significant
Fits of goodness fit	R2	۰/۸۳	
	J statistical	۱/۳۴	
	Result	The tools are convenient	
	h-Dorbbin	۲/۱۴	

Instant reaction functions

The above graphs show that if the variables affecting accrual earnings management increase by a standard deviation, accrual earnings management generally increases. Based on the results of increasing a standard deviation of the oil sales momentum variable has a positive effect on the accrual earnings management variable.

Table (16) Diagrams of the instantaneous response functions of the VSOIL variable



Analysis of variance

In this section, the results of analysis of variance were presented. This index shows the effect of each variable on the dependent variable in the whole period.

According to the results, oil price has the highest effect on the interpretation of accrued earnings changes, followed by the priority of oil price momentum and oil sales momentum, respectively, has the highest effect on accrued earnings management changes.

Table (17) Model analysis of variance

Target variable / effective variables	Percentage of changes
AEM	40 percent
POIL	25 percent
VSOIL	11 percent
VPOIL	24 percent

Results and Discussion

Developing countries, including Iran, have a high degree of uncertainty in macroeconomic variables. Growth, inflation, liquidity, exchange rate and other macroeconomic variables are more subject to fluctuations compared to the economies of industrialized countries, and the effects of these fluctuations and their continuation can lead to the formation of more structural problems in different economic sectors in these countries. Fluctuations in these indices affect the stock market and consequently the accrued earnings management by creating risk and uncertainty, with an impact on investment and

investors' decisions (Armagan et al., 2022). Examining the realities of Iran's economy shows the role of dependence of the country's national production on oil revenues in the economy. It can be concluded that any type of fluctuation in oil price affects production and other macro variables in Iran's economy. It is for this reason that in the last three decades, despite the appearance of various economic and political shocks in the world market, the foreign exchange earnings from oil exports have always been the dominant and major part of the country's foreign exchange earnings, during the recent years (before the embargo) Oil revenues have increased in the country's budget process, and the national economy has always maintained this dependence on sources of income from oil exports. Even in recent years, due to the embargo on oil sales, oil revenues are one of the sources of budget income.

Basher and Sadorsky (2006) believe that if the price of oil increases, two scenarios will emerge, firstly, that consumers will look for cheaper energy options, and secondly, the production cost of companies that use oil as a production input will increase, which is uncertain. And it increases the risk and ultimately has a negative effect on the stock market and reduces investment. Also, the phenomenon of "information asymmetry" occurs in business relations when a contracting party is more knowledgeable than the other. Accounting standards are set and audit activities are performed to prevent manager opportunism. Nevertheless, the existence of information asymmetry between managers and outsiders causes the former to apply their personal opinions in preparing and reporting accounting information and to prepare reports to meet personal interests (Arab Salehi et al., 2016). Although overall industry performance and macroeconomic conditions significantly affect accounting quality, it is rare to find relevant studies on how oil price shocks affect accounting quality. In recent decades, several studies have focused on oil price or oil market shocks to economic growth, stock returns, and other economic indicators. Among them is a key mechanism on how oil price fluctuations affect real economic activity by affecting production and investment decisions at the firm level (Lin and Wu, 2022).

In general, during the past years, there have been extensive studies on economic variables and earnings management. Nevertheless, previous studies still remain unsolved regarding the answer to the question of what effect oil price, oil price shocks and oil sales shocks have on earnings management. Therefore, the purpose of this study was to investigate how the accounting choices oil companies listed on the stock exchange change in response to changes in oil prices, oil price shocks and oil sales shocks. Based on the results, it was found that oil prices have a negative effect on accrued earnings management and the shocks of this variable and oil sales shocks has a positive effect on accrued earnings management. Based on the vector auto-regression method, this result was obtained. If the variables of oil price, oil price fluctuation and oil sales fluctuation increase by a standard deviation, accrued earnings management variable will show negative, positive and positive reactions, respectively. Analysis of variance determined the contribution of each of the risk variables and its severity. Based on these results, oil prices have the highest explanation for changes in accrued earnings management; also, based on the results after oil prices, oil price shocks and oil sales shocks affect accrued earnings management. In particular, by taking advantage of the uncertain macroeconomic environment, companies recorded large revenue-reducing accruals during the years 2013 to 2021.

The importance of the results of this study is related to downstream oil industries. Downstream oil industries is a term that is usually used to refer to the refining of crude oil, and the sale and distribution of natural gas and products derived from crude oil. Operations such as the sale and distribution of natural gas and crude oil-derived products such as liquefied petroleum gas (LPG), gasoline, jet fuel, diesel, oils, and asphalt are classified in the downstream sector. Unlike the upstream part of the oil industry, the downstream part of oil is in direct contact with consumers. Establishing a relationship with consumers is done through the distribution and sale of products such as gasoline, diesel fuel, fuel oil, grease, rubber, plastic, fertilizer, antifreeze, pesticide, natural gas, propane, etc. (National Petrochemical Company of Iran, 2019). In general, from the results of this study, several groups and individuals are the most key and main group of investors. Investors can use the analysis of this study in order to be able to invest in a relatively safe economic environment without worrying about unexpected shocks. The second is to provide a

situation where access to information and its analysis is easily possible for all investors. Meanwhile, the study of accrual earnings management in response to oil shocks is of special importance in the financial analysis of groups using financial and accounting information.

The findings of the present study are consistent with the study of Kjaerland et al. (2020). These events can be attributed in part to the big bath strategy. The present study also supports studies that have reported declining earnings management in times of crisis. For example studies, Saleh and Ahmad, 2005; Rusmin et al., 2012, are such studies. However, it contradicts studies that have found more accurate financial reports during the recession, for example; Studies by Philip and Raffournier, 2014; Arthur et al., 2015, are such studies that have shown that less earnings management is often explained by increased conservatism and scrutiny by stakeholders such as legislators and auditors.

Finally, previous studies show that managers can manipulate accruals and actual activities to change the firm's observable performance (Teoh et al., 1998). In general, when oil prices rise, companies may manipulate earnings by considering macro and micro dimensions. Therefore, investigating the impact of oil price shocks on the quality of accounting is a special and necessary matter. Also, while most previous studies on economics as a whole have done research, the present study focuses on the refining and petrochemical industries, and this contributes to the earnings management literature in the oil industry. Another difference of this study is that previous studies have examined the oil industry after positive oil price shocks, but this study examined the effect of oil prices, oil price shocks and oil sales shocks on accrual earnings management in downstream oil exchange companies. Although both positive and negative shock events lead to earnings management accounting choices, Han and Wang (1998) and Byard et al. (2007) attribute this phenomenon and their findings to another theory, the political cost hypothesis. The findings of the present study have valuable implications for the stakeholders of the oil industry, especially the stock companies of the downstream oil industries. The findings of this study, together with previous studies, show that investors should always be vigilant in both good and bad times. In addition, accounting choices affect future accounting periods, so that they offer less valuable assets, less accruals and exaggerated earnings in subsequent periods. If investors and other stakeholders are unaware of this action, the company's stock price will be overvalued.

The present study is not without limitations. In fact, in this study, variables related to governance have been removed. In addition, proxy criteria are relied upon for earnings management, in the sense that it cannot be ruled out whether the findings of this study are subject to more natural explanations, such as the principle of conservatism, rather than earnings management. Although the erroneous conclusion due to the shortcomings of the model cannot be ruled out, it is also believed that the use of different models strengthens the reliability of the findings. Finally, relatively small sample sizes may also affect results, and since it focuses only on listed companies downstream oil industries, the external credibility of the findings is limited. Future studies may also examine whether the findings of the present study are comparable to those of the oil industry in other countries, especially in European and Asian countries. It will also be interesting to examine accounting options in the oil industry as oil prices improve. Also, in the last decade, neural network methods have provided promising capabilities for earnings management recognition. Finally, based on the findings, the following suggestions are made:

- Oil prices, price shocks and oil sales shocks, and indeed the variables affecting the stock market, can have a tremendous impact on the management of accrued earnings in the stock market. Therefore, it is necessary for investors to be aware of the impact of corporate earnings and, in fact, earnings management due to changes in these variables. As Iran is a developing country, in addition to the existence of sanctions on this country has caused a high degree of uncertainty in macroeconomic variables, and these uncertainties create an uncertain and risky environment for investment decisions. Therefore, it is suggested that stock exchange officials should pay more attention to the factor of their impact on macroeconomic variables (oil prices and shocks) as well as stabilization in this market in order to achieve the growth of the stock market.

- Policies should be created to motivate transparency in various companies, and to control oil shocks on the economy, practical policies should be implemented in the true sense of the word, not nominally in order to stabilize the country's economy.
- Due to the effects of oil shocks on the management of companies' earnings in the country's capital market, the country's economic officials need to refrain from relying on oil and avoid the single-product economy.

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