OIL PRICE SHOCKS AND POLICY IMPLICATIONS
THE EMERGENCE OF U.S. TIGHT OIL PRODUCTION: A CASE STUDY

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Rio de Janeiro - 2015
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Abstract

How have shocks to supply and demand affected global oil prices; and what are key policy implications following the resurgence of oil production in the United States?

Highlights:
- The recent collapse in global oil prices was dominated by oversupply.
- The future of tight oil in the United States is vulnerable to obstacles beyond oil prices.
- Opinions on tight oil from the Top 25 think tank organizations are considered.

Global oil prices have fallen more than fifty percent since mid-2014. While price corrections in the global oil markets resulted from multiple factors over the past twelve months, surging tight oil production from the United States was a key driver. Tight oil is considered an unconventional or transitional oil source due to its location in oil-bearing shale instead of conventional oil reservoirs. These qualities make tight oil production fundamentally different from regular crude, posing unique challenges. This case study examines these challenges and explores how shocks to supply and demand affect global oil prices while identifying important policy considerations. Analysis of existing evidence is supported by expert opinions from more than one hundred scholars from top-tier think tank organizations. Finally, implications for United States tight oil production as well as global ramifications of a new low price environment are explored.

Keywords:
Energy; Oil; Economics; Organization of the Petroleum Exporting Countries (OPEC); Organization for Economic Cooperation and Development (OECD); United States
1 Introduction
Starting in 2Q2014, the global oil market experienced a massive price correction with prices declining over 50% to their lowest point before stabilizing in 2Q2015. Preceding this event was a buildup in the global supply of oil fueled by tight oil production in the U.S. Tight oil production nearly doubled total U.S. output of crude between 2008 and 2015, which greatly reduced the need for U.S. imports of oil. This freed significant supplies for the global market at a time when overall demand for oil was slowing on an annual basis.

Continued oversupply in 4Q2014, forced by OPECs decision to maintain production rates and transfer the role of “swing producer” to unconventional oil producers, catalyzed further price declines. With oil prices projected to stay within $50-$100 USD through 2025, the future of tight oil raises many questions as the complex process of tight oil production is only economical during periods of high oil prices.

This case study examines how shocks to supply and demand affect global oil prices while identifying important policy considerations. Analysis of existing evidence from January 2004 through June 2015 is supported by expert opinions from more than one hundred scholars from top-tier think tank organizations. Finally, implications for United States tight oil production as well as global ramifications of a new low price environment are explored.

2 Understanding and Defining Key Case Study Topics
2.1 Tight Oil
It was not until the late 1990s and early 2000s that rapid advances in horizontal drilling and hydraulic fracturing technologies allowed for commercial production of tight oil (CBO, 2014) (Ladislaw, et al., 2014) (Brown & Yucel, 2013) (Fattouh, 2013). By the mid-2000s, large scale tight oil production was in place in the U.S., and production would rapidly accelerate over the next decade to elevate the U.S. to be the top global oil producer in 2014. That same year, the EIA estimated that tight oil accounted for about 49% of total U.S. crude oil production, up from 2.5% in 2003 (EIA, April 2015).

While the U.S. has seen tight oil production soar, other countries are now working towards commercially extracting their own shale resources. Although the technology that allows for tight oil extraction is mature, significant challenges and uncertainties remain. Economic
considerations, geology of shale formations, government regulations and the price of crude will all impact the future development of tight oil in the U.S. and the world (Ashraf & Satapathy, 2012-2013) (Sandrea, March 2014).

Figure 1. Tight Oil: A Primer

2.1.1 The Search for a Definition
The geological parameters of tight oil differ from those of conventional oil reservoirs; therefore, it is considered an "unconventional oil" or "transitional oil" (Ratner & Tiemann, 2015) (Pápay, 2014) (Gordon, May 2012). The qualities that make tight oil different from regular crude pose significant challenges and implications for development. Tight oil is found in low porous rocks such as shale, limestone and dolomite about a mile underground, deep enough such that kerogen (a solid organic compound that, through retorting, can generate oil) has already been converted into oil and gas (COGA, 2013). This differs from conventional crude where hydrocarbons migrate from a source rock to a reservoir rock. The hydrocarbons in shale are locked in place, necessitating more technologically advanced and expensive methods of extraction.
2.1.2 Extraction Techniques
Tight oil extraction requires horizontal drilling, which is more complex than traditional vertical drilling, and hydraulic fracturing ("fracking") to release tight oil trapped in low porous rock (Bommer, 2008). High-pressure water, sand and chemicals are pumped into a well to open cracks in the rocks, allowing the oil or gas to be extracted. Shale plays have a high degree of variation in permeability and required drilling depth, further complicating the extraction process (Rodgers, April 2013). Fracking has come under intense scrutiny for a variety of reasons, ranging from the potential of underground water well contamination to allegations of microseismic events (Maugeri, June 2012) (Ratner & Tiemann, 2015) (Schafer, July 2012).

2.1.3 Decline Rates
In addition to the geological characteristics and extraction methods of tight oil, its production profiles differ considerably from conventional crude due to high decline rates. Tight oil wells peak rapidly during the first weeks of production ("IP30"), register 40-50% lower rates by the end of the first year and decline a further 30-40% by the end of the second year. These high decline rates are characteristic of the industry (Maugeri, 2013) (Sandrea, December 2012).

Conversely, conventional wells display a hyperbolic decline curve that peaks after several months but then stabilizes for periods lasting well over a decade (Rodgers, April 2013) (Nelson & Whall, February 2014) (McCracken, 2015). For conventional wells, owners can more readily recoup the price of drilling the well such that profit can be achieved even during periods of low oil prices (Tully, 2015). However, tight oil production requires constant drilling of new wells to generate revenue, thus the value of a tight oil well is short lived (Livingston, 2014) (Maugeri, June 2012).

This can be seen in the Bakken oil field, one of the largest in the U.S., where the decline rate over three years is 85% (Hughes, 2014). Additionally, due to field decline rates of around 45% in the first year alone, larger numbers of wells are required to increase production figures. For example, an increase in production of 300 kb/d to 500 kb/d necessitated 1,092 new wells, while the same 200 kb/d increase from 500 kb/d to 700 kb/d required 1,554 additional wells.
With the average cost of each new well at the Bakken of around $7.5 million in 2014, the need for constant drilling requires significant investment on the part of producers to maintain production rates high (KLJ, Inc, 2014).

This can be further quantified by examining EIA Drilling Productivity Reports (DPR) of two of the largest shale plays in the U.S., Bakken and Eagle Ford. During the period in which the DPR has been produced, projected month-on-month new production at the Bakken grew from 86 kb/d in November 2013 to 92 kb/d in June 2014 (the high mark for oil prices) and down to 52 kb/d in July 2015. Legacy declines grew from 60 kb/d to 72kb/d to 74kb/d over the same period (EIA, October 2013) (EIA, June 2014) (EIA, July 2015). At Eagle Ford, projected month-on-month new production grew from 105kb/d in November 2013 to 138kb/d in June 2014 and down to 86kb/d in July 2015. Legacy declines grew from 81 kb/d to 114 kb/d to 141kb/d over the same period (EIA, October 2013) (EIA, June 2014) (EIA, July 2015).

Declines in U.S. tight oil production are primarily caused by the inability of daily production to keep pace by bringing new wells online. It is likely that the most productive fields have already been tapped or are close to depletion, forcing companies to use shale plays that have limiting factors (Livingston, 2014). Indeed, since May 2015 the sum total of the regions that comprise the DPR have shown production from new wells trailing legacy declines (Nulle, 2015).

2.1.4 Location and Volume

While commercial tight oil production has so far been primarily confined to the U.S. and Canada (Argentina began small scale production in 2014), extractable tight oil exists around the world (EIA, 2015). It is estimated that the U.S. has 17% of the global total of technically recoverable tight oil and, as of 1Q2014, accounted for 91% of global tight oil production with Canada comprising the remaining 9% (EIA, January 2014). In 4Q2013, tight oil production in the U.S. represented 4.3% of total global crude oil production. The EIA estimates in its projections of U.S. crude oil production to 2025 that tight oil production in the U.S. after 2020 will decline as production moves into less productive plays (EIA, May 2015) (Blanchard, Spring 2014).

1 First released in November 2013, the DPR shows production from new wells drilled in the seven main shale plays of the US along with legacy production changes.
Significant deposits of recoverable shale oil exist in Russia, China, Argentina and Columbia (Webster, July 2014) (EIA, June 2013) (PwC, February 2013). The EIA estimates that technically recoverable tight oil comprises 10% of the world’s crude oil, with Russia possessing the largest shale reserves globally (Henderson, October 2013). Exxon Mobil estimates that tight oil production globally will account for 7% of total crude production by 2040 (ExxonMobil, 2015). Questions remain as to what extent and what impact tight oil production activities overseas will have on the industry as there are numerous country specific financial constraints and other issues over the recoverability of tight oil that will pose obstacles to further development. According to Schlumberger, one of the world’s largest oil field services companies, non-North American tight oil production could amount to less than 10% of global supply by 2020 though might rise to 50% by 2035. Argentina, Columbia and Russia could conceivably account for 25% of global tight oil production by 2035 (Ashraf & Satapathy, 2013).
2.2 A Primer on Oil Price Economics

Crude oil is a commodity which globally is both greatly abundant and in high demand. The fall in oil prices in the second half of 2014 into 2015 qualifies as a significant event comparable to two of the five other largest price declines in crude oil over the past 30 years that witnessed 30% price declines over seven or more months (Baffes, et al., March 2015). The circumstances surrounding the price declines in 1985 to 1986 (Oil Glut) and 1997 to 1998 (East Asia financial crisis) bear striking similarities to the most recent drop in price. Examining the economics of crude oil can give insight into the reasons for oil price fluctuations and the similarities between now and the events of the mid-1980s and late 1990s.

The price of crude is primarily determined by the basic economic concept of supply and demand (Energy Charter, 2007; Fattouh, March 2007). Supply and demand itself can be impacted by a variety of exogenous market forces, including geopolitical uncertainty, natural disasters and manipulation by OPEC (The Brattle Group, 2014) (Hamilton, 2009) (NRCAN, October 2010).

Demand and supply can be captured in a simple diagram that sums all the market participants’ willingness to buy (demand) or sell (supply) at each price. A market is in balance (“equilibrium”) if demand and supply are equal. The price that matches demand and supply is the market price.

Economist Gregory Mankiw states, “Supply and demand are the forces that make market economies work. They determine the quantity of each good produced and the price at which it is sold.” (Mankiw, 2011, p. 65).
Applying the concepts of short and long run demand and elasticity facilitates a broader understanding of why oil prices fluctuate.

By August 2015, crude oil slipped below $40/bbl for the first time since the fallout of the global recession, and 50% less than mid-2014. The last time the oil market experienced such a rapid price decline was in 2008, a decline brought on by the global recession (Hamilton, Spring 2009). However, the global economic environment of the past year is quite different from that of 2008 and, despite uncertain global growth, the IMF forecasts global GDP growth rates of 3.4%, 3.3% and 3.8% in 2014, 2015 and 2016 respectively, which will result in rising demand for crude (IMF, July 2015) (IMF, April 2015).

The underlying drivers of the 2014 collapse in oil prices are reminiscent of the events in 1985 and 1998 (Smith, Summer 2009) (Mabro, 1998) (Hamilton, 2013) (Unalmis, et al., November 2012). Long term supply shifts were the basis for each price fall and, although each event was unique, sufficient similarities exist to suggest repeated cyclical characteristics. Based on these events in a market that was characterized by stability for most of the 20th century, it becomes apparent that the oil market is susceptible to reoccurring “long” or “super” cycles (Cuddington & Zellou, September 2012).

2.2.1 Role of Supply and Demand
In each event, a decline in demand was the proximate trigger for the price collapse. Between 1984 and 1985, oil demand growth slowed due to a global recession brought on by the doubling of prices in 1979-80 that forced a general shift away from oil (Helbling, 2013) (Dargay & Gately, 2010). Between 1997 and 1998, the demand decline was even greater as a result of the East Asia financial crisis. Most recently, demand has slowed, though not declined, due to a gradual reduction in consumption among OECD countries and slower growth in non-OECD countries. Environmental considerations such as the mild winters in the Northern Hemisphere in 1998 and 2014 also served to reduce demand.
More important than demand in triggering the price declines was the role of supply and, in each cycle, a gradual buildup in supply preceded the fall of oil prices. During the 1980s, world oil supply actually fell in 1985 on an annual basis, masking a sharp pickup in the second half of the year that continued into 1986. In the 1990s, before the peak growth of 1997, supply had been accelerating over several years. Since 2010, supply growth has been strong with declines only in 2013 (a result of supply interruptions brought on by the Arab Spring). The 2000s saw growth rates in many countries while the massive growth in the U.S. can almost be entirely attributed to tight oil production. Furthermore, in each event, the level of supply overtook that of demand, causing a rise of inventories.

2.2.2 Role of OPEC
Any discussion of movements in the oil market would be remiss without mentioning the role of the Organization of the Petroleum Exporting Countries (OPEC) due to its 40% share of the market and historical role. Between 1973 and 1988, the power to set oil prices was primarily the reserve of OPEC, though the degree of OPECs influence has decreased in recent years (Fattouh, January 2011) (Fattouh, March 2007). Today, OPEC can significantly influence crude oil prices but cannot set them (Smith, Summer 2009) (O'Keefe, June 2014) (Colgan, 2014).
2.2.2.1 Role of OPEC: 1984-1985
Despite OPEC reducing its output in an attempt to stabilize prices and justify the 1979-80 price doubling, crude oil prices dropped between 1981 and 1985. Saudi Arabia bore the brunt of this policy and greatly increased its output in the second half of 1985, resulting in crude prices crashing and the 1980s oil glut (Mabro, 1986) (Fattouh & Sen, June 2015). This move by the Saudis was aimed at not only recapturing lost market share from non-OPEC producers (primarily Mexico, the North Sea and Alaska) but also an attempt by Saudi Arabia to restore its market share within OPEC and impose production discipline on other OPEC members (Gately, 1986) (Alkhathlan, et al., 2014). The resulting sharp fall in oil prices ended in late 1986 when OPEC collectively decided to cut back production (Mabro, 2005).

2.2.2.2 Role of OPEC: 1997-1998
The massive growth of supply in 1997 was driven by increased OPEC output as well as large production increases by non-quota-complying members such as Venezuela (Mabro, 1998). Saudi Arabia responded by stepping up its own production in the latter half of the year as a way to validate the previous production increases. This production hike was rooted in the misjudgment that global demand would continue to be high, and there was a significant, concerted quota increase in November 1997 (Mabro, 1998). By 1998, the East Asia financial crisis worsened and oil demand collapsed, resulting in OPEC quota cuts in 1998 and 1999 (PIRINC, August 1999). However, this action failed to halt declines in oil prices which continued until mid-1999. In this case, OPEC was unable to sufficiently cut production to offset oversupply.

2.2.2.3 Role of OPEC: 2014-2015
In the wake of the 2008 financial crisis, OPEC output rose sharply through 2012. Due to geopolitical events in OPEC member states such as Libya and Iraq, temporary supply disruptions occurred in the following years but were quickly mitigated by expanded output elsewhere (El-Katiri, et al., March 2014). The decision by Saudi Arabia (essentially speaking for OPEC) in November 2014 not to act as swing producer and restrain its production surprised the market and represented a change in the typical Saudi response to falling oil prices (McNally, October 2014; Tortoise Capital Advisors, November 28, 2014) (Fattouh, October 2014). In its effort to maintain market share and force higher cost producers (like tight oil producers) to take more responsibility
for market adjustments, OPEC’s decision not to cut production despite falling prices forced 
immediate further price declines (Deutsche Asset & Wealth Management, November 28, 2014).

2.2.2.4 Role of OPEC: A Summary

Though the proximate cause differed from case to case, OPEC temporarily relinquished control 
of the market in each of these market disrupting events. For each one, corresponding declining 
prices resulted from more fundamental economic forces at work distinct from OPEC. Preceding 
each major event was a buildup of non-OPEC production driven by a combination of 
technological breakthrough and previous high prices that encouraged investment. The power to 
control the underlying pace of global demand growth is beyond OPEC as it cannot determine 
growth in the world economy or changes in energy efficiency. Additionally, OPEC cannot 
control total supply as it increasingly competes with countries that each act to maximize their 
individual supply function (Greiner, May 2015).

In 1973, OPEC’s share of global crude production was 51% but dropped to 28% by 1985 
(Fattouh, January 2011). High oil prices during that time period, brought on partly by OPEC’s 
actions, provided the incentive to non-OPEC countries at the time to look for sources of crude 
elsewhere and spurred the development of technology to extract it while consumers adapted to 
decreased consumption (Morse, 2009). The most recent cycle has similar roots: U.S. exploitation 
of technology to extract tight oil was made efficient by the high prices of 2007-14. Significant 
production growth in non-OPEC countries, spurred by broader application of technology and 
reduced production costs, fueled supplies (Ratti & Vespignani, 2015).

2.2.3 Oil Price Cycles

Currently, the global crude market is characterized by dramatic moves in prices and long 
fundamental swings in supply likened to the “hog cycle” (Lane, January 13, 2015). These cycles 
occur due to low supply inelasticity of oil in the short term and high elasticity in the long term 
(Mankiw, 2007). There are two characteristics of the oil market that help determine the supply 
response: the capital intensive nature of production and the structure of the market.

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4 Elasticity when discussing oil prices measures responsiveness of consumption and production of oil to changes in 
its price. *Invalid source specified.*
Oil production is typified by a high fixed production cost which then transitions to relatively low variable production costs.\(^6\) Once a field is established, low marginal variable costs of production make it economical and logical for an oil producer to continue to produce even if prices fall sharply. In the long run, supply becomes elastic while production loses efficiency due to a lack of investment and a failure to put new fields into production. Historically, production lags take approximately one year as demonstrated by the sharp falls in production in 1986 and 1999.

Because of this lag, inventories grow as supply exceeds demand for a period after the initial price fall. The move back to market equilibrium through falling supplies also sees a lag as producers need high prices to attract new investment among other considerations.

This cyclical pattern was evident during the 2000s when economic growth in Asia led demand to greatly exceed supply. Between the East Asia financial crisis of the late 1990s and the 2008 financial crisis, most commodities saw a double digit annual real price growth (Canuto, June 2014) (Erten & Ocampo, 2013). Oil alone rose over tenfold between 2004 and 2008. This supercycle was fueled by growing demand resulting from industrial development and rapid urbanization in emerging markets and underinvestment in various commodity markets.

In the immediate aftermath of the 2008 global financial crisis, all commodities suffered greatly with oil experiencing a decrease in investment (Hamilton, Spring 2009) (Khan, August 2009). With a notable exception in the oil sector, most commodities rebounded and peaked in 1Q2011 followed by a steady decline in prices. Slower demand resulting from the recession reduced investment in supply, though prices would shortly rise above $100/bbl as the global economy recovered in 2010 and growths in OPEC production in 2011 were limited due to the Arab Spring (Darbouche & Fattouh, September 2011). Faced with high crude prices, there was a sharp increase in investment particularly in U.S. tight oil as high prices made it profitable (Fattouh, 2013).

\(^6\) http://www.encharter.org/fileadmin/user_upload/document/Pricing_-_chapter_2.pdf
The structure of the market also has a significant impact on supply. Although OPEC does behave in many ways like a cartel, it does not produce the majority of the world’s crude (Colgan, 2014). Many non-OPEC producers are not located in the Middle East and are relatively free from the geopolitical events that have negatively impacted that region. Furthermore, while OPEC members are extremely varied economically, they are somewhat constrained to follow a single policy. Non-OPEC producers do not face similar constraints regarding how much they can produce.

2.2.4 Strength of the U.S. Dollar
A factor of oil prices less mentioned than OPEC but still important is the strength of the U.S. dollar (USO). Since the USD is used as the medium of exchange for most global trade, its value has an impact on prices. When the USD is weak, oil producers stand to gain; when it is appreciating, oil producers stand to lose (Obadi, 2012).

3 Oil Price Shocks
3.1 Phase One: Methodology - Questionnaire
A survey on crude oil prices and the impact on U.S. shale oil was conducted to assess the perceptions and experiences of top domestic think tank thought leaders. These individuals comprise a diverse group of scholars and active participants on the front lines of the energy, environmental and economic impact of the shale oil revolution in the U.S. Leading scholars from the top 25 think tank organizations, as ranked by the Think Tanks and Civil Societies Program at The Lauder Institute of the University of Pennsylvania, were invited to participate in the survey (McGann, March 2015).
Figure 5. Overview of Survey Research
The field survey was conducted during the period between the 1st and the 30th of June 2015. 170 individuals were invited to participate in the survey. In order to ensure high quality of the response, only respondents with energy sector expertise in the fields of economics, policy analysis, and scientific discovery were invited to participate in the survey. During the month of June, two separate emails reminders were sent out to encourage participants to respond to the survey. At the completion of the survey the overall response rate was 63% with 107 respondents. The margin for error was 5% at the 95% confidence level.

Of the 107 respondents, 75% hold a doctorate, more than half hold faculty positions at leading universities, and several have held prominent policy positions within the U.S. federal government, Economists from nine out of the 10 leading national universities, according to U.S. News and World Report, are represented (Princeton, Harvard, Yale, Colombia, Chicago, Duke, Massachusetts Institute of Technology, University of Pennsylvania, and Dartmouth). The majority of respondents were from the National Bureau of Economic Research (19), RAND Corporation (15), Brookings Institute (13), Belfer Center at Harvard University’s Kennedy School of Government (10), World Resources Institute (9), and the James Baker III Institute for Public Policy at Rice University (6).

The survey asked five questions:

a. The decline in global oil prices over the past 12 months was primarily a result of (options).

b. If oil prices stay where they are at today, what impact will there be on U.S. shale oil suppliers?

c. How much more or less capital spending by U.S. shale oil suppliers do you foresee?

d. Do you believe that U.S. shale oil supply will begin contracting over the next 12 months?

e. What will the price of crude oil (WTI) be per barrel at the end of 2015?
3.1.1 Few Attribute Collapse in Oil Prices to Weak Demand

Few attribute the recent price collapse in global oil prices to weak demand.

While 42% attributed the price correction to an equal balance of oversupply and weak demand, the difference between those who pointed to either supply or demand was wide. A total of 40% cited oversupply while only 6% responded that weak demand was the primary cause. Out of the total respondents, 82% and 48% recognize the significant impact of oversupply and weak demand respectively.

3.1.2 Negative Impact on U.S. Tight Oil Suppliers

3 out of 4 respondents see a negative impact on U.S. tight oil suppliers.
At 75%, the overwhelming majority of respondents believe that current low oil prices will negatively impact shale oil producers in the U.S. Additionally, more respondents believe that there will be no impact than those who believe the impact will be positive, very positive, or very negative. Overall, 80% see a negative impact, and only 6% project a positive impact. These assessments are reflective of the general opinion of the oil and financial industry. When the survey was conducted, the selling price of WTI was below the breakeven price for a significant number of shale producers. Even for those who are operating profitably, the reduced net profit will negatively impact future operations.

3.1.3 Reductions in Capital Spending
*Majority of thought leaders see a reduction in capital spending within the U.S. Shale industry*

Nearly half of the respondents (45%) believe that CAPEX spending will decline slightly over the next 12 months while an additional 15% envision more significant declines. Conversely, 14% project a slight uptick in spending while only 1% believes much more spending will occur. In the middle are the 25% who predict that overall CAPEX spending will remain roughly the same. Regardless, those who envision reduced spending outnumber those who envision spending growth by 4:1. CAPEX declines are already being seen in large scale layoffs, reduced exploration of plays, cancelation of future projects and consolidation of existing operations.

3.1.4 Uncertainty Abounds Over Tight Oil Supply
*Uncertainty abounds as to the supply of shale oil over the next 12 months*

While 41% of respondents do not envision a contraction of U.S. shale oil over the next 12 months, 27% are unsure while 32% envision declines. Although the forecast of a positive future for the shale industry received the highest response, the fact that the majority responded with uncertainty or negative predictions is significant. Even so, a high number predicts supplies remaining stable, and this logically points to the lag that exists in the market. Despite the declining prices in 1Q2015, production at shale plays (oil-bearing shale formations) remained stable as producers were protected by long term hedges and newly dug wells being brought online.
3.1.5 Think Tank Leaders See Prices Stabilizing

*Majority expect crude oil prices to remain relatively stable through 2015*

The overwhelming majority of respondents (68%) envision a closing price of $60-$80/bbl by the end of the year. While 15% see a price range of $40-$60, 13% predict prices of $80-$100. Only 4% envision prices outside of the $40 to $100 range. Overall, oil prices are projected to rise by the end of the year but will not match their highs of 2014. This price range matches EIA estimates and, though the range is wide, points to rising but manageable prices.

3.1.6 Hypothesis Testing – Analyzing Questionnaire Data

Three hypotheses about the data were tested. “Don’t know” responses were treated as missing data and were not included in the non-parametric tests described below. Throughout the analysis, the ability to perform statistical tests on the data obtained was intentionally limited based on the non-parametric data available. Data obtained from respondents was either categorical or ordinal, with only a few response options possible for each question. From the onset, this eliminated several types of data analysis such as regression and t-tests which is why Chi-square and Kruskal-Wallis tests were run using IBM SPSS version 22. Two independent variables, the respondents’ institution and highest level of education, could have tested the difference in response applying an analysis of variance (ANOVA), however the descriptive data was determined to be sufficient to show the consensus among respondents.

3.1.6.1 Hypothesis 1(a) and 1(b)

Respondents who believed that the decline in oil prices over the past 12 months was a result of excess supply would predict (a) less capital spending over the next 12 months by shale oil suppliers and (b) shale oil suppliers will begin contracting over the next 12 months.

For hypothesis 1a, a Kruskal-Wallis test, which is a method for determining if multiple samples come from the same sample, did not reveal any significant differences between belief in the causes of oil prices and prediction of capital spending over the next 12 months by shale oil suppliers. This is primarily because approximately equal groups of respondents chose “excess supply” and “equal parts excess supply and weak demand,” and those two groups made similar
predictions about capital spending by shale oil suppliers. Both groups predicted less spending in the next 12 months by shale oil suppliers, with the majority of both groups predicting “somewhat less spending” and some predicting “much less spending.”

For hypothesis 1b, a Chi-square test, which is a method for determining the similarity between observed data and projected data, did not reveal any significant differences between belief in the cause of the decline in oil prices and prediction of whether shale oil suppliers would begin contracting in the next 12 months. Again, this is primarily because approximately equal groups of respondents chose “excess supply” and “equal parts excess supply and weak demand,” and those two groups made similar predictions about whether shale oil suppliers would begin contracting in the next 12 months. In both groups, a slight majority predicted that shale oil suppliers would not begin contracting in the next 12 months.

3.1.6.2 Hypothesis 2

Respondents who forecasted less capital spending by U.S. shale oil suppliers would also predict a reduction in supply, or that shale oil suppliers would begin contracting in the next 12 months.

A Kruskal-Wallis test, which again is a method for determining if multiple samples come from the same sample, revealed a significant difference ($\chi^2 = 4.57$, df = 1, $p = .033$) between predicting that U.S. shale oil suppliers would or would not begin contracting in the next 12 months, based on the respondents’ forecast of capital spending by U.S. shale oil suppliers. Respondents who forecasted less spending predicted that U.S. shale oil suppliers would begin contracting in the next 12 months.

3.1.6.3 Hypothesis 3

Respondents who predicted that crude oil prices will remain stable would also predict a negative impact on U.S. shale oil suppliers.

The survey data were not sufficient to test this hypothesis because of lack of variability. Most respondents predicted stable oil prices and negative impact on shale oil, and there were too few respondents who predicted otherwise to test the relationship between these two variables.
3.1.7 Summary of Results
Responses to the survey, supported by trends within the industry, forecast that sustained low oil prices will negatively impact the U.S. shale industry. Substantially reduced profit margins will prevent substantial growth and expansion in an industry that requires constant capital. By the end of the year, oil prices are not expected to rise significantly. However, prices at the upper limit may allow many U.S. shale producers to achieve net profit. Despite the uncertainties, limited volatility is projected for the supply of shale over the next 12 months as shale producers will continue to operate until they are forced to shut wells.

3.2 Phase Two: Explanatory Research

3.2.1 A Decade of Volatility: 2004-2013
In the decade between 2004 and 2013, an incredible degree of change occurred in the global crude market. Rising global demand for crude in the wake of the late 1990s East Asia financial crisis could not be met immediately by matching increases in supply, resulting in crude oil prices reaching a historic high before the recession of 2008 forced prices downward. To cope with the higher prices, unconventional sources of oil were tapped, and this would play a major role in shaping the price correction and decline of 2014 which continued into 2015.

The second half of the 2000s would see tremendous growth in the production of unconventional oils particularly in the U.S. High oil prices spurred the development of non-OPEC based energy resources while changes in consumption, consumer trends and government mandates minimized the need for OPEC sourced oil. The result was the U.S. shale oil boom that allowed for the U.S. to reach its highest crude oil production levels in four decades (Jr. & Tom, 2015). In the Bakken alone, production increased from a few barrels in 2006 to over 530 kb/d in December 2011 to over 1 mb/d in December 2014 (EIA, December 2014). This is an amount equal to current production levels of the sixth largest oil exporter, Iraq (Ladislaw, et al., 2014, p. v).

A number of factors contributed to this rise in oil prices and parallel development of tight oil (Fattouh, January 2010). One of these was the earlier mentioned commodity supercycle that occurred in the wake of the East Asia financial crisis, fueled by growing demand in emerging markets and underinvestment in various commodity markets (Canuto, June 2014) (Erten & Ocampo, 2013).
While world demand increased, global supply failed to keep pace owing to global instability and limits on traditional crude production (Livingston, 2014, p. 31). For the first time since oil drilling began in the mid-19th century, crude prices increased for seven consecutive years from 2002 to 2008. This catalyzed the beginning of the U.S. tight oil boom that began in earnest in 2008 (Gordon, May 2012).

3.2.1.1 Increasing Global Demand
The 2000s saw a global shift in the demand of oil. OECD countries, once the biggest consumers, were supplanted by rapidly developing countries such as China and India whose growth led to strong increases in demand that offset declines elsewhere in the world (Baffes, April 9, 2012) (Finley, 2012). Between 2000 and 2010, consumption in OECD countries declined while non-OECD consumption rose by 40% with the period between 4Q2005 and 2Q2010 seeing almost constant declines in consumption by OECD countries (EIA, 2015). Furthermore, consumption overall among non-OECD countries only declined in two quarters between 1Q2001 and 2Q2015 (EIA, 2015). As early as 2006, demand from non-OECD countries had essentially eliminated the world’s spare crude production capacity (The Brattle Group, 2014). Increased demand from non-OECD countries and decreased global supply resulted in a tightening world market for oil and increasing prices until 2008.

Demand in developing countries is especially visible in China’s and India’s massive industrial development and rapid urbanization. China’s share of world consumption was 12% in 2014, up from 8% in 2004 (BP, June 2015). Although economic growth is slowing in China, increasing annual consumption in that country is a long term trend (The World Bank, June 2015). The EIA has reported that China and India will be responsible for half of the increase in the world’s consumption of energy between 2008 and 2035 (EIA, September 2014).

7 This disparity in consumption between non-OECD and OECD countries is primarily due to structural conditions such as the more mature transportation sectors of OECD countries. This is despite the relative inelasticity of oil demand in the short run though consumption over the past decade has been tapering off as increasing gas efficiencies and general consumer trends have somewhat limited growths in consumption. Additionally, economic growth is weaker in advanced countries than it is in developing countries.
Between 2004 and 2014, demand generally rose at a steady rate but did taper off in the immediate aftermath of the global recession in 2008-2009. In 2008, the global financial crisis caused annual worldwide oil consumption to decline for the first time since 1993. As demand collapsed, oil fell from its all-time high of $144.22/bbl for Brent on July 3, 2008 to a low of $33.50/bbl by December 23, 2008, a 77% decline (BP, June 2009). This was especially apparent in advanced economies like the U.S. and Japan where the decline in oil consumption more than offset the consumption growth experienced in some other regions (IMF, October 2009) (Yanagisawa, March 2015). 8

Economic recovery in 2010 would increase demand and by early 2011 the price of oil had once again passed $100/bbl. However, increasing demand was not compensated by increasing global oil supplies due to a variety of factors. In the U.S. alone, between 2013 and 2014 demand was relatively stagnant (EIA, July 2015). Government mandated fuel economy for cars, ethanol replacing a portion of oil used in gasoline, substitution of oil demand by shale derived gas/NGLs and the slow and uneven economic recovery all contributed to reduced demand for crude oil (Troner, October 2014). Since 2007, imports of crude oil into the U.S. have steadily declined due to rising domestic supply from tight oil and falling consumer demand (EIA, 2015). In 2005, imports into the U.S. from outside North America were around 9mb/d but would fall to approximately 1.95mb/d by mid-2014 (Livingston, 2014).

3.2.1.2 Stagnant Global Supply
As global demand rose from 2005, global conventional crude oil production went into decline as exports fell from their peak that same year, resulting in crude oil prices sharply rising in both nominal and real terms. Between 2005 and 2008, stagnant oil production and accelerating demand, particularly from China, fueled oil prices to hit an all-time high in July 2008.

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8 The steep decline in oil prices in the wake of the financial crisis was due primarily to common factors and quickly rebounded. These common factors included the sudden drop in demand due to the financial crisis, global uncertainty, and liquidity constraints. For that reason, the oil price decline of 2008 bears fewer similarities to the price declines in the late 1990s and mid-1980s, events which were heavily impacted by industry structural factors (Hamilton, Spring 2009).
Compounding limited growth in oil production capacity in the first half of the 2000s was instability and conflict in the MENA region that would last throughout the decade. In the latter half of the 2000s, this caused reductions in supply and led to fears of future geopolitically induced production cuts (Amenc, et al., November 2008) (Darbouche & Fattouh, September 2011). Production disruptions in Iraq and Venezuela in the early 2000s were offset by increased production from other OPEC countries, especially Saudi Arabia. In compensating for these, OPEC decreased its spare production capacity which limited its ability to meet rising demands and act as a traditional swing producer (Fattouh, October 2014) (Hamilton, 2013). Spare capacity in OPEC increased only marginally between 3Q2005 and 2Q2007 by 1.3mb/d which was not enough to offset increasing global demand (Murphy, April 2011) (EIA, 2015).

Between 2005 and 2008, net increases from non-OPEC producers were small, and annual growth averaged 200kb/d (EIA, 2015) (EIA, February 2008). Majority growth in overall global oil supplies since 2005 resulted from the production of unconventional oils such as tight oil outside of OPEC. Indeed, between 2000 and 2013 crude oil production increased daily by 7.4mb/d though the majority of that, 71% or 5.2mb/d, occurred between 2000 and 2005. The period between 2006 and 2013 only accounted for 29% or 2.2mb/d of the increase. Without the surge in tight oil from the U.S. in 2008, total crude production globally would have been in decline with little to no spare capacity (Fattouh & Sen, September 2013) (Maugeri, 2013).

This relatively small increase in conventional global crude output between 2005 and 2008 is contrasted by increasing prices. This imbalance is attributable to a lack of high spare capacity among producers. Accelerating decline rates in ageing conventional fields and a shortage of easy, cheap alternative sources of conventional crude can partly explain for the absence of significant expansion in crude output (Sorrell, et al., 2010).

Prior to the 2008 financial crisis, OPEC countries were persuaded in 2007 at Jakarta to increase production for the first time in two years. This was despite early signs of economic instability coming from the U.S. in the form of the subprime mortgage crisis, and the economic crisis in the following year would lead to an immediate reversal of OPEC’s decision to increase production (Khan, August 2009). To cope with the resulting oil price declines, OPEC significantly cut
production in the second half of 2008 and in 2009. OPEC would increase supply again in 2010 as demand rebounded, and by early 2011 crude had passed $100/bbl. Even so, OPEC production cuts were not fully reversed until 2012 (BP, June 2010) (BP, June 2011).

In the 2010-2012 period, economic recovery led by East Asia resulted in increased demand. However, demand exceeded supply, and this was compounded by other factors leading to increasing prices. Supply disruptions resulting from the Arab Spring impacted operations in Libya and elsewhere, economic sanctions imposed against Iran for its nuclear program substantially reduced supplies and non-OPEC areas such as the North Sea and Mexico witnessed declines in production (Azzarello & Wightman, July 7, 2014) (Stevens, March 2015) (El-Katiri, et al., March 2014). Adding to this was the impact of speculation and fears of further negative events on the future trading markets (Amenc, et al., November 2008). These factors led to high oil prices in world markets though not as high as those of 2008.

Oil prices would not stabilize again until 2011 when they reached levels aligned with or close to average all-time highs. This stability was brought about by a solid balance between supply and demand as well as other factors. Again, the impact of supply disruptions had negative repercussions on the level of worldwide spare oil production capacity between 2012 and 2013. In 2011 alone, Libyan oil production dropped over 1mb/d, forcing increased production elsewhere (ERGO, February 2012). Declines in OPEC spare production capacity continually dropped until reaching a low of 1.6mb/d in 3Q2013, a situation reminiscent of the mid-2000s (EIA, 2015).

3.2.1.3 Surging U.S. Unconventional Resources
U.S. production of crude fueled by tight oil grew by nearly 100% between 2008 and 2015 as the largest tight oil fields in the U.S. (Eagle Ford, Bakken and Permian) increased production from less than 0.4mb/d in 2007 to over 3.5mb/d at the beginning of 2015 (Baffes, et al., March 2015) (EIA, 2015) (EIA, January 2015) (Fattouh, October 2014). Tight oil production in the U.S. has been credited with reversing the slump the U.S. has experienced in crude production since its last peak in 1970 (IMF, 2011). From a negative annual growth in crude production in 2008, 1mb/d of oil was added in 2011 and 2012 before rising even higher in the following years (Fattough & Sen, September 2013).
3.2.2 Oil Prices Collapse: 2014-2015
In 3Q2014, oil prices would begin a steep decline from almost $116 on June 17, 2014 that would continue into 2015 with the price of Brent fluctuating between $47 and $57 from its lowest point through the start of 2Q2015. This nearly 60% decline was brought about by a number of factors though oversupply is widely accepted to have been the dominant cause in triggering and motivating the June price correction (Badel & McGillicuddy, 2015) (Baffes, et al., March 2015) (ExxonMobil, 2015) (Nulle, 2015) (Thomson Reuters, February 2015) (Arezki & Blanchard, December 22, 2014) (Hamilton, December 14, 2014). Throughout the price correction, supply has continuously exceeded demand, but demand factors have increasingly come into play (Kirby & Meaning, 2015).

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9 Before the start of the decline in June 2014, the EIA was forecasting the average price of Brent to be $108/bbl and $102/bbl in 2014 and 2015 respectively (EIA, June 2014). Current EIA forecasts of Brent for 2015 are $60/bbl, 60% lower than the previous year’s forecast.
3.2.2.1 Supply and Demand
According to the IEA, global demand slowed from 91.9mb/d in 2013 to 92.6mb/d in 2014 while supply increased from 91.3mb/d to 93.7mb/d, creating an oversupply of 1.4mb/d. In 1Q2015, the difference was even more pronounced with a 1.8mb/d oversupply (IEA, July 10, 2015).

3.2.2.2 Demand
Global growth has continuously failed to meet forecasts, and this has seriously impacted demand. In July 2014, the EIA, IEA and OPEC forecasted 2015 global liquids growth to be 1.7 on average. However, by December 2014 the forecast was revised down to 1.1% (Deloitte, 2015). In OECD countries, declining consumption that began in the 2000s continued partly due to increasing gas efficiencies worldwide and changing consumer trends (EIA, 2015). Adding to this were continued economic fears in Europe over issues in countries such as Greece, leading oil demand in Europe to sink to its lowest in over 20 years (BP, June 2015).

Government legislation in the U.S. leading up to 2014, such as the 2005 Energy Policy Act and the 2007 Energy Independence Act that outlined higher fuel economy standards for vehicles and a blending of ethanol into gasoline, led to reduced U.S. demand with consumption declining by
over 2mb/d between 2005 and 2013. Similar legislation has been enacted elsewhere in OECD countries and contributes to declining demand (Thomson Reuters, February 2015).

In 2014, China’s slowing economic growth, which had been the largest single source of increasing crude demand, served to limit growth of oil consumption growth (The World Bank, June 2015) (EIA, May 2015) (The Economist, 2015). That year, the Chinese economy grew by 7.4%, a healthy amount though a decline from the average annual growth rate of 10% that had held steady for three decades (IMF, April 2015). For non-OECD countries, while demand remained positive, annual growth had slowed considerably with 1Q2013 being the last time demand growth exceeded 4% over the previous quarter (EIA, 2015).

![Consumption: OECD vs non-OECD](image)

**Figure 9.** Consumption: OECD vs non-OECD

### 3.2.2.3 Supply

#### OPEC Supply Changes

In the preceding decade, OPEC saw its share of the global crude market gradually erode due to rising tight oil production in the U.S. and its own price targeting range. To reverse this, several OPEC members, including Saudi Arabia, began in 3Q2014 to export crude to East Asia at reduced prices (Fattouh, October 2014) (Raval, 2014) (El Gamel & Shamshedine, 2014). Despite
falling prices, OPEC production increased in September, the largest increase in almost three years (Smith, 2014).

In Vienna on November 27, 2014, OPEC decided against cutting production as a way of stabilizing prices and instead agreed to maintain the existing 30mb/d production level (OPEC, November 27, 2014) (El Gamal, et al., 2014). Saudi Oil Minister Ali al-Naimi stated the move was an attempt by Saudi Arabia, the world's largest low cost producer, to retain market share and fend off non-OPEC competitors (ThomsonReuters, 2015).

Immediately, Brent fell over $6 on that day alone, a 5% drop to $72.82 (BBCNews, 2014). Over the course of the next month, Brent would continue to fall to $59. This decision by OPEC benefitted the Gulf state members but was opposed by others such as Venezuela, Algeria and Iran who sought production cuts as falling prices seriously impacted their revenue streams.

The agreement by OPEC was a rejection of its past objective to target an oil price band and the start of a new objective to maintain market share. Before this, OPEC had acted as a swing producer, but that role would now fall on other oil producers such as those in the unconventional field. Despite an oil price plunge of 40% since the previous year, in June 2015 OPEC ministers refused to cut production, signaling intent to maintain production rates that were actually marginally rising (Faucon, et al., 2015) (OPEC, June 11, 2014).

Non-OPEC Supply Changes
In the U.S., total crude production throughout 2014 and into 2015 was nearly double what it was in 2008, primarily due to tight oil production which the IEA considers to be the single largest source of increasing crude supply globally (IEA, 2015). U.S. production between 2008 and June 2014 rose from 5mb/d to 8.5mb/d, a 71% increase. Even as oil prices fell in the latter half of 2014, U.S. oil production continued rising from an average of 8.5mb/d in 2014 to 9.7mb/d by the start of 2Q2015 (EIA, 2015). Overall, the 4.7mb/d rise in U.S. production between 2008 into 2015 represents almost 15% of total OPEC output in May 2015 (IEA, July 10, 2015). This increased production reduced U.S. need for imports and freed up millions of barrels a day for the rest of the global market.
Despite the negative economic impact falling prices had on tight oil producers in the short run going into 2Q2015, the effects were not nearly as bad as had been anticipated (The Economist, 2015). Due to a backlog of wells and price hedges sheltering tight oil producers from the downturn, U.S. supply continued to increase in 2015 even as overall production fell (BlackRock, February 2015) (EIA, July 2015). The EIA estimates U.S. crude production for 2015 rose by 200/kbd (EIA, July 2015).

Apart from the U.S. and tight oil, there were also production increases in Canada and Brazil as well as from other unconventional sources. Led by the U.S. and Brazil, biofuel production in 2014 produced almost 1.4mb/d crude equivalent in 2014 with the top two countries responsible for 68% of global production. Extraction of oil from oil sands in Canada produced 4mb/d of oil in 2014.

3.2.2.4 Geopolitical Challenges
Playing into supply were geopolitical concerns and events. In 2014, global geopolitical tensions abounded, including the conflict in East Ukraine, the ISIS offensives in Iraq and sectarian violence as well as the lack of a stable government in Libya. Despite these crises, which would give commodities traders reason for caution and speculation over supply disruptions ultimately leading to higher prices, quite the opposite occurred (al Harmi, 2014). Preliminary fears over potential supply disruptions in 2014 proved mostly unfounded.

ISIS, which has been on the offensive in Iraq since late 2013, went on to capture Mosul, Iraq’s second largest city, in June 2014 before their offensive stalled out (Nordland & Rubin, 2014). Fears of large scale cuts in overall Iraqi oil output due to the loss of northern oilfields were also unfounded as production increased rapidly in the south and in Kurdistan (Columbia SIPA, 2014) (Edinburgh International, 2014). Instead of declines, Iraqi output actually increased in 2014 with an output average of 330kb/d over 2013 and was the second leading contributor to global oil supply growth in 2014 (EIA, February 9, 2015) (Lynch, 2015).
Meanwhile in post-Gaddafi Libya, production which had fallen by over 80% from its highs in 1Q2013 to its lows in 2Q2014 saw production gradually increase fourfold by the start of 4Q2014 before falling again (Fauccon, 2014) (Trading Economics, 2015). Despite the placement of economic sanctions on Russia as a result of the conflict in East Ukraine, declines on the total output from Russia were short lived and minimal with production immediately increasing in 3Q2014 and eventually hitting its highest output over the past decade by 1Q2015 (Trading Economics, 2015) (Morgan, 2015).

3.2.2.5 Appreciation of U.S. Dollar
Beginning in the second half of 2014, the USD began a rapid appreciation against other major currencies, totaling over 20% between 2Q2014 and 2Q2015 (ODI, March 2015). As stated earlier, since most commodities including crude are traded in USD, a rise in the value of the dollar tends to negatively impact oil producers while decreasing demand by reducing the purchasing power of other countries (Deloitte, 2015). Monetary policies in the U.S. have played a considerable role in the appreciation of the USD (Frankel, December 2014).

Overall, the significant but not unprecedented price decline between 2014 and 2015 was dominated by an excess of supply resulting in a price correction. While supply was the primary driver, the impact of slowing demand is significant. Revised forecasts and estimates continue to show that demand has been repeatedly less than originally anticipated. Furthermore, the appreciation of the USD and the failure of supply disruptions to have meaningful impact have all served to contribute to the price decline.

3.2.3 Short and Long Term Outlook
3.2.3.1 Oil in the Short Term
Despite a small rebound in prices through the first half of 2015, have once again begun to significantly decline and call into question any prolonged stability. Several outlooks show that demand will increase in the short term, but the extent to which existing inventories and increases in supply will keep prices stable remains in question. Due to the hog cycle and inelastic nature of the crude market in the short term, supply and demand imbalances take time to reach
equilibrium. The IEA projects that the price correction and rebalancing of the crude market will extend well into 2016 before equilibrium is reached.

Over the coming year, massive swings are not expected in the oil sector, a sentiment shared by the EIA, IEA and OPEC in recent forecasts. Implied volatility for oil in the coming months is in line with historical ranges despite being higher than last year. This indicates that supply and demand imbalances are expected to narrow, but projected supply is still expected to exceed demand.

If demand and supply match estimates, what will result is a gradual tightening of the market and demand slowly picking up and overtaking supply by the end of the decade. Tight oil production in the U.S. is expected to remain solid until 2020 supported by declining breakeven costs and rising oil prices. However, afterwards begins a prolonged descent as the amount of recoverable shale deposits decline.

There are two principle factors that must be taken into account when estimating where oil prices will go in the future: demand and short term price variations. Global economic growth should rise slowly over the next year, thus increasing demand for oil. In meeting demand, higher price unconventional oils will be needed as conventional crude production can no longer accommodate significant increases unless additional sources are brought onto the market such as those from Iran. At current trading prices, supply and demand cannot be balanced due to the need for higher prices to support unconventional production.

Conversely, existing inventories and projected supply rates will be able to keep prices stable in the short run. However, short run prices are subject to overshoots that can be either overly high or low. For oil producers, short term marginal cost are the true deciding factor of whether to pump oil or not. Due to this, the impact of sudden price spikes or declines will have a significant impact on unconventional producers who are the new swing producers.
3.2.3.1.1 Changing Market Dynamics
The dynamics of the oil market have changed over the past few years and even more significantly over the past year. OPEC has given its role as swing producer over to unconventional producers that are highly elastic from a supply side (Basu and Indrawati 2015) (BlackRock, February 2015) (Tortoise Capital Advisors, November 28, 2014). This is a direct result of the tremendous surge in tight oil output from the U.S. since 2008 which changed the nature of global oil supply.

3.2.3.1.2 U.S. Tight Oil Production
The speed and size at which oil prices will rise is highly dependent on how highly elastic U.S. tight oil producers respond (Krane & Agerton, 2015). While tight oil production has been robust in the first half of 2015 due to wells drilled in 2014 coming online and price hedges protecting producers, declines in capital spending will slow production growth over the next six months to a year (EIA, July 2015) (BlackRock, February 2015) (UBS, March 2015). Reduced investment has seen rig counts decline to 640 in the week ending September 25th, down from 1592 rigs a year earlier (Baker Hughes, September 25, 2015). U.S. production led by tight oil experienced five weeks of constant declines going into mid-September, the longest retreat in over a decade as producers scale back operations. The IEA in September expects production will further decrease by 0.4mb/d in 2016.

Breakeven costs for production will also determine the immediate future of tight oil. At its lowest price this August, most producers were operating at a loss however maturing technologies and greater efficiency continue to lower breakeven costs. Eagle Ford’s breakeven costs decreased from nearly $60/bbl in 2012 to around $45/bbl in 2014, and Rystad Energy estimated that that the main U.S. shale plays had an average WTI breakeven of $58/bbl (Rystad Energy, January 2015). In the current low cost environment, tight oil producers have shown remarkable resilience leveraging maturing technologies, renegotiating contracts with oilfield service companies, large scale lay-offs and increasing efficiency to lower breakeven costs.

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10 In the U.S., rig counts are often looked at as an indicator of the health of the tight oil industry but rig numbers and rig productivity rates are not linear owing to variations in wells among plays.
Further compounding issues, is the high degree of leverage in the industry, limiting the amount of financing available for future expansion (CIEP, July 2015). Futures contracts and other swaps and options purchased in 2014 by producers as insurance against falling prices as of September are beginning to expire. Low prices have driven investors away from tight which is seen as extremely risky, especially due to the volatility of the market and the financial issues faced by producers. The industry is faced with billions of debt and new sources of financing will be hard to come by in the immediate future.

Tight oil also faces considerable public opposition in the U.S., specifically due to fracking. Public support of fracking has declined from 48% in March 2014 to 40% in March 2015 while opposition has increased dramatically. Such growing opposition has translated into action being taken by state governments to ban fracking, even if temporarily, until concerns can be adequately addressed (Energy in Depth, April 2015) (Goho, 2012).

Fracking has been also been connected to health, environmental, and community impacts. Contamination and depletion of fresh water supplies have occurred as a result of fracking while elevated levels of toxins around shale fields have been seen due to convoys of trucks, the flaring of gas and wastewater storage vehicles (Rotkin-Ellman & Srebotnjak, December 2014) (PSR, 2014). Because negative impacts vary in magnitude across regions and solutions need to be tailored to each area, tight oil producers have been slow in addressing problems. State specific regulation and compliance issues further complicate the addressing of these problems. Problems are also exacerbated by producer noncompliance and lack of effective regulatory enforcement. Failure to address these issues may result in the government intervention, motivated by growing public opposition to fracking. Legislation has been introduced to limit fracking, and, if enacted, the cost to produce tight oil will rise as producers are forced to abide by tighter regulations.

3.2.3.1.3 Supply
The massive fall in oil prices has forced a retrenchment in investment across the oil industry, leading to dramatic cutbacks in global capital expenditures similar to the situation in the early 2000s (Friedman, 2015). It will take time for the full effect of these cutbacks to be realized, and supply should continue to increase over the next 12 months.

The EIA does expect crude production in the U.S. to fall by the end of 2015, and the IEA predicts that non-OPEC growth will halt in 2016 due to low oil prices impacting production (EIA, July 2015) (IEA, July 10, 2015). U.S. declines due to unattractive economic returns and seasonal factors will continue into 2016 before growth resumes in late 2016. Projected U.S. crude oil production averages are 9.5mb/d in 2015 and 9.3mb/d in 2016 and is expected overall for 2015 to be 800kb/d higher than 2014 (EIA, May 2015). As of 2Q2015, U.S. crude production is at its highest in 40 years (Shenk & Smith, 2015).

Globally, in June 2015, oil supply rose by 550kb/d for a total output of 96.6mb/d, a gain of 3.1mb/d over 2014. The same month, OPEC hit a three year high for output with daily output 1.5mb/d higher than 2014 mainly due to record high output from Iraq, Saudi Arabia and UAE.

Including the U.S., the EIA estimates that non-OPEC growth will fall from 2.3mb/d in 2014 to 1.4mb/d in 2015 to 200kb/d in 2016. However, the IEA predicts lower non-OPEC growth of 1mb/d in 2015 and no growth in 2016. OPEC is estimated to see a 600kb/d increase for 2015 and a 200kb/d decrease in 2016.
However, the abovementioned OPEC estimates may need to be revised as they were conducted before the Iran deal. Prior to sanctions being placed in 2011, Iran produced 3.6mb/d with June 2015 estimates of 2.9mb/d (EIA, July 2015). The question of increased supply from Iran is dependent on the time required for additional production to be brought online. Regardless, the EIA estimates that an influx of Iranian oil on the market can lead to a $5/bbl to $15/bbl reduced baseline for oil prices in 2016. Additionally, Iran is believed to currently have between 30 and 50 million barrels stored on 25 Very Large Crude Carriers. The sale of this crude alone will slightly depress oil prices (LeVine, 2015).

3.2.3.1.4 Demand
The EIA estimates global consumption to rise by 1.3mb/d and 1.4mb/d in 2015 and 2016 respectively (EIA, July 2015). In its July oil market report, the IEA sees demand growth for 2015 and 2016 to be 1.4mb/d and 1.2mb/d respectively after having peaked at 1.8mb/d in 1Q2015 (IEA, July 10, 2015). Non-OECD countries in Asia are expected to be the dominant sources of increasing demand.

Demand has been growing in the U.S., but the IEA reports slower than anticipated growth in Europe and Japan. Demand in Europe is still being held back due to fears over the Greek debt crisis and the possibility of it eventually departing the Eurozone. China is expected by the EIA to see 300kb/d growth in both 2015 and 2016, accounting for 20% to 25% of global demand growth in those years. Meanwhile, Russia will experience a 200kb/d decrease in both 2015 and 2016 as a result of its economic downturn over the past year.

Judging by EIA estimates, the gap between supply and demand will fall from 1.43mb/d in 4Q2015 to 850kb/d by 2Q2016. Figures from IEA estimates are roughly similar.

3.2.3.1.5 Price Outlook
Positive economic growth is not likely to reverse depressed oil prices in the short term. The EIA in its Short-Term Energy Outlook is forecasting WTI prices in December 2015 to remain below $50/bbl, roughly in line with NYMEX futures. NYMEX futures upper and lower confidence levels show a varied spread. The upper and lower limits (95 percentile) at six months are $89/bbl
and $41/bbl respectively while in one year they are slightly higher than $100/bbl and just below $40/bbl respectively. EIA Brent average forecasts are $54/bbl in 2015 and $59/bbl in 2016 (EIA, July 2015).

3.2.3.1.6 Exogenous Impacts
Adding to uncertainty in the markets are geopolitical events that cannot be accurately quantified in advance of their occurrence. However, as aptly noted by economist and New York University professor Nouriel Roubini at the 2015 World Economic Forum “The oil price collapse is driven by economics rather than geopolitics” (Figure 11). Recent history demonstrates that effects from events resulting in supply disruptions, for example in Libya and Iraq in 2014, do not have a significant impact on the overall market (Darbouche & Fattouh, September 2011) (El-Katiri, et al., March 2014). Furthermore, with the already reduced spare capacity of OPEC, any supply declines in the MENA region should be compensated by swing producers, benefitting industries such as tight oil. The same holds true for disruptions caused by weather such as storms in the North Sea or hurricanes in the Gulf of Mexico.

Figure 11. Oil Price Collapse

3.2.3.2 Oil in the Long Term
According to the EIA AEO2015 Reference Case, oil prices rise steadily after 2015 due to increased demand from non-OECD countries, leading to a Brent price in 2020 of $90/bbl, a price kept low as continued increases in U.S. crude production exert downward price pressure (EIA,
April 2015). 2020 will begin to see a decline in U.S. crude production, but increased output in other countries will allow oil prices to rise slowly to $112/bbl by 2025.

In all AEO2015 cases, production from tight oil leads to growth in total U.S. crude production though the range varies widely between cases. Tight oil in most cases will begin to decline between 2020 and 2025 as drilling moves to less productive plays. Imports of crude will also continue to decline with energy imports and exports coming into balance in 2028.

The IEA in its World Energy Outlook forecasts that production from North America, primarily the U.S., will continue to lead global supply growth to 2020 (IEA, 2015). Tight oil producers will not be negatively affected by the 2014 price correction in the coming years, but other non-OPEC producers such as Russia will be. The IEA envisions that demand growth will remain stable into 2020 while world supply capacity growth declines on a year to year basis. Pricing outlook from the IEA does vary considerably from the EIA with a $73/bbl price expected in 2020.


4 Policy Implications

4.1 Global Activity

Oil prices impact growth and inflation through various channels: direct effects on prices and activity for both importers and exporters; indirect effects via trade and other commodity markets; monetary and fiscal policy responses; and investment uncertainty. Through these channels, oil prices can also have immediate repercussions, even absent discretionary policy responses, on fiscal and external balances (IMF, 2011) (Arezki & Blanchard, December 22, 2014).

The shift in real income from net oil-exporting economies, which tend to have higher average saving rates, to net oil-importing countries, where the propensity to spend tends to be higher,
should generally result in stronger global demand over the medium term (Baffes, et al., March 2015). However, the effects could vary significantly across countries and over time. While some exporting economies may be forced by financial constraints to adjust both government spending and imports abruptly in the short term, benefits for importing countries could be diffuse and offset by higher precautionary savings if confidence in growth prospects remains subdued. Secondary effects of low energy prices on other commodity markets could generate additional changes in trading terms for a range of commodity exporters.

In oil importing countries where declining oil prices may reduce medium term inflation expectations below target and reduce external financing pressures, central banks may respond with additional monetary policy loosening, which in turn can support growth. In oil exporting countries, however, lower oil prices might trigger sharp currency adjustments, repricing of credit and sovereign risk and contractionary fiscal policy measures unless buffers are available to protect expenditures from the decline in tax revenues from the oil sector.

4.2 National Activity
Income shifts are significantly impacted by changes in global markets though they vary considerably between oil exporting and importing countries. Changing oil prices and their effect on an individual country is dependent on a variety of country specific factors. Although low prices tend to benefit oil importers, it can take time to realize the benefits while the negative impact from low oil prices on exporters is immediate.

4.2.1 Oil Importing Countries
A decline in oil prices can lead to economic growth in oil importing country as companies and households have more disposable income (Kilian, 2014). OECD countries can see a .1% to .6% growth in their economies when oil prices decrease by 10% (Jimenez-Rodriguez & Sanchez, 2005). As with anything else, there is considerable variation between countries, and the magnitude of actual benefits a country stands to gain depends on internal conditions. Furthermore, the causes behind oil price declines also determine the exact impact low prices will have on a country.
4.2.2 Oil Exporting Countries
Logically, a decline in oil prices will negatively impact an oil exporting country (IMF, January 2015). For each member of OPEC, oil is the predominant export and the main provider of fiscal revenues. However, the diversity of member state economies and access to foreign reserves will impact each differently (Norland, March 2015). Currently, the overwhelming majority of OPEC countries are facing budgetary shortfalls as the price of oil is far below what is needed to balance national budgets (Deloitte, 2015) (Ecobank, March 26, 2015) (Deutsche Bank, October 2014) (IMF, January 2015). The result is a decline in government revenue, in some cases the liquidation of foreign cash reserves, and reduced investment in national oil industries. Similar situations are playing out in major non-OPEC producers such as Russia (SEB, January 13, 2015).

Figure 12. Low Oil Prices are Creating Financial Challenges for Producers
In the short term, financial pressures are immediate and expand to other areas in the medium term. While some countries such as Saudi Arabia have substantial foreign reserves, allowing them to weather an oil price fall in the short run, most oil exporters do not have that safeguard. Faced with budgets that cannot be met, an exporter will be forced to implement austerity measures that can pose serious political problems. In some OPEC countries, public spending was raised considerably during the Arab Spring to quell civil disturbances. If social spending is no longer in place, state political power will erode (El-Katiri, et al., March 2014) (Deutsche Bank, October 2014). Compounding this loss of revenue is the damage to current accounts and resulting currency depreciations.
As a result, declines in oil prices often contract an oil exporter’s economy. In several MENA countries and Russia, a 10% decline in average annual oil prices can cause an economic contraction ranging from .8% to 2.5%. If oil is trading below the breakeven price, government revenue and investment in the sector falls, leading to a range of negatives from layoffs to decreased productivity of existing fields.

4.3 Monetary and Fiscal Policies
The differing effects of falling oil prices on oil importing and exporting countries are especially true regarding fiscal and monetary policies (McCafferty, March 10, 2015). Issues of inflation and deflation for importers can arise with central banks becoming more accommodating to policy changes in the former and needing to take action to counter the latter (Kasznar, 2014). Fiscally, importers stand to save, and this can benefit fiscal space by allowing more funding to be allotted towards programs ranging from social assistance to infrastructure development. Additionally, the opportunity arises for the implementation of structural reforms towards greater energy efficiencies and movement to renewable energy (Klevnäs, et al., May 2015).

When crude oil prices are low, exporters face an unenviable situation. Rising inflation and currency pressures are concerns that exporters’ central banks must address while still managing to support economic growth. The impact on fiscal policies is readily apparent for exporters as the loss of revenue makes existing budgets unrealistic and can ultimately force cuts to public services. For OPEC members whose primary economic activity is oil, declines make the need for economic diversification apparent. However, the finances to develop other sectors of the economy are not available.

4.4 Local Environmental Challenges
While the boom in U.S. crude production is responsible for lower oil process, tight oil faces considerable public opposition in the U.S., specifically to the fracking required for extraction. Public support of fracking has declined from 48% in March 2014 to 40% in March 2015 while
opposition has increased dramatically. Such growing opposition has translated into action being taken by state governments to ban fracking, even if temporarily, until concerns can be adequately addressed (Energy in Depth, April 2015) (Goho, 2012). Fracking has been empirically linked to negative health, environmental and community impacts. Thus far, the industry has not developed effective responses to these problems (Maugeri, June 2012) (Ratner & Tiemann, 2015).

Tight oil production has caused huge growth in economic activity in once isolated areas of the country, but fracking activities tend to increase air and water pollution (Rotkin-Ellman & Srebotnjak, December 2014) (PSR, 2014). Due to the nature of fracking, groundwater supplies can become contaminated while its high usage of water can deplete freshwater supplies that poses particular problems in more remote regions of the U.S. Convoys of trucks, the flaring of gas and wastewater storage vehicles all contribute to elevated levels of toxins around shale fields. As mentioned earlier, fracking has resulted in increased seismic events across the country where there was none before. Meanwhile, communities where oil and gas development never existed prior are now having to cope with significant changes brought by the introduction of tight oil producers, including visual and noise pollution, increased truck traffic and despoiled landscapes.

Because negative impacts vary in magnitude across regions and solutions need to be tailored to each area, tight oil producers have been slow in addressing problems. Furthermore, state specific regulation and compliance issues make addressing problems all the more difficult and costly. On the other hand, problems can also be exacerbated by producer noncompliance and lack of effective regulatory enforcement.

One of the primary problems the industry has in facing these issues is due to the fragmented and unstandardized nature of the industry itself that prevents the implementation of greater, more concerted efforts in tackling problems. Industry failure to address problems might actually pose a greater negative in the long run as the government, motivated by growing public opposition to fracking, could impose stronger regulation on the industry. Government legislation has been introduced to limit fracking, and, if enacted, the cost of tight oil will inevitably rise as producers

are forced to abide by tighter regulations. Already the industry has suffered monetary setbacks when several states implemented temporary bans.

4.4 Climate Change Policy Drivers
Over the past decade, there has been growing global emphasis on addressing the role human activity has on the climate. In 2014, the Intergovernmental Panel on Climate Change (IPCC) concluded that it is "extremely likely" that recent trends in global warming are caused by an increase in the concentration in the atmosphere of emissions of greenhouse gases, resulting from human activity. In recent years, numerous steps have been taken to address the issue of greenhouse gases that have increasingly impacted the oil industry.\(^\text{13}\) If and when stronger climate change policies emerge, there will be considerable concern in the fossil fuel industry as to how deep the impacts of new regulations will be and how much this will impact investment in high risk and high cost fuel sources.

It is expected that, at the very least, the upcoming Paris negotiations this December will result in a framework providing for higher reduction commitments that will eventually translate into national government policies. As a result, confidence in renewables and in energy efficiencies across economies will be strengthened, allowing for growth in those fields (Klevnäs, et al., May 2015).

When stronger, clearer policies emerge, private-sector companies that have only 10–20 years of reserves will have time to monetize these reserves, reduce CAPEX and increase pay-outs. Coming in the form of dividends and share buy-backs, these payouts allow the financial markets and investors to reallocate such funds to other parts of the economy, including alternative energy sources and companies committed to higher efficiency. Companies can add consumer value by building on existing strengths and assets such as by maximizing the value of hydrocarbon molecules or by focusing on high-value oils. The option to diversify also presents additional but higher risk opportunities.

\(^{13}\) These include the Cancún climate agreements of 2010, the climate change pact reached at Lima in 2014 and the November 2014 U.S.-China Climate Agreement. Later this December in Paris, a Conference of the Parties to the 1992 UN Framework Convention on Climate Change (UNFCCC) will be held focusing on a legal framework for voluntary commitments by countries in limiting greenhouse emissions.
Oil exporters stand to lose greatly due to tighter climate change policies, decreasing their economic base and rendering economic diversification imperative (Sowers & Weinthal, September 2010). Diversification requires high upfront costs, and ultimately budgets will have to reflect the decreased overall revenue brought on by declining oil revenues. Other economic sectors will be negatively impacted as fiscal subsidies are reduced or cut because the revenue streams no longer exist to support them. In the past year alone, the fall in oil prices has revealed how fragile the economies of several OPEC members are due to their overwhelming reliance on fossil fuels and extremely limited diversification.

Most climate change policies are aimed at reducing the demand for fossil fuels, not reducing supply directly. Demand reduction is accomplished through regulation as seen in the U.S. through government mandates that reduce emission outputs from vehicles while increasing gas efficiency. Elsewhere, the implementation of carbon taxes provides companies with incentives to reduce use of fossil fuels while climate change policies reduce consumer demand and lower producer prices. As an economy moves away from fossil fuels, money spent by the consumer is increasingly diverted away from traditional fuel suppliers and towards more efficient fossil fuel producers and renewable producers. In lowering demand, climate change policies in turn lower fossil fuel supplies as there is less demand to be met.

5 Conclusions and Recommendations

Is the surge in tight oil production from U.S. shale formations a temporary bubble or the event which will fundamentally change global energy markets? Leading up to the 2014 price correction, tight oil production boomed in a high price environment but now stands to fall back to earth as prices remain depressed, non-competitive producers are forced out, and as capital investments turn elsewhere. Even prior to the 2014 price correction, EIA forecasts showed that if high production rates were to be maintained, production would peak in the next decade and then slowly decline. Current low prices will limit production and push that peak further into the future. That said, in the near term, through tight oil the U.S. has emerged as the swing producer.
The continuing dramatic oil price correction of 2014 marks the end of the commodities supercycle and four years of relative stability in oil prices. As prices stabilized during the second half of 2015, a changing oil market will emerge shaped by new realities. The role of swing producer now lies with the U.S., most notably tight oil producers. Oil prices now and in the coming years will be more reflective of supply and demand, and demand for oil is slowing globally.

Though the 2014 price decline was dramatic, it is not unprecedented in recent history and bears strong similarities to events in 1998-1999 and more so to 1985-1986. In each case, dramatic price declines coincided with common global economic and structural factors. Similar to 1985-1986 was a strong buildup of non-OPEC crude, resulting in a price correction and ultimately abandonment by OPEC of price targeting policies in favor of maintaining market share through increasing production.

Initially, oversupply made possible through the enormous surge in tight oil production in the U.S. surprised world markets and brought about the 2014 decline. Compounding oversupply was weakening global demand due to increasing gas efficiencies and slower growth in OECD countries as well as faltering growth in non-OECD countries such as China. Price declines accelerated rapidly as OPEC shifted its policy, leading to increasing supplies as demand decelerated further. The failure of certain geopolitical risks to significantly impact global supply furthered retreats while the appreciation of the USD reduced commodity prices across markets.

Continuing volatility in global oil markets is a given, but prices are expected to remain below $100/bbl in the medium term as the gap between demand and supply is not expected to grow disproportionately wide in either direction (EIA, July 2015) (IEA, 2015). Oil prices below $50/bbl may be unsustainable for tight oil producers as projects may not be able to operate achieve breakeven at such a level while meeting rising demand. Inevitably, prices should rise as demand grows and the burden of supplying additional crude will fall on unconventional oil, particularly tight oil producers. Tight oil producers have been lowering their operating costs over the years, and concerns of their impending demise due to low prices may have been unfounded.
It is believed that over the short and medium term, income shifts from oil exporters to oil importers will result in a net positive effect for global economic activity by increasing global GDP and reducing global inflation (Baffes, et al., March 2015). On a positive note, continued weak global demand can serve to limit global inflation. However, adjustments in currencies and effects of taxes, subsidies and regulations on prices might serve to cancel out the disinflationary implications of falling oil prices.

Already, oil exporting countries are facing financial budgetary stress, and continued low prices will seriously impact the ability of these countries to diversify their economies and provide services to their citizens (Norland, March 2015). Investment in the oil industry has fallen in an economic atmosphere where there is less economic incentive to explore potential high cost energy sources in countries that are currently oil importers (Deloitte, 2015). Furthermore, there is now reduced interest in certain renewable energies as long as oil is so low, but that can quickly change (Frankfurt School, 2015).

If there is one rule for tight oil producers to consider, it is that the future of the oil market is plagued with uncertainty. Over the past several years, forecasts on future supply, demand and prices have often missed the mark substantially.

Oil prices should gradually increase as global demand for crude oil grows. In addition to demand exerting upward pressure on the real price of oil are structural constraints in the industry; geological constraints between aging fields; new fields where extraction is more intensive and costlier; and increased production of crude that necessitates extensive refining. Technological advances could serve to slow the increase in prices as already seen with tight oil where advances have greatly lowered breakeven points. Considering all of these factors, it is important for both tight oil producers and policymakers to realize that the nature of the global oil markets has fundamentally changed and that tight oil may represent the single largest economic opportunity for the United States over the next decade.
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Appendix 1 Descriptive Output from Questionnaire

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<th>Definition of Missing</th>
<th>User-defined missing values are treated as missing.</th>
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<tbody>
<tr>
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<td>Cases Used</td>
<td>Statistics are based on all cases with valid data.</td>
</tr>
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</table>

| Syntax                 | FREQUENCIES VARIABLES=Org /
|                        | ORDER=ANALYSIS.       |

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</thead>
<tbody>
<tr>
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<td>00:00:00.00</td>
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</tbody>
</table>

## Statistics

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<th>Valid</th>
<th>Missing</th>
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</thead>
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<td>Percent</td>
<td>Valid Percent</td>
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<td>Wilson Center</td>
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<td>4.7</td>
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<td>WRI</td>
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<td>100.0</td>
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</table>

DATASET ACTIVATE DataSet1.

SAVE OUTFILE="/Oil Prices Survey.sav"
/COMPRESSED.
FREQUENCIES VARIABLES=EducationLevel
/ORDER=ANALYSIS.
Frequencies

<table>
<thead>
<tr>
<th>Statistics</th>
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<tbody>
<tr>
<td>Highest Education</td>
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</tbody>
</table>

<table>
<thead>
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<th>Valid</th>
<th>Missing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>107</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Highest Education</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Valid</td>
</tr>
<tr>
<td>Bachelors</td>
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<tr>
<td>Masters</td>
</tr>
<tr>
<td>Doctorate</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

User-defined missing values are treated as missing.
Statistics are based on all cases with valid data.

FREQUENCIES
VARIABLES=EducationLevel
/OPTION=ANALYSIS.

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Output Created: 18-JUL-2015 10:05:34
Comments:
Input: Data: /Oil Prices Survey.sav
Active Dataset: DataSet1
Filter: <none>
Weight: <none>
Split File: <none>
N of Rows in Working Data File: 107
Missing Value Handling: Definition of Missing: User-defined missing values are treated as missing.
Cases Used: Statistics are based on all cases with valid data.
Syntax:
FREQUENCIES
VARIABLES=EducationLevel
/ORDER=ANALYSIS.

Resources:
Processor Time: 00:00:00.00
Elapsed Time: 00:00:00.00
Appendix 2 Hypothesis 1(a)

DATASET ACTIVATE DataSet1.
SAVE OUTFILE='/Oil Prices Survey.sav'
/COMPRESSED.
NPAR TESTS
/CHISQUARE=Thedecliningglobaloilpricesoverthepast12months wasprimarilyaresul
tomuchmoreorlesscapitalspendingbyU.S.shaleoilsuppliersdoyoufore
/EXPECTED=EQUAL
/MISSING ANALYSIS.

NPar Tests

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<tr>
<td>Split File</td>
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<tr>
<td>N of Rows in Working Data</td>
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</tr>
<tr>
<td>File</td>
<td></td>
</tr>
<tr>
<td>Missing Value Handling</td>
<td>Definition of Missing</td>
</tr>
<tr>
<td>Cases Used</td>
<td>User-defined missing values are treated as missing.</td>
</tr>
<tr>
<td>Statistics for each test are based on all cases with valid data for the variable(s) used in that test.</td>
<td></td>
</tr>
<tr>
<td>Syntax</td>
<td>NPAR TESTS</td>
</tr>
</tbody>
</table>
| /CHISQUARE=Thedecliningglobaloilpricesoverthepast12months wasprimarilyaresul
tomuchmoreorlesscapitalspendingbyU.S.shaleoilsuppliersdoyoufore |
| /EXPECTED=EQUAL |
| /MISSING ANALYSIS. |
| Resources | Processor Time |
| Elapsed Time | 00:00:00.01 |
| Number of Cases Allowed | 157286 |

a. Based on availability of workspace memory.
Chi-Square Test

Frequencies

The decline in global oil prices over the past 12 months was / primarily a result of:

<table>
<thead>
<tr>
<th></th>
<th>Observed N</th>
<th>Expected N</th>
<th>Residual</th>
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</thead>
<tbody>
<tr>
<td>Excess supply</td>
<td>42</td>
<td>31.3</td>
<td>10.7</td>
</tr>
<tr>
<td>Weak demand</td>
<td>7</td>
<td>31.3</td>
<td>-24.3</td>
</tr>
<tr>
<td>Equal parts excess supply and weak demand</td>
<td>45</td>
<td>31.3</td>
<td>13.7</td>
</tr>
<tr>
<td>Total</td>
<td>94</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How much more or less capital spending by U.S. shale oil suppliers / do you foresee in the next 12...

<table>
<thead>
<tr>
<th></th>
<th>Observed N</th>
<th>Expected N</th>
<th>Residual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somewhat more spending</td>
<td>14</td>
<td>26.8</td>
<td>-12.8</td>
</tr>
<tr>
<td>About the same spending</td>
<td>26</td>
<td>26.8</td>
<td>-.8</td>
</tr>
<tr>
<td>Somewhat less spending</td>
<td>50</td>
<td>26.8</td>
<td>23.3</td>
</tr>
<tr>
<td>Much less spending</td>
<td>17</td>
<td>26.8</td>
<td>-9.8</td>
</tr>
<tr>
<td>Total</td>
<td>107</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Test Statistics

Chi-Square 28.489<sup>a</sup> 29.860<sup>b</sup>
df 2 3
Asymp. Sig. .000 .000

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 31.3.
b. 0 cells (.0\%) have expected frequencies less than 5. The minimum expected cell frequency is 26.8.

CROSSTABS
/TABLES=The decline in global oil prices over the past 12 months was primarily a result of how much more or less capital spending by U.S. shale oil suppliers do you foresee
/FORMAT=AVALUE TABLES
/STATISTICS=CHISQ
/CELLS=COUNT ROW
/COUNT ROUND CELL.

Crosstabs

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<tr>
<td>Weight</td>
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<td>Percent</td>
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<td>87.9%</td>
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<td>Percent</td>
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<td>13</td>
<td>12.1%</td>
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<tr>
<td>N</td>
<td>Percent</td>
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<tr>
<td>107</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The decline in global oil prices over the past 12 months was primarily a result of: *How much more or less capital spending by U.S. shale oil suppliers do you foresee in the next 12...
The decline in global oil prices over the past 12 months was primarily a result of:

<table>
<thead>
<tr>
<th>How much more or less capital spending by U.S. shale oil suppliers do you foresee in the next 12 months?</th>
<th>Somewhat more spending</th>
<th>About the same spending</th>
<th>Somewhat less spending</th>
<th>Much less spending</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excess supply</td>
<td>Count</td>
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<td>10</td>
<td>18</td>
<td>9</td>
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<tr>
<td></td>
<td>% within The decline in global oil prices over the past 12 months</td>
<td>11.9%</td>
<td>23.8%</td>
<td>42.9%</td>
<td>21.4%</td>
</tr>
<tr>
<td>Weak demand</td>
<td>Count</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>% within The decline in global oil prices over the past 12 months</td>
<td>14.3%</td>
<td>28.6%</td>
<td>28.6%</td>
<td>28.6%</td>
</tr>
<tr>
<td>Equal parts excess supply and weak demand</td>
<td>Count</td>
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<td>10</td>
<td>27</td>
<td>4</td>
</tr>
<tr>
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<td>% within The decline in global oil prices over the past 12 months</td>
<td>8.9%</td>
<td>22.2%</td>
<td>60.5%</td>
<td>8.6%</td>
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<td>Count</td>
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<td>22</td>
<td>47</td>
<td>15</td>
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<tr>
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<td>% within The decline in global oil prices over the past 12 months</td>
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<td>23.4%</td>
<td>53.0%</td>
<td>19.0%</td>
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<td>----</td>
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<td>.511</td>
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</tr>
<tr>
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</table>

*a. 6 cells (50.0%) have expected count less than 5. The minimum expected count is .74.*
NPAR TESTS
/K-W=HowmuchmoreorlesscapitalspendingbyU.S.shaleoil suppliersdoyoufore BY Thedeclineinglobaloilpricesoverthepast12months wasprimarilyaresult(1 3) /MISSING ANALYSIS.

### NPar Tests

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<td>DataSet1</td>
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<tr>
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<tr>
<td>Weight</td>
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</tr>
<tr>
<td>N of Rows in Working Data File</td>
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</table>

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<th>Missing Value Handling</th>
<th>Definition of Missing Cases Used</th>
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<tbody>
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<td>User-defined missing values are treated as missing.</td>
<td>Statistics for each test are based on all cases with valid data for the variable(s) used in that test.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Syntax</th>
<th>NPAR TESTS /K-W=HowmuchmoreorlesscapitalspendingbyU.S.shaleoil suppliersdoyoufore BY Thedeclineinglobaloilpricesoverthepast12months wasprimarilyaresult(1 3) /MISSING ANALYSIS.</th>
</tr>
</thead>
</table>

<table>
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<th>Elapsed Time</th>
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<td>112347</td>
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a. Based on availability of workspace memory.
Kruskal-Wallis Test

<table>
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<th>N</th>
<th>Mean Rank</th>
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<tr>
<td></td>
<td>Excess supply</td>
<td>42</td>
<td>48.42</td>
</tr>
<tr>
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<td>Weak demand</td>
<td>7</td>
<td>47.79</td>
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<td>Equal parts excess supply and weak demand</td>
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<td>46.60</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>94</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Statistics\textsuperscript{a,b}</th>
<th>How much more or less capital spending by U.S. shale oil suppliers / do you foresee in the next 12...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square</td>
<td>.113</td>
</tr>
<tr>
<td>df</td>
<td>2</td>
</tr>
<tr>
<td>Asymp. Sig.</td>
<td>.945</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Kruskal Wallis Test
\textsuperscript{b} Grouping Variable: The decline in global oil prices over the past 12 months was / primarily a result of:
Appendix 3 Hypothesis 1(b)

CROSSTABS
/TABLES=The decline in global oil prices over the past 12 months was primarily a result of... BY
/Doyoubelieve that U.S. shale oil supply will begin contracting over the next...
/FORMAT=VALUE TABLES
/STATISTICS=CHISQ
/CELLS=COUNT ROW
/COUNT ROUND CELL.

Crosstabs

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<td>N of Rows in Working Data File</td>
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<td>Missing Value Handling</td>
<td>Definition of Missing Cases Used</td>
</tr>
<tr>
<td>Syntax</td>
<td>CROSSTABS</td>
</tr>
</tbody>
</table>
|               | /TABLES=The decline in global oil prices over the past 12 months was primarily a result of... BY
|               | /Doyou believe that U.S. shale oil supply will begin contracting over the next...
|               | /FORMAT=VALUE TABLES
|               | /STATISTICS=CHISQ    |
|               | /CELLS=COUNT ROW     |
|               | /COUNT ROUND CELL.   |
| Resources      | Processor Time       |
|               | Elapsed Time         |
|               | Dimensions Requested |
|               | Cells Available      |
|               | 00:00:00.01          |
|               | 00:00:00.00          |
|               | 2                   |
|               | 131029               |

User-defined missing values are treated as missing. Statistics for each table are based on all the cases with valid data in the specified range(s) for all variables in each table.
The decline in global oil prices over the past 12 months was primarily a result of:

<table>
<thead>
<tr>
<th>Case Description</th>
<th>Valid N</th>
<th>Valid Percent</th>
<th>Missing N</th>
<th>Missing Percent</th>
<th>Total N</th>
<th>Total Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Do you believe that U.S. shale oil supply will begin contracting over the next 12 months?</td>
<td>72</td>
<td>67.3%</td>
<td>35</td>
<td>32.7%</td>
<td>107</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
The decline in global oil prices over the past 12 months was primarily a result of:

- Do you believe that U.S. shale oil supply will begin contracting over the next 12 months? Crosstabulation

<table>
<thead>
<tr>
<th>The decline in global oil prices over the past 12 months was primarily a result of:</th>
<th>Do you believe that U.S. shale oil supply will begin contracting over the next 12 months?</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excess supply</td>
<td>Count</td>
<td>13</td>
<td>16</td>
<td>29</td>
</tr>
<tr>
<td>% within The decline in global oil prices over the past 12 months was primarily a result of:</td>
<td>44.8%</td>
<td>55.2%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>Weak demand</td>
<td>Count</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>% within The decline in global oil prices over the past 12 months was primarily a result of:</td>
<td>66.7%</td>
<td>33.3%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>Equal parts excess supply and weak demand</td>
<td>Count</td>
<td>16</td>
<td>21</td>
<td>37</td>
</tr>
<tr>
<td>% within The decline in global oil prices over the past 12 months was primarily a result of:</td>
<td>43.2%</td>
<td>56.8%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>Count</td>
<td>33</td>
<td>39</td>
<td>72</td>
</tr>
<tr>
<td>% within The decline in global oil prices over the past 12 months was primarily a result of:</td>
<td>45.8%</td>
<td>54.2%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>Chi-Square Tests</td>
<td>Value</td>
<td>df</td>
<td>Asymp. Sig. (2-sided)</td>
<td></td>
</tr>
<tr>
<td>------------------</td>
<td>--------</td>
<td>-----</td>
<td>----------------------</td>
<td></td>
</tr>
<tr>
<td>Pearson Chi-Square</td>
<td>1.161*</td>
<td>2</td>
<td>.560</td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>1.166</td>
<td>2</td>
<td>.558</td>
<td></td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>.027</td>
<td>1</td>
<td>.869</td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>72</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 2.75.
Appendix 4 Hypothesis 2

DATASET ACTIVATE DataSet1. 
SAVE OUTFILE='/Oil Prices Survey.sav' /COMPRESSED. 
CROSSTABS 
/STATISTICS=CHISQ 
/TABLES=Q3HowmuchcapitalspendingbyU.S.shaleoilsuppliersforecast BY Q4Doyoubelievethatshaleoilsupplywillbegincontracting12months 
/FORMAT=VALUE TABLES

Crosstabs

<table>
<thead>
<tr>
<th>Notes</th>
<th>25-JUL-2015 18:04:27</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Data</td>
</tr>
<tr>
<td></td>
<td>Active Dataset</td>
</tr>
<tr>
<td></td>
<td>Filter</td>
</tr>
<tr>
<td></td>
<td>Weight</td>
</tr>
<tr>
<td></td>
<td>Split File</td>
</tr>
<tr>
<td></td>
<td>N of Rows in Working Data File</td>
</tr>
<tr>
<td>Missing Value Handling</td>
<td>Definition of Missing Cases Used</td>
</tr>
<tr>
<td>Syntax</td>
<td>User-defined missing values are treated as missing. Statistics for each table are based on all the cases with valid data in the specified range(s) for all variables in each table.</td>
</tr>
<tr>
<td>Syntax</td>
<td>CROSSTABS</td>
</tr>
<tr>
<td>Syntax</td>
<td>/STATISTICS=CHISQ</td>
</tr>
<tr>
<td>Syntax</td>
<td>/CELLS=COUNT ROW</td>
</tr>
<tr>
<td>Syntax</td>
<td>/COUNT ROUND CELL.</td>
</tr>
</tbody>
</table>

| Syntax | /TABLES=Q3Howmuchcapitalspending byU.S.shaleoilsuppliersforecast BY Q4Doyoubelievethatshaleoilsupplywillbegincontracting12months |

| Resources | Processor Time | 00:00:00.01 |
| Resources | Elapsed Time | 00:00:00.00 |
| Resources | Dimensions Requested | 2 |
| Resources | Cells Available | 131029 |

63
### Case Processing Summary

<table>
<thead>
<tr>
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<th></th>
<th>Total</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Percent</td>
<td>N</td>
<td>Percent</td>
<td>N</td>
</tr>
<tr>
<td>How much more or less capital spending by U.S. shale oil suppliers / do you foresee in the next 12... * Do you believe that U.S. shale oil supply will begin contracting / over the next 12 months?</td>
<td>77</td>
<td>72.0%</td>
<td>30</td>
<td>28.0%</td>
<td>107</td>
</tr>
</tbody>
</table>
How much more or less capital spending by U.S. shale oil suppliers / do you foresee in the next 12... * Do you believe that U.S. shale oil supply will begin contracting over the next 12 months? Crosstabulation

<table>
<thead>
<tr>
<th>How much more or less capital spending by U.S. shale oil suppliers / do you foresee in the next 12...</th>
<th>Do you believe that U.S. shale oil supply will begin contracting / over the next 12 months?</th>
<th>( % ) within</th>
<th>Yes</th>
<th>No</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Somewhat more spending</td>
<td>Count</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% within How much more or less capital spending by U.S. shale oil suppliers / do you foresee in the next 12...</td>
<td>33.3%</td>
<td>66.7%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>About the same spending</td>
<td>Count</td>
<td>3</td>
<td>13</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% within How much more or less capital spending by U.S. shale oil suppliers / do you foresee in the next 12...</td>
<td>16.6%</td>
<td>81.3%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>Somewhat less spending</td>
<td>Count</td>
<td>21</td>
<td>15</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% within How much more or less capital spending by U.S. shale oil suppliers / do you foresee in the next 12...</td>
<td>58.3%</td>
<td>41.7%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>Much less spending</td>
<td>Count</td>
<td>7</td>
<td>6</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% within How much more or less capital spending by U.S. shale oil suppliers / do you foresee in the next 12...</td>
<td>53.8%</td>
<td>46.2%</td>
<td>100.0%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>Count</td>
<td>35</td>
<td>42</td>
<td>77</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% within How much more or less capital spending by U.S. shale oil suppliers / do you foresee in the next 12...</td>
<td>45.5%</td>
<td>54.5%</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>
Chi-Square Tests

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
<th>df</th>
<th>Asymp. Sig. (2-sided)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Chi-Square</td>
<td>8.091a</td>
<td>3</td>
<td>.044</td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>8.542</td>
<td>3</td>
<td>.036</td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>4.034</td>
<td>1</td>
<td>.045</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>77</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.45.

DATASET ACTIVATE DataSet1.

SAVE OUTFILE='\Oil Prices Survey.sav'
   /COMPRESSED.

NPAR TESTS
   /K-W=Q3HowmuchcapitalspendingbyU.S.shaleoil suppliersforecast BY Q4Doyoubelievethatshaleoil supply will begin contracting 12 months (1 2)
   /MISSING ANALYSIS.
NPar Tests

<table>
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<tr>
<th>Notes</th>
<th>25-JUL-2015 18:15:20</th>
</tr>
</thead>
</table>

<table>
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<tr>
<th>Input</th>
<th>Output Created</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>/Oil Prices Survey.sav</td>
</tr>
<tr>
<td>Active Dataset</td>
<td>DataSet1</td>
</tr>
<tr>
<td>Filter</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>Weight</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>Split File</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>N of Rows in Working Data File</td>
<td>107</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Missing Value Handling</th>
<th>Definition of Missing Cases Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>User-defined missing values are treated as missing.</td>
<td>Statistics for each test are based on all cases with valid data for the variable(s) used in that test.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Syntax</th>
<th>NPAR TESTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>W=Q3HowmuchcapitalspendingbyU.S. shaleoil suppliersforecast BY Q4Doyoubelievethatshaleoilsupplywillbegoncontracting12months(1 2) /MISSING ANALYSIS.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resources</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor Time</td>
<td>00:00:00:01</td>
</tr>
<tr>
<td>Elapsed Time</td>
<td>00:00:01:00</td>
</tr>
<tr>
<td>Number of Cases Alloweda</td>
<td>112347</td>
</tr>
</tbody>
</table>

a. Based on availability of workspace memory.
Kruskal-Wallis Test

<table>
<thead>
<tr>
<th>Ranks</th>
<th>Q4 Do you believe that U.S. shale oil supply will begin contracting / over the next 12 months?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Q3 How much more or less capital spending by U.S. shale oil suppliers / do you foresee in the next 12...</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>35</td>
</tr>
<tr>
<td>No</td>
<td>42</td>
</tr>
<tr>
<td>Total</td>
<td>77</td>
</tr>
</tbody>
</table>

Test Statistics $a,b$

<table>
<thead>
<tr>
<th>Q3 How much more or less capital spending by U.S. shale oil suppliers / do you foresee in the next 12...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square</td>
</tr>
<tr>
<td>df</td>
</tr>
<tr>
<td>Asymp. Sig.</td>
</tr>
</tbody>
</table>

a. Kruskal Wallis Test
b. Grouping Variable: Q4 Do you believe that U.S. shale oil supply will begin contracting / over the next 12 months?
Appendix 5 Hypothesis 3

CROSSTABS
/TABLES=Q5WhatwillthepriceofcrudeoilWTIbeperbarrelattheendof2015 BY Q2follpricesstaywheretheyaretodaywhatimpactonU.S.shahat
/FORMAT=AVALUE TABLES
/STATISTICS=CHISQ
/CELLS=COUNT ROW
/COUNT ROUND CELL.

<table>
<thead>
<tr>
<th>Notes</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Output Created</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>/Oil Prices Survey.sav</td>
</tr>
<tr>
<td>Active Dataset</td>
<td>DataSet1</td>
</tr>
<tr>
<td>Filter</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>Weight</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>Split File</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>N of Rows in Working Data File</td>
<td>107</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Missing Value Handling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition of Missing</td>
</tr>
<tr>
<td>User-defined missing values are treated as missing.</td>
</tr>
<tr>
<td>Statistics for each table are based on all the cases with valid data in the specified range(s) for all variables in each table.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Syntax</th>
</tr>
</thead>
<tbody>
<tr>
<td>CROSSTABS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resources</th>
<th>Processor Time</th>
<th>00:00:00.01</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Elapsed Time</td>
<td>00:00:00.00</td>
</tr>
<tr>
<td></td>
<td>Dimensions Requested</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Cells Available</td>
<td>131029</td>
</tr>
</tbody>
</table>
### Case Processing Summary

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<th>Missng</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Percent</td>
<td>N</td>
<td>Percent</td>
</tr>
<tr>
<td>---</td>
<td>---------</td>
<td>---</td>
<td>---------</td>
</tr>
<tr>
<td>Q5 What will the price of crude oil (WTI) be per barrel at the end of / 2015 (June 1, 2015 close at $6... * Q2 if oil prices stay where they are at today, what impact will there / be on U.S. shale oil suppliers?</td>
<td>104</td>
<td>97.2%</td>
<td>3</td>
</tr>
</tbody>
</table>
Q6: What will the price of crude oil (WTI) be per barrel at the end of 2015 (June 1, 2015 close at $6...? *Q7: If oil prices stay where they are at today, what impact will there be on U.S. shale suppliers? Cross tabulation

<table>
<thead>
<tr>
<th>Q6: What will the price of crude oil (WTI) be per barrel at the end of 2015 (June 1, 2015 close at $6...?</th>
<th>Very negative</th>
<th>Negative</th>
<th>No impact</th>
<th>Positive impact</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>120-140</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>20% within Q6: What will the price of crude oil (WTI) be per barrel at the end of 2015 (June 1, 2015 close at $6...?</td>
<td>0.0%</td>
<td>0.0%</td>
<td>100.0%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>80-100</td>
<td>0</td>
<td>12</td>
<td>3</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>20% within Q6: What will the price of crude oil (WTI) be per barrel at the end of 2015 (June 1, 2015 close at $6...?</td>
<td>0.0%</td>
<td>71.4%</td>
<td>21.4%</td>
<td>7.1%</td>
<td>100.0%</td>
</tr>
<tr>
<td>60-80</td>
<td>2</td>
<td>57</td>
<td>10</td>
<td>4</td>
<td>73</td>
</tr>
<tr>
<td>20% within Q6: What will the price of crude oil (WTI) be per barrel at the end of 2015 (June 1, 2015 close at $6...?</td>
<td>2.7%</td>
<td>78.1%</td>
<td>13.7%</td>
<td>5.5%</td>
<td>100.0%</td>
</tr>
<tr>
<td>40-60</td>
<td>2</td>
<td>12</td>
<td>2</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>20% within Q6: What will the price of crude oil (WTI) be per barrel at the end of 2015 (June 1, 2015 close at $6...?</td>
<td>12.6%</td>
<td>75.0%</td>
<td>12.5%</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Total</td>
<td>4</td>
<td>79</td>
<td>16</td>
<td>5</td>
<td>104</td>
</tr>
<tr>
<td>20% within Q6: What will the price of crude oil (WTI) be per barrel at the end of 2015 (June 1, 2015 close at $6...?</td>
<td>3.8%</td>
<td>75.0%</td>
<td>15.4%</td>
<td>4.8%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Test</td>
<td>Value</td>
<td>df</td>
<td>Asymp. Sig. (2-sided)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td>------------</td>
<td>----</td>
<td>----------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearson Chi-Square</td>
<td>11.020a</td>
<td>9</td>
<td>.274</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Likelihood Ratio</td>
<td>9.378</td>
<td>9</td>
<td>.403</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear-by-Linear Association</td>
<td>4.200</td>
<td>1</td>
<td>.040</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>104</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. 12 cells (75.0%) have expected count less than 5. The minimum expected count is .04.
NPAR TESTS
/K-W=Q2Ifoilpricesstaywhere theyarettodaywhatimpactonU.S.shal
Q5WhatwillthepriceofcrudeoilWTibepebarrelattheendof2015(18)
/MISSING ANALYSIS.

**NPar Tests**

<table>
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</tr>
<tr>
<td><strong>Input</strong></td>
<td></td>
</tr>
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<td>/Oil Prices Survey.sav</td>
</tr>
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<td>DataSet1</td>
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<td>Filter</td>
<td>&lt;none&gt;</td>
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<tr>
<td>Weight</td>
<td>&lt;none&gt;</td>
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<tr>
<td>Split File</td>
<td>&lt;none&gt;</td>
</tr>
<tr>
<td>N of Rows in Working Data File</td>
<td>107</td>
</tr>
<tr>
<td><strong>Missing Value Handling</strong></td>
<td></td>
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<tr>
<td>Definition of Missing</td>
<td></td>
</tr>
<tr>
<td>User-defined missing values are treated as missing.</td>
<td></td>
</tr>
<tr>
<td>Cases Used</td>
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</tr>
<tr>
<td>Statistics for each test are based on all cases with valid data for the variable(s) used in that test.</td>
<td></td>
</tr>
<tr>
<td><strong>Syntax</strong></td>
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<tr>
<td>NPAR TESTS</td>
<td></td>
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<tr>
<td>/K-W=Q2IfoilpricesstaywheretheyarettodaywhatimpactonU.S.shal</td>
<td></td>
</tr>
<tr>
<td>Q5WhatwillthepriceofcrudeoilWTibepebarrelattheendof2015(18)</td>
<td></td>
</tr>
<tr>
<td>/MISSING ANALYSIS.</td>
<td></td>
</tr>
<tr>
<td><strong>Resources</strong></td>
<td></td>
</tr>
<tr>
<td>Processor Time</td>
<td>00:00:00.01</td>
</tr>
<tr>
<td>Elapsed Time</td>
<td>00:00:00.00</td>
</tr>
<tr>
<td>Number of Cases Allowed*</td>
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</tbody>
</table>

a. Based on availability of workspace memory.
Kruskal-Wallis Test

### Ranks

<table>
<thead>
<tr>
<th>Q5 What will the price of crude oil (WTI) be per barrel at the end of 2015 (June 1, 2015 close at $6...</th>
<th>N</th>
<th>Mean Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q2 If oil prices stay where they are at today, what impact will there be on U.S. shale oil suppliers?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>120 to 140</td>
<td>1</td>
<td>91.50</td>
</tr>
<tr>
<td>80 to 100</td>
<td>14</td>
<td>58.32</td>
</tr>
<tr>
<td>60 to 80</td>
<td>73</td>
<td>52.55</td>
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<tr>
<td>40 to 60</td>
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<td>44.75</td>
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<tr>
<td>Total</td>
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### Test Statistics

<table>
<thead>
<tr>
<th>Q2 If oil prices stay where they are at today, what impact will there be on U.S. shale oil suppliers?</th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>Chi-Square</td>
<td>5.823</td>
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<td>df</td>
<td>3</td>
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<tr>
<td>Asymp. Sig.</td>
<td>.121</td>
<td></td>
</tr>
</tbody>
</table>

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a. Kruskal Wallis Test
b. Grouping Variable: Q5 What will the price of crude oil (WTI) be per barrel at the end of 2015 (June 1, 2015 close at $6...