Imperial College Business School: Energy Business Report

Impacts of Hydraulic Fracturing on Global Hydrocarbon Supply and Price Dynamics

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1. Abstract

The emergence of shale oil within the global oil market has disrupted conventional market dynamics and greatly influenced existing oil price volatility. This report will explore how the rise of shale oil will result in reducing oil price volatility although certain exogenous factors could still disturb overall price stability. This finding is rationalized after first examining the historical and current trends of the global oil market and shale oil. Next, the impact of shale oil on supply elasticity is analyzed to uncover the endogenous factors affecting the market. Subsequently, the effects of various exogenous factors on oil prices are studied, including technology and infrastructure, political and regulatory environments and geopolitical aspects.

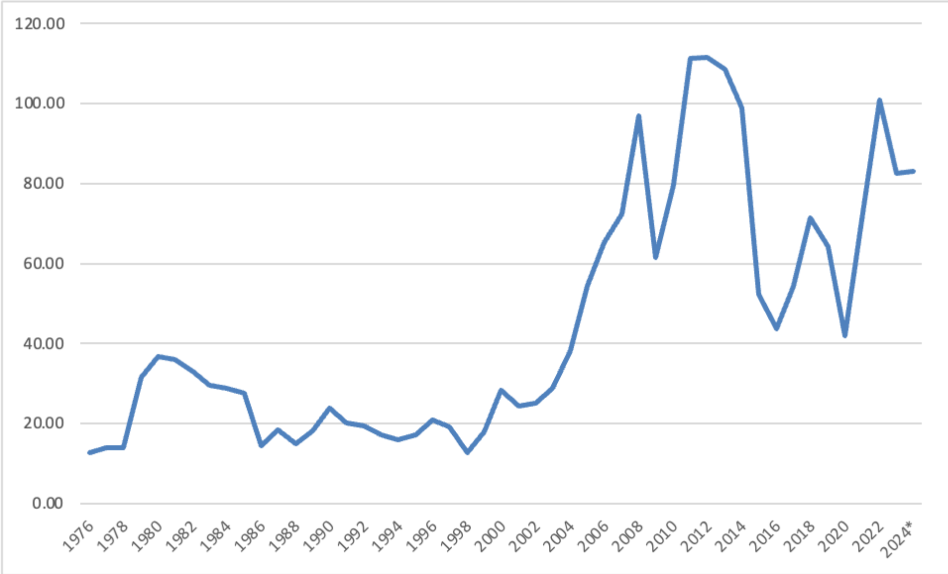
2. Overview of the Global Oil Market and the Role of Hydraulic Fracturing

Crude oil, a vital energy source, drives modern economies, fuels transportation, and serves as a key raw material for various industries. The global oil market is characterized by its complexity, involving multiple players including countries, corporations, and international organizations (Yergin, 2011). Major oil-producing countries like Saudi Arabia, Russia, and the United States significantly influence global supply (BP, 2023). Key international organizations such as the Organization of the Petroleum Exporting Countries (OPEC) and the International Energy Agency (IEA) play pivotal roles in coordinating production policies and monitoring energy trends respectively (IEA, 2023).

Historically, the oil industry experienced exponential growth post-World War II, driven by increasing industrialization and global economic expansion. During this period, the Middle East emerged as a dominant oil-producing region, largely due to its vast, easily accessible reserves (Mitchell and Stevens, 2008). The establishment of OPEC in 1960 aimed to coordinate and unify petroleum policies among member countries, significantly impacting global oil politics. The oil crisis of 1973 marked a turning point in the history of the oil market. Triggered by geopolitical tensions and the Yom Kippur War, OPEC's oil embargo led to a dramatic increase in oil prices, quadrupling from $3 to $12 per barrel (Hamilton, 2011). This event exposed the vulnerability of Western economies to oil supply disruptions and underscored the strategic importance of energy security. In response, many countries sought to diversify their energy sources and invest in alternative energy technologies (Maugeri, 2006). The subsequent oil shock in 1979, caused by the Iranian Revolution, further destabilized the market. The loss of Iranian oil production, combined with widespread panic, resulted in another surge in prices, reaching nearly $40 per barrel (Yergin, 2011). These crises led to a reevaluation of energy strategies, including increased emphasis on energy efficiency and the development of strategic petroleum reserves. The 1980s witnessed an oil glut, as increased production and reduced demand led to a collapse in oil prices. This period of low prices persisted until the late 1990s, influencing global economic conditions and prompting oil companies to innovate and cut costs (Adelman, 1993). The 1990-1991 Gulf War briefly disrupted oil supplies but did not result in long-term price increases, demonstrating the market's increased resilience (Mabro, 1992).

Since the financial crisis, oil prices have exhibited significant volatility（Graph 1), reflecting the oil market's susceptibility to sudden and unpredictable changes. Over the past few decades, geopolitical events, economic cycles, and technological advancements have all contributed to these price fluctuations. For instance, the COVID-19 pandemic in 2020 caused a dramatic drop in oil demand, leading to a historic plunge in prices. However, the subsequent recovery in global economic activity and supply chain disruptions have driven prices back up. These events highlight the ongoing uncertainty in the oil market and this uncertainty is likely to persist.

Figure 1: Brent crude oil price annually 1976-2024 in USD



Source: Statista (2024)

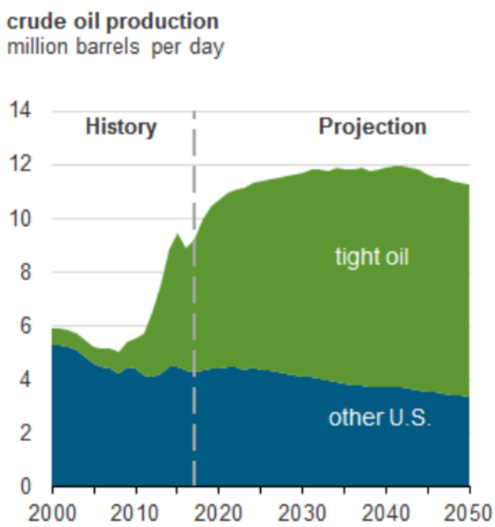
Shale oil emerged as a significant player in the global oil market in the early 21st century, especially in the US. Two evolutions of shale oil are of particular interest, the pre-21st century one and the current one. Although the latter is the predominant focus of this report, this section will outline both periods to provide context to its existing performance.

Since the early 20th century, shale oil has undergone several cycles of varying interest. In the US, the Green River Formation, comprising Utah, Wyoming, and Colorado, had historically been economically viable (Boak et al., 2022). However, these facilities were closed by 1930 due to the discovery of conventional oil fields in other parts of the US. The following peak of development came around after World War II when shale oil was viewed as a secure fuel source. However, the plants were small and production costs were high as extracting and processing shale oil is an expensive and difficult process (National Geographic, 2024). It requires pyrolysis, which involves heating the rock to above 300°C in the absence of oxygen (Boak et al., 2022). Therefore, shale oil was unprofitable to businesses and this cycle subsequently ended.

After World War II, US policymakers were increasingly concerned about oil security due to their overdependence on imported energy. These concerns were further highlighted when the US experienced the 1973 Oil Crisis (Brown and Yucel, 2013). As a result, the US government turned to shale oil and invested billions into various projects through its Synthetic Fuels Corporation (SFC) (Boak et al., 2022). Meanwhile, further investments were made by major oil companies with the expectation that oil prices would remain high going forward. Instead, they only experienced a slight increase and then a plunge in the 1980s, reducing interest in shale oil again. In response, the government terminated the SFC under the Consolidated Omnibus Budget Reconciliation Act of 1985 (Andrews, 2006).

The real transformation, often referred to as the "shale revolution," began in the early 2000s. This new cycle of interest was driven by rising crude oil prices, spurred by growing demand in Asia (Boak et al., 2022). Significant production in the US became possible due to advancements in extraction technologies such as horizontal drilling (Brown and Yucel, 2013). These technologies allowed for drilling over greater distances, making shale extraction economically viable (Lepetit, 2023). This "shale revolution" significantly increased U.S. oil production, contributing to a more flexible and responsive supply system. The increased production capacity of shale oil has been instrumental in stabilizing global oil prices, reducing the likelihood of prolonged periods of extreme price fluctuations (EIA, 2023).

Figure 2: Hydraulic Fracturing Proportions of USA Oil and Gas Production Forecast 2000-2050



Source: EIA (2018)

In 2023, US oil production reached 12.9 million barrels a day, marking a 9% increase from the previous year (EIA, 2024). Production is forecasted to continue growing, reaching an output of 15 million barrels a day before 2026 (Eberhart, 2023). This growth is expected to be driven by efficiency and productivity gains made by major shale companies using plays such as the Permian Basin and other smaller shale sources like Bakken and Eagle Ford. The cost of producing one barrel of shale oil ranged between $35 to $65, but this has fallen considerably over the years (Vaidya, 2021). Consequently, shale oil will continue to be profitable as long as the overall price of crude oil remains higher than the cost of production.

In the previous discussion, the advent of shale oil has revolutionized the US and even global oil market, introducing complexity and resilience to supply dynamics. Shale oil extraction, characterized by techniques such as hydraulic fracturing and horizontal drilling, has enabled the United States to significantly boost its oil production, transforming it from a major importer to a leading producer and exporter. Meanwhile, this surge in shale oil has not only influenced global oil prices but has also reshaped market strategies and regulatory landscapes. Because shale oil production produces CO_2 when combusted, where it emits 10% to 20% more CO_2 than conventional oil production (Boak et al., 2022), and large volumes of freshwater are required, often demanding 3 litres of water to produce just 1 litre of shale oil (National Geographic, 2024). Additionally, from geopolitical view, increased US shale oil production has transformed US from being an oil importer reliant on Middle Eastern crude oil sources, into an oil exporter that is energy independent and can impact oil prices (Berry, 2020) and therefore, US shale has placed increasing pressure on OPEC’s influence over the global market (Wethe et al., 2023). Overall, the dynamics between US shale oil and these factors will be further analyzed to determine the impact on overall oil prices.

3. Supply Elasticity and Empiric Methods

The supply and demand curves in the oil market are influenced by global economic conditions, production costs, technologies, and regulatory policies. Typically, the supply curve slopes upward to the right, indicating that marginal production costs increase with production. Conversely, the demand curve slopes downward to the right, showing that demand decreases as prices rise. To better understand oil market dynamics, this section explores market conditions through supply and demand elasticity, laying the groundwork for a deeper understanding of how various factors influence prices in later parts.

Primarily, the oil market's supply curve is composed of conventional oil, deep water oil, heavy oil, arctic oil, and shale oil. These categories have different breakeven prices based on reserves and production characteristics, forming a stepwise distribution on the breakeven price axis. As prices rise, more economically feasible resources are tapped, increasing overall market supply. Unlike electricity, which has distinct peak and off-peak demands, the demand curve for oil is smoother. Therefore, when global or regional demand exceeds the supply from lower-cost sources, the market relies on more expensive oil resources as prices rise, making these higher-cost productions economically viable.

Understanding the elasticity of supply and demand in the oil market is crucial for predicting how oil prices and production levels might respond to changes. In a time series linear regression model (1),

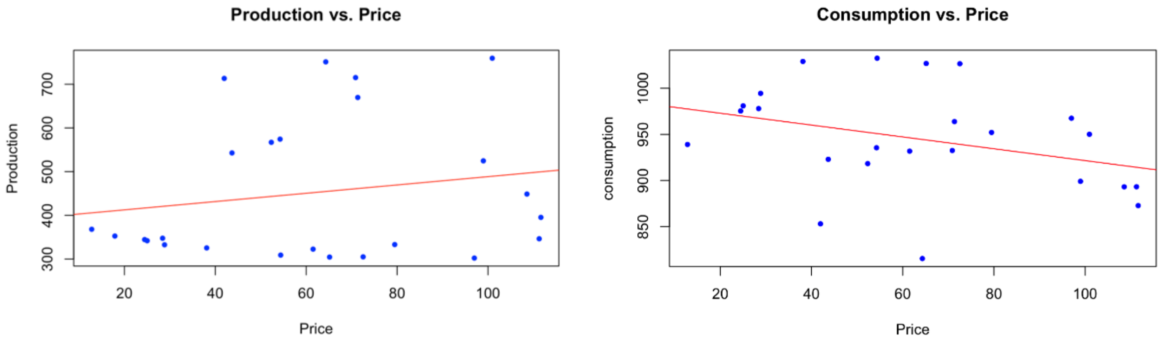
$$Y = \beta_0 + \beta_1 X + \varepsilon, \tag{1}$$

where Y is consumption (demand) or production (supply) and X is price. After getting the coefficient β1, we can calculate the elasticity as equation (2),

$$Elasticity = \beta_1 \times \frac{Average\ Price}{Average\ Production}, \tag{2}$$

This reflects the percentage change in production for a 1% change in price. The data used include Brent crude oil prices and U.S. oil production and consumption from 1998-2022. The results in Graph 2 show a supply elasticity of 0.129 and a demand elasticity of -0.04, both inelastic, which aligns with reality since oil extraction and production involves high fixed costs and complex infrastructure which is hard to adjust in the short run. Moreover, oil is an essential resource for transport systems and many other industries making consumers less sensitive to price change. Notably, demand elasticity is close to theoretical expectations in lectures, but supply elasticity is higher than the theoretical value of 0.05. One possible reason for the difference in elasticity values is that the datasets used have different time frames. Compared to the older data showing an elasticity of 0.05, the more recent data reflect advances in technology that enable quicker extraction and production, thus speeding up the supply response to price changes. Another potential reason is that the data come from different regions, implying significant differences in production conditions, market structures, policy environments, and technological progress. Due to these data limitations, the estimates provided here are relatively short-term. However, according to Krichene (2002), long-term supply and demand elasticities tend to be slightly higher than short-term ones. This is because, in the short term, supply is determined by existing production capacity, which cannot exceed its limits. Additionally, supply is influenced by existing sales contracts or OPEC quotas in the short run. Likewise, short-term demand lacks price elasticity because energy consumption is primarily determined by fixed capital and is adjusted through inventories.

Figure 3: Linear Relationship Between Price, Production, and Consumption

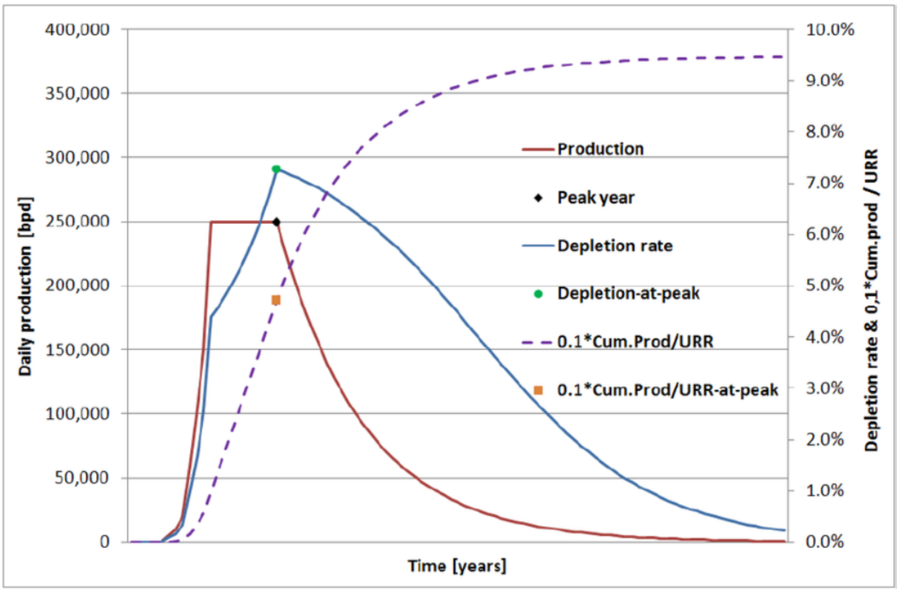


Based on previous analysis, the introduction and expansion of shale oil production mainly influences global oil supply elasticity. According to Foroni and Stracca (2023), the shale oil boom, driven by technological advancements and cost reductions, typically allows for quick adjustments in production, thus potentially increasing elasticity. Moreover, the widespread distribution of shale oil resources, especially in the U.S., diminishes the market control of single resource regions, thereby increasing global supply elasticity. Therefore, if shale oil indeed makes oil supply more elastic, it could reduce the likelihood of future oil price fluctuations. This is because if oil prices rise, shale oil producers can quickly increase production, thereby helping to suppress prices. Conversely, if oil prices fall, shale oil producers may reduce production, which helps support prices. In the following sections, we will discuss more about exogenous factors and verify in detail whether these factors will adjust supply more flexibly, allowing it to adapt to changes in market demand, thereby stabilizing price fluctuations.

4. Infrastructure and Technology

Research has observed negative price elasticity for peak production from wells: as oil prices move higher, less productive locations become feasible to drill yet require more input for less extracted resources (Mason and Roberts, 2017). Firms may drill at “sweet spots” first, before moving on to more challenging extraction sites later as increased prices cause them to become more profitable despite increasing inputs. Well lifetime production profiles tend to peak very early and trail off, with newer wells seeing accelerated extraction profiles attributable to technological innovation and increased adaptation of existing technology. This incentive structure supports the argument that midrange prices will prevail as fracking activities constitute greater proportions of supply, with deviations to higher prices being offset by increased elasticity of supply in times of elevated prices, and substantial costs of production making low prices unlikely. Increased commitment to fixed delivery infrastructure is a signal component in the stability of future oil prices, with increased ease of delivery representing more competitive products for producers.

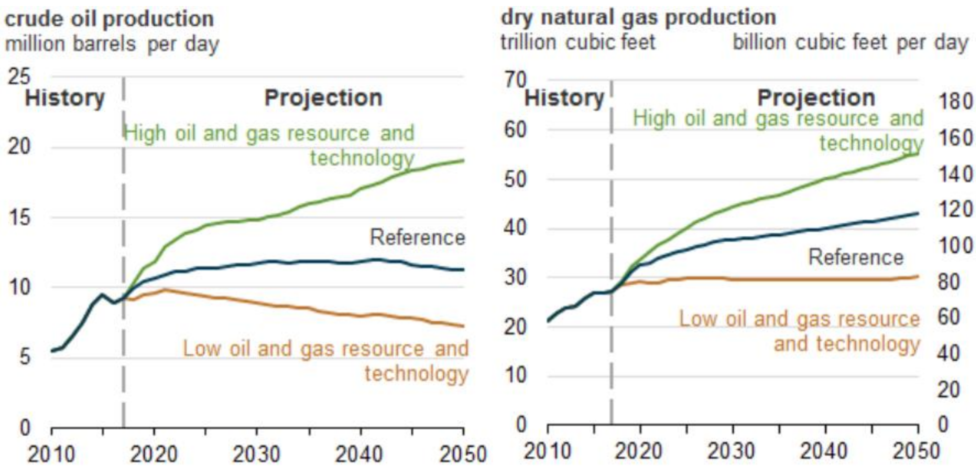
Figure 4: Lifetime Well Extraction Profile



Source: Höök et al (2009)

Overground rail transportation of crude costs between $5-$10 more per barrel than pipeline delivery but has rational applications in the absence of greater pipeline capacity. Rail transport offers increased flexibility when it comes to timely overground delivery, covering distances in 5-7 days that would be 40 days if pipelined (Andrews et al., 2014). Such flexibility is especially useful during times of price volatility, with rail delivery operating on much shorter contracts (1-5yrs) than those required by pipeline operators (10-15yrs). Rail transportation has been employed in situations where existing pipeline infrastructure is insufficient to handle production volumes, with pipeline bottlenecks resulting in difficulty delivering oil to consumers in a timely fashion, creating discounts which justify the increased costs of rail delivery. A decrease in these bottlenecks, chiefly in the form of increased pipeline infrastructure, is likely to increase the competitiveness of supply from areas underserved by delivery infrastructure and eliminate these bottleneck discounts, with such local price appreciation causing increased production at sources of supply, thereby increasing elasticity of supply in the United States.

Figure 5: USA Oil and Gas Production Prediction 2010-2050



Source: EIA (2018)

Regulatory permissions are key to pipeline projects, with successive American presidential administrations espousing differing positions on hydrocarbon infrastructure megaprojects. Democratic administrations have tended to side with environmentalist factions and opposed permit approval, while Republican administrations have been seen to be pro-hydrocarbon infrastructure investment. The Keystone XL pipeline timeline of regulatory approval demonstrates this important political component: the Obama administration originally cancelled permits for the pipeline in 2015, followed by approval in 2017 by the Trump administration, grassroots legal opposition in 2018 halting developments, ultimately reverting in 2021 by executive order of the Biden administration revoking the permits. Such short-term uncertainty may discourage long-term investment, thereby decreasing elasticity of supply, contributing to volatility of prices.

Nevertheless, an increase in elasticity could be witnessed from a technological advancement perspective. Focusing on shale, the development in hydraulic fracturing could play a major role in the decrease of price volatility of shale and of overall crude oil prices (Smith, 2021). Three characteristics of fracking have currently seen clear cut advancements:

- Horizontal drilling: increases the number of fractures made in the rock-formations, thus giving more access to oil reservoirs.
- Proppant technology: a change in the materials used for proppants, with resin and ceramic becoming the most cost and production efficient solutions (proppants are used to assure the free flow of liquid through the fractures).
- Fracturing fluids: The fluids used are now becoming more environment friendly thus increasing the potential subsidy revenues and reducing associated regulatory costs of disclosure.

Additionally, data analytics and digitalization of the mechanics of fracking have also increased the efficiency of shale oil production (Siemens, 2021). With those multiple advancements efficiency of production will benefit greatly, with costs decreasing, even though it is possible these new technologies could become barriers to entry that represent high initial costs for new entrants. The elasticity of supply would in those cases see a resulting increase, thus reducing price volatility.

5. Political, Regulatory, and Legal Status of Fracking Operations

In the United States the primary regulatory contention is focused primarily on the additional disclosure requirements desired by regulators, and private firms arguing that such disclosure requirements infringe on proprietary technologies and other such trade secrets, especially regarding the chemical compositions of fluids, foams, gels, and sands used for fracturing and extraction. In these cases, an opaque patchwork of state and federal legislation necessitates disclosure of chemical compounds in the extraction process, but still in cases allows for compounds used in the prior hydraulic fracturing process to remain undisclosed as trade secrets, making the testing of groundwater for chemical compounds inefficient if not outright ineffective. Hydraulic fracturing has become a highly contentious regulatory issue since the early 2000's, with social disagreement leading to non-producing territories banning fracking practices pre-emptively (Osterath, 2015), illustrating the political grip of the topic on the surrounding debate.

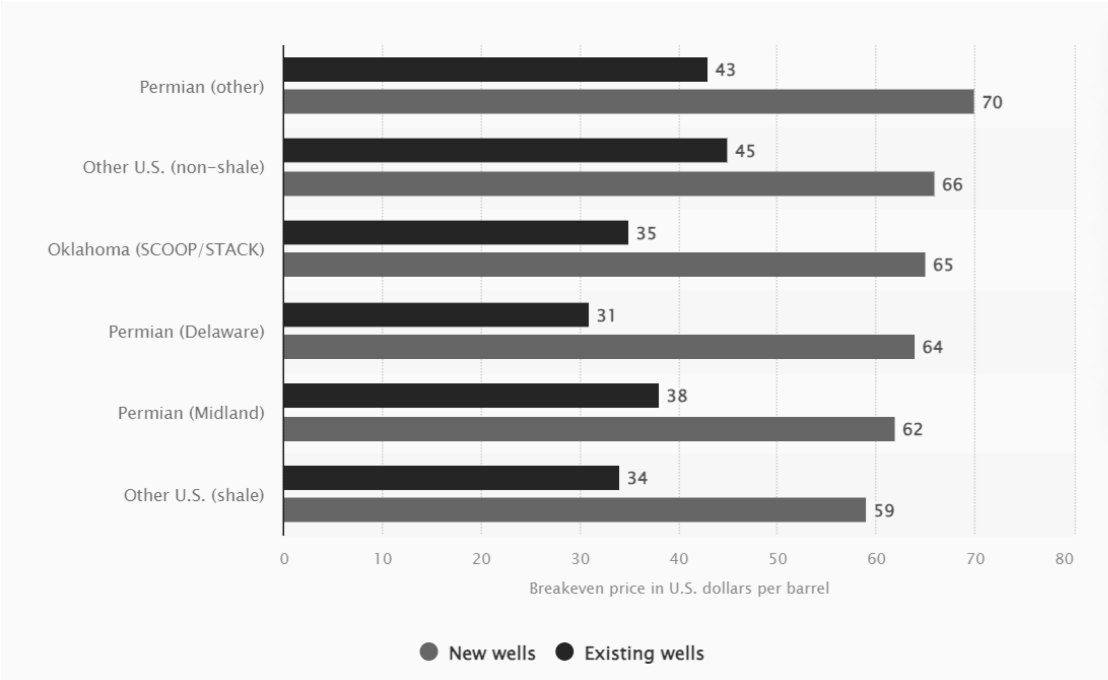
The greater regulatory debate centres primarily around environmentalist concerns vs. private corporate interests: whether the use of hydraulic fracturing fluids can affect the safety of drinking water resources, whether pollutants can escape from production operations into the air or surrounding environment, and whether hydraulic fracturing activities can destabilise geological features causing seismic activity. Regulation of fracking operations primarily operates with the objective of greater required disclosure of the chemicals used in hydraulic fracturing, greater monitoring of potential leakages of methane or waste chemicals at production sites, and reporting on seismic activity and geological integrity of production sites, with production license allocation systems based on pre-operation environmental metrics and penalties for infringement. The infamous Halliburton loophole refers to the exemption of most hydraulic fracturing activities from the Safe Drinking Water Act of 1974, and thereby the Underground Injection Control framework, by way of provisions in the Environmental Protection Act of 2005 which do not classify hydraulically fractured wells as injection wells except for those which contain diesel fuels during the fracturing process. This exemption is the largest federal legislative issue around which the fracking debate centres in the United States, with no comprehensive federal system regulating fracking in place to date. Counters to this loophole, such as the FRAC Act, represent a substantial increase in potential costs associated with reporting obligations, more stringent environmental forensics, and greater penalties for chemical leakage (Underhill et al., 2022). More importantly, such regulation may infringe on "secret recipes" proprietary to individual firms, representing costs associated with loss of intellectual property and raising competitive practice concerns.

Other concerns have been raised regarding the seismological impact of fractured wells, with some hydraulic fracturing activities resulting in seismic activity, the largest recorded US example being a magnitude 4.0 earthquake in Texas in 2018 (United States Geological Survey, 2018). The occurrence of magnitude 2.3 and 2.9 earthquakes led to the halt and subsequent banning of limited hydraulic fracturing activities in the United Kingdom between 2011 and 2019. Regulation aims to require tiltmeters and methane detection systems to be present in order to monitor geological integrity of operations and ensure safety of surrounding settlements. American oil and gas companies have an incentive to favor a state-by-state regulatory approach, as a federal regulatory approach subjects inter-state resources such as large bodies of water to a greater degree of scrutiny while local and state government lobbying efforts can be more effective than lobbying at the federal level. Large oil and gas companies with deep pockets and expert legal teams are at an advantage in legal cases of opposition at local levels, as smaller municipalities may not have the resources for legal contests against oil and gas majors, unlike the federal government.

Election outcomes in the United States represent a potential policy shift affecting elasticity of supply, with the Trump administration promising to enable exploration and fracking on federal lands, countering a policy of banning exploration and extraction on federal lands championed by the Biden administration. In the event of a 2024 Republican presidency win, there is a reasonable expectation that fracking activities within United States territory will expand, contributing to improving the United States' position as a major hydrocarbon titan in world markets. Such dominance is what is likely to lead to increased future stability in prices as the United States continues to rival OPEC members, decreasing the threat of potential OPEC production cuts. The increase of American oil and gas production is the biggest counterweight to high and volatile oil prices; OPEC will no longer be able to threaten global markets with curtailed production, but can still threaten American fracking operations through overproduction and low prices. Current developments in hydraulic fracturing projects by industry titans Exxon, Chevron, and Occidental have set break-even prices of as low as \$25-\$30 per barrel in some of their Permian basin operations, with enormous \$59.5Bn and \$53Bn deals by Exxon and Chevron for Pioneer Natural Resources and Hess Corporation respectively demonstrating substantial commitment to future fracking operation in the United States, and accounting for the largest value deals of 2023 during a period of notable slowdown in M&A activity (ExxonMobil, 2023; Chevron, 2023).

Low cost of supply wells may not be representative of all future projects: while existing wells in the United States have minimum profitable prices averaging some \$38, new wells have an almost double minimum break-even price of \$62, indicating that in a future where hydrocarbon market supply is substantially constituted by hydraulic fracturing production, we can expect midrange oil prices to prevail as is the case now as of June 2024, with WTI oil price consistently trading in the \$70-90\$ range for the trailing 36 months. We note marked stability in the last 12 months despite ongoing geopolitical shock factors to major hydrocarbon producing regions such as the Middle East and Russia. Further discoveries in Guyana by American industry majors Exxon and Chevron cement security of supply in the western hemisphere, and further bolster a case for stable midrange oil prices prevailing in the foreseeable future, as these companies will be in a more advantageous market position to influence prices and adjust production according to their profitability requirements.

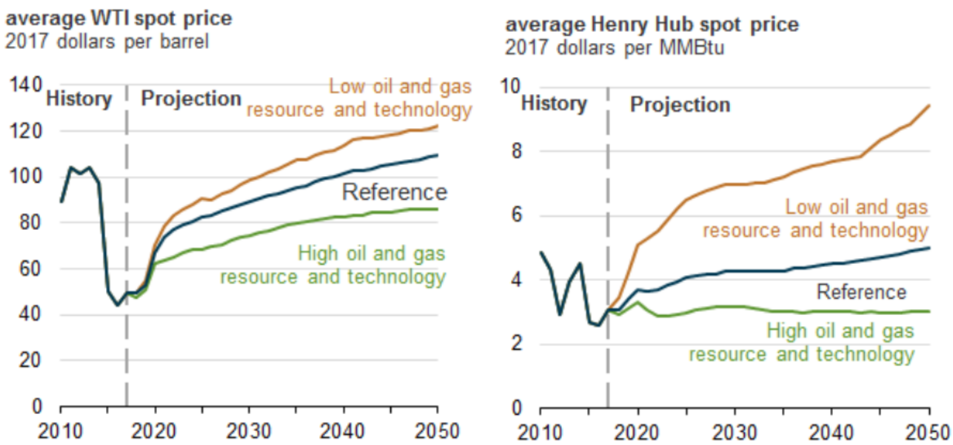
Figure 6: Breakeven Prices for Drilled Wells in the United States



Source: Statista (2022)

The threat of overproduction by non-US aligned OPEC members is far less credible than threats of production cuts, especially at times when members such as Russia and Iran require oil and oil revenue to finance ongoing military operations. A Republican 2024 presidency with increased devolvement of fracking regulation to the state level represents the brightest regulatory future for American tight oil operators in which stable midrange oil price prevail, while a Democrat 2024 presidency which intends to restrict operations on federal lands and extend Underground Injection Control provisions to fractured wells may result in substantial costs for oil and gas companies, disincentivizing future projects and enabling greater OPEC influence over supply, contributing to greater oil price volatility.

Figure 7: USA Oil and Gas Price Forecast 2010-2050



Source: EIA (2018)

We have previously witnessed American administrations intervene in the oil market by opening the Strategic Petroleum Reserve to the market, as the Biden administration did in early 2022. With a monstrous authorized storage capacity of 714 million barrels, such a reserve can act as a bulwark against periods of sudden supply shortage in world oil markets, both internationally and domestically. Domestic production is inseparable from policies which build up and expand this reserve, and will contribute to future stability in oil prices, with the Biden administration promising to fully restock the SPR by the end of 2024. Given that the DOE estimates that 95% of new wells were hydraulically fractured as of 2018, future domestic reserves will be overwhelmingly produced through fracking, highlighting the central importance of hydraulic fracturing to American energy security.

6. Geopolitical Factors

One of the major uncertainties regarding future oil prices in the event of an increase in shale oil in the United States could come from geopolitical reactions. Historically oil prices have been dictated by international relations between the supply and demand producing sides. On the supply side we can notably cite the OPEC countries as major contributors to price instability. Additionally, the US ambivalent relationship with Middle Eastern countries could affect prices in relatively high proportions. Firstly, the context of the United States becoming a major oil exporter will be set. Then, the reaction to the US becoming an exporter will be analyzed. Finally, an overview of the demand side will be given in order to properly understand which actors could affect oil prices following the shale oil influx to the market.

In the hypothetical case where the United States discovers high amounts of shale oil reservoirs on their territory, the question on whether to keep it for national consumption or storage or export it becomes crucial. The two political parties in the US seem to have a different perspective on shale oil in general. The approaching 2024 presidential elections could set the trajectory for American energy diversification for the coming years. Firstly, in the event where Americans decide to become major exporters, it needs to be specified that the amount of shale oil found in those reservoirs would largely outweigh the current energy consumption of the US. The US was already a net exporter in 2011 (Foreso, 2014), however with a high enough influx of production they could become a major player, overshadowing OPEC dominance (Reuters, 2023). If such a circumstance were to transpire the repercussions on an international level would have consequences on oil price stability around the world. However, from a demand and supply perspective, the stability of being supplied by the US would increase stability in oil exchanges, as elasticity of supply would increase greatly with American companies setting base as future market makers for oil exports.

The main reaction that needs to be looked at will come from OPEC nations. As established, shale oil extraction and refining come at a larger cost compared to traditional oil extraction. OPEC nations control over 30% of crude oil production and OPEC+ produced over 40% (Reuters, 2024). In the event where the US could compete to become the leading entity in influencing oil prices instead of OPEC, it would be logical to expect a reaction from the organization (IMF, 2015). With increased shale oil production, the US could cement its place as the biggest oil producer in the world and would therefore have a major role and deciding vote in the determination of oil prices. The shale oil revolution of the 21st century gives us a potential outlook on what type of reaction we could expect. In 2014, following the 2008 crisis and the slowed down economic stimulus in Europe, OPEC had considerably reduced its oil prices (Lutz, 2008). However, the main reason behind that drastic cut can also be explained by the US constant development of their shale oil supplies (Baffes, Stocker, and Vorisek, 2018). The ECB analyzed the OPEC reaction and conjectured that it was a strategy to undermine the recent influx of shale oil in the market and US hydrocarbon development efforts. Shale oil costs are still too high for the US to properly compete on the export market with OPEC countries. Nevertheless, with recent technological developments, we can expect the US to reduce its prices and truly start to compete with OPEC regarding oil sovereignty but also in determining future prices. Overall, the consensus would be that following a surge in shale oil in the US, OPEC countries would reduce the prices of their exports in order to make shale oil production too expensive for American exporters. Price instability would greatly increase, as elasticity of supply would decrease. Due to the US's entry in said market, geopolitical tensions would likely increase, especially with Russia and the Middle East (BBC, 2023). Europe could turn towards American exports depending on their capacity to reduce prices. With increased tensions, price stability would be greatly affected and vulnerable to international relations as well as geopolitical tensions. The demand side could see itself determining price stability because of the origin, and more importantly because of the emissions behind that newly found shale oil in the US. Europe, Asia and Africa will determine the next pathway, setting energy demand. If those continents decide to follow a pathway mostly focused on renewables, oil prices will suffer, and shale oil might even become obsolete outside of the US.

7. Conclusion

This paper has set the contextual background of the United States energy situation and of the shale oil industry in order to understand how a sudden expansion of shale oil reserves in the United States would impact price stability of the whole oil market. Through empirical methods, we verified oil supply and demand elasticity and recognized that both supply and demand in the oil market are inelastic, with supply elasticity being relatively greater. Additionally, through our discussion we understand that exogenous factors affecting shale oil can alter the sensitivity of prices, meaning price fluctuations, by influencing supply elasticity. Political indecision and changes in policy regimes can stall projects, even resulting in total cancellation following years of approvals processes subject to the agendas of ruling administrations. Finally, technological advancements reduce barriers to production and from our perspective play a major role in augmenting elasticity of supply. On the demand side however, the uncertainty regarding oil demand and renewable technology adoption remains, and therefore casts doubt on the potential stability and necessity of the oil and shale oil markets. Clear and decisive regulatory regimes are needed to commit to hydrocarbon supply stability and expansion, with domestic American production likely determining the trajectory and stability of oil prices in the years to come.

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