THE COST OF LAWSUIT ABUSE:

An Economic Analysis
of Louisiana's Coastal Litigation

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EXECUTIVE SUMMARY

The research in this study was performed to estimate the impact Louisiana's lawsuit climate has on the state's economy, particularly as it pertains to the state and local governments' coastal lawsuits against oil and gas industry companies. The earliest coastal lawsuits were filed separately by Plaquemines Parish and Jefferson Parish in 2013. Currently, six coastal parishes in South Louisiana have filed lawsuits against a large number of energy companies alleging coastal damage resulting from oil and gas extraction and production activities.

This study will first provide readers with a framework of how increased risk of litigation factors into oil and natural gas industry companies' decisions on new or continued investments. *Economic theory indicates that with increased risk of lawsuits against oil and gas producers comes less investment, and more specifically, less drilling activity.* It's important to note that drilling is the primary determining factor on which production decisions are made in the oil and gas industry. *When the risk of getting sued increases, the expected costs faced by companies increases and as a result, drilling activity decreases.* Further, the world today offers many drilling opportunities to oil and gas producers and the investors that finance them, and that makes seeking opportunity elsewhere more likely as litigation risk increases.

Next, this study will explain how oil and gas drilling and production data is used to estimate the economic losses the industry faces due to the increased risk of lawsuits in Louisiana. *We discovered that between 53 and 74 fewer oil wells were drilled offshore Louisiana than would have been drilled if the threat of lawsuits was lower in the state.* We also predict the amount of oil and gas that these wells would have produced in their first year based on recent data on production from wells drilled offshore Louisiana. (We use only first-year production to be conservative in light of the inherent uncertainty of our estimates.) These revenues represent our estimate of the total annual economic losses to Louisiana's oil and gas sector as a result of increased risk of litigation. *According to our estimated range, Louisiana's economy loses $44.4 million to $113.0 million per year due to lawsuit risk.* Large portions of these revenues go to the salaries and wages of employees, which are relatively high in the oil and gas sector relative to other sectors of Louisiana's economy, as well as to the profits earned by both large and small oil and gas producing companies in the state and to drilling royalties paid to the state of Louisiana. *Given that the average royalty rate in the coastal zone of Louisiana is approximately 20%, we estimate Louisiana's state and local governments lose $8.9 million per year to $22.6 million per year in royalty revenue.* This means Louisiana is losing more in royalty revenue than oil and gas producing companies are losing in profit, which are likely less than 20% of revenues on average, due to litigation risk.

These estimated ranges are conservative, because we underestimated the effect as different assumptions were made throughout the analysis. For example, we only focused on Louisiana state offshore drilling, because it was the only region in Louisiana that was both affected by increased litigation risk and could be compared to a reasonably similar drilling region that was not affected by increased litigation risk – the federal offshore drilling area that is adjacent to the Louisiana state offshore drilling area. *Our estimate of the minimum economic loss associated with coastal lawsuits is $44.4 million per year.*

Then, we move on to investigate the impact of increased risk of lawsuits on employment and earnings in Louisiana's oil and gas sector. While we are not able to make a direct correlation on the impact of increased risk of lawsuits on employment and earnings due to the low available employment data, we do find job losses and earnings *losses that are consistent with our estimates of decreased drilling activity and the associated economic losses.* In conclusion, we find the increased lawsuit risk in Louisiana equates to a *decrease of more than 2,000 employees across four occupations in the state's oil and gas industry, and these lost jobs equate to lost earnings of $70 million per year.*

INTRODUCTION

This report analyzes the economic impact of increased litigation risk associated with coastal lawsuits on the oil and gas sector in Louisiana. Litigation risk associated with coastal lawsuits became an issue in November 2013 when Plaquemines Parish and Jefferson Parish each filed lawsuits against nine oil and gas companies. Four additional coastal parishes also eventually filed coastal lawsuits in 2016 and 2017. In the first section of this paper, we explain the theoretical economic underpinnings of how increased litigation risk will affect the development investment decisions of crude oil and gas producing firms. Economic theory explains why we would expect increased litigation risk to decrease investment in oil and gas development.

We then use drilling data to analyze whether there was a decrease in drilling activity in affected areas using difference-in-differences analysis. We find that increased litigation risk led to a decrease in drilling in the Louisiana state offshore area, and that this decreased drilling led to large economic losses in Louisiana's oil and gas sector. In particular, we found that increased litigation risk from coastal lawsuits led to a decrease of between 53 and 74 oil wells drilled in the Louisiana state offshore area between January 2014 and October 2016. This decrease in drilling activity led to economic losses in the range of $125.7 million to $320.3 million during that 34- month period for Louisiana's oil and gas economy, or annual losses in the range of $44.4 million per year to $113.0 million per year. These economic losses likely understate the total impact: this analysis only accounts for offshore drilling in Louisiana state waters, as other regions affected by increased litigation risk were not amenable to difference-in-differences analysis.

LITIGATION RISK AND INVESTMENT

This section provides a theoretical framework with which to analyze the effects of increased litigation risk on crude oil and natural gas production. We will focus on crude oil production for simplicity, but most of this analysis is also relevant in the context of natural gas production. Crude oil and natural gas producing firms make choices not only to earn a profit, but to maximize profit provided all opportunities available.

Equation (1) provides an expression for the present-value profit of an individual oil or gas producing well.

PROFIT EQUATION VARIABLES

t : An index for the time period (month) during the operating life of the well.
T : The last time period that the well produces oil: the time period during which the well is shut down.
$™$: The discount factor, which accounts for the time-value of money – revenues received in the future are less valuable than revenues received today, while costs incurred in the future are less costly than costs incurred today.
P_t : The oil price received by the operator of the well in time period (month) t.
Q_t : The quantity of oil produced by the well in time period (month) t.
OC_t : The well's operating cost in time period (month) t. Might include well maintenance, for example.
DC_0 : The upfront cost associated with drilling the well, which tends to make up the majority of crude oil production costs (Anderson et al., 2018; Mason and Roberts, 2018). The time index $t=0$ indicates that drilling costs are incurred in the same period the well is drilled.
$OppCost_0$: The economic opportunity cost at $t=0$. Although $™$ captures the financial opportunity cost faced by the firm, there may also be other profitable opportunities available to the firm during the time period in which the drilling decision is made. For example, while a well might have a positive ***accounting profit*** (the profit that does not account for this $OppCost_0$ term), there may be more profitable investment opportunities available to the firm, such as other wells that could be drilled, which may lead to a negative ***economic profit.***

Beginning in time period $t=0$ and continuing until the well stops producing in period $t=T$, the well will earn revenue each period. Revenue is the product of the oil price in period t, P_t, and the total oil production from the well, Q_t. There are different types of cost that will be of interest in our analysis. The oil producing firm will pay an operating cost, OC_t, in each period that the well is operating, which might include processing, labor, transportation of product, etc. Note that profit per time period is contained in the brackets in equation (1). Most of these profits per time period associated with oil and gas drilling will be earned from product that flows from the wells in the future. Therefore, oil and gas producers will discount expected revenues at some discount factor, $™$, raised to the power of the number of periods into the future. The discount factor will vary from firm to firm, and from time to time for a variety of reasons. For example, if the market rate of interest is very high, then the firm can make a good return by investing its money in a safe financial asset (or equivalently saving interest from borrowing the funds to drill a well), and will account for this by discounting oil profits at a higher rate to make them comparable to other available investment opportunities. Thus, discounting is one way that oil and gas producers account for foregone investment opportunities, which economists refer to as opportunity costs. Opportunity costs will play a central role in our theoretical analysis of the impact of litigation risk on oil and gas investment decisions. Another type of opportunity faced by oil producers, and represented by the last term in equation (1) is discussed below.

The firm will pay the cost of drilling, DC_0, in the drilling time period, $t = 0$. The cost of drilling generally makes up the majority of the total production cost in the oil and gas industry because the actual drilling of wells is the most labor and capital intensive part of the crude oil and natural gas production process (Anderson et al., 2018; Mason and Roberts, 2018). Also, many future costs related to oil and gas production are locked in at the time of drilling, and while monetary outlays may actually occur after drilling, these costs are accounted for at the time of drilling. In economics jargon, a great deal of oil and gas production costs are "sunk" at the time of drilling meaning that these costs cannot be recovered at a later date.

The fact that a large proportion of oil production costs are sunk at the time of drilling, while the proportion of costs that are paid after drilling during the producing life of the well are relatively small, implies that oil producers might have a larger adverse reaction to litigation risk than industries with more flexibility. Oil-producers' short-term responses to changes in costs, such as increases in litigation risk, should be most readily apparent in drilling decisions. In this analysis, we will treat litigation risk as a component of DC_0, because firms are likely to take litigation risk into account when the drilling decision is made, especially in the case of coastal lawsuits and legacy lawsuits, as these lawsuits tend to target all parties that have operated in a particular area. The only way to avoid such litigation is to avoid drilling in the region with higher litigation risk.

Although litigation risk is a component of sunk drilling costs, the most important impact of increased litigation risk in a specific region might be reflected in the opportunity cost component, $OppCost_0$. This variable represents other investment opportunities available to the oil producing firm. Imagine a situation in which increased litigation risk increases DC_0, for a particular well, but the accounting profits (profits that ignore $OppCost_0$) are still positive. A naïve analysis might conclude that the well still be drilled, because the well will be profitable in accounting terms. However, if the producer has the opportunity to move to a different region without incurring the litigation risk, then the economic profits might become negative as a result of the increased litigation risk, and we would not expect the well to be drilled even though the accounting profits are positive.

While equation (1) is quite simple, it summarizes the basic economic calculus of an oil and gas producing firm when it comes to making drilling decisions, and allows for a straightforward analysis of impact of increased litigation risk on such decisions. This simple model allows us to identify two ways by which increased litigation risk might decrease drilling. First, increased litigation risk might increase expected costs to the point that drilling a particular well is simply unprofitable from an accounting perspective. However, even if expected accounting profits remain positive, increased litigation risk might decrease drilling activity if firms have the opportunity to pursue oil and gas development in other regions that are not affected by the increased litigation risk. In the following section, we analyze drilling data from the state of Louisiana to measure the impact of increased litigation risk on drilling activity in Louisiana's coastal regions. We find that increased litigation risk has significantly decreased drilling activity in Louisiana's state offshore region.

MEASURING THE IMPACT OF COASTAL LAWSUITS

This report applies a difference-in-differences analysis to measure the impact of increased litigation risk associated with coastal lawsuits on crude oil and natural gas development activity in Southern Louisiana. The difference-in-differences methodology relies on comparing oil and gas development in areas of Louisiana that are affected by increased litigation risk associated with coastal lawsuits (the treatment group) to similar oil and gas producing regions that are not subject to this increased risk (the control group). Let $X_{LA,b}$ represent a measure of oil and/or gas development in **Louisiana before (LA,b)** increased litigation risk associated with coastal lawsuits is present, and let $X_{LA,a}$ represent the same measure of oil and gas development activity in **Louisiana after (LA,a)** increased litigation risk associated with coastal lawsuits is present. One potential estimate of the effect of increased litigation risk on oil and gas development activity simply looks at the difference: $X_{LA,a}$ - $X_{LA,b}$. However, this measure ignores the influence of other time-varying factors that affect oil and gas development such as changing crude oil prices and/or natural gas prices. For example, crude oil prices decreased dramatically in 2015 when increased litigation risk associated with coastal lawsuits was present in Louisiana, and it would be inappropriate to attribute decreases in oil development activity related to lower prices to increased litigation risk.

It is necessary to compare the change in oil and gas development activity in Louisiana to a similar producing region that is not affected by increased coastal litigation risk, but is affected by the same set of other time-varying factors, such as prices, to control for the influence of those other time-varying factors on oil and gas development. Let $X_{O,b}$ represent a measure of oil and/or gas development activity in some **other region before (O,b)** increased coastal litigation risk occurs in Louisiana, and let $X_{O,a}$ represent the same measure of development activity in that **other region after (O,a)** increased coastal litigation risk occurs in Louisiana. Then, $X_{O,a}$ - $X_{O,b}$ represents changes in oil drilling activity that occurred over the same time period, but in the absence of increased litigation risk. Now, the difference-in-differences estimate of the effect of increased litigation on oil and/or gas development activity in Louisiana is

$$DiD = (X_{LA,a} - X_{LA,b}) - (X_{O,a} - X_{O,b})$$

The first set of parentheses contains the change in oil and/or gas development activity that occurred in Louisiana over the period when litigation risk increased. This change in development activity in Louisiana is the result of increased litigation risk **and** other time-varying factors that impact oil and/or gas development. The second set of parentheses contains the change in oil and/or gas development activity that occurred in the other region that was not subject to increased litigation risk, and is the result of only other time-varying factors, **and not** a result of increased litigation risk. The effect of increased litigation risk on our measure of oil and/or gas development activity can be isolated by subtracting the change in the other region from the change in regions of Louisiana affected by increased litigation risk.

An assumption must be satisfied in order to make the difference-in-differences estimate effective in quantifying the effect of the treatment: we assume that the treatment group would have changed in the same way as the control group in the absence of the treatment.

In our analysis, this means we assume that the region of Louisiana under study would have changed at the same rate as the control group in the absence of increased litigation risk. Mathematically, this assumption means that

$$(X_{LA,a} - X_{LA,b}) = (X_{O,a} - X_{O,b})$$

in the absence of increased litigation risk. Therefore, the control region should be chosen carefully in order to get the most accurate measure of the effect of litigation risk on oil and/or gas development activity in Southern Louisiana.

Southern Louisiana is somewhat unique in its mix of onshore, inland offshore, and offshore drilling, which makes identifying a feasible control group somewhat difficult. However, the division between Louisiana state offshore and federal offshore drilling is particularly amenable to comparison via difference-in-differences analysis, because similar technologies and drilling techniques are applied across these two regions. The state of Louisiana owns minerals below the seafloor within three miles of the Louisiana coast, while the federal government owns minerals below the seafloor that are further than three miles from Louisiana's coast (Corbitt Jr., 1970).

Importantly, we make the additional assumption that increased coastal litigation risk in the state of Louisiana did not significantly impact drilling in the federal offshore region. If this assumption fails then we will underestimate or overestimate the impact of increased litigation risk on offshore drilling in Louisiana. For example, it is possible that producers perceive drilling in the federal offshore region off the Louisiana coast as more risky as a result of increased litigation risk in Louisiana, which would lead to less drilling in the federal offshore region than we observe. In this case, we will underestimate the negative impact of litigation risk on Louisiana offshore drilling. On the other hand, it is possible there is a trade-off between drilling in the Louisiana offshore area and drilling in the federal offshore area if firms drill in the federal offshore area to replace wells they would have drilled in the state offshore area. We would expect to see this latter effect by observing the decisions of individual firms that drilled in both regions over our time period of interest. Inspection of firm-level data indicates that firms operating in both regions systematically drilled less in the state offshore region when litigation risk increased, but did not commensurately increase drilling in the federal offshore region.

Figure 1 displays monthly time series of the number of oil and gas wells drilled in the federal offshore region off the coast of Louisiana, and state offshore off the coast of Louisiana. Litigation risk associated with coastal lawsuits increased in the year 2013 when Plaquemines Parish and Jefferson Parish both filed coastal lawsuits in November of that year. The year 2013 is removed from the dataset to create a clear delimitation between the time period before and after increased litigation risk occurred.

**Wells Drilled per Month during 34 months before and after 2013:
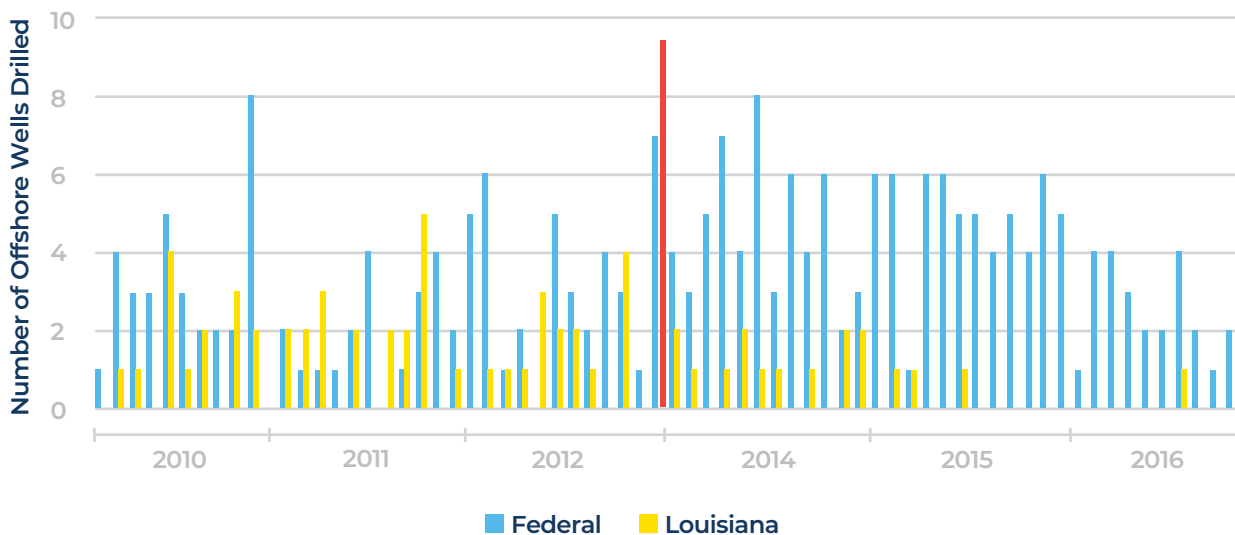Federal Offshore vs. State of LA Offshore**

Figure 1. Number of offshore oil and gas wells drilled per month during 34 months before and after 2013. The red line indicates 2013 when litigation risk associated with coastal lawsuits increased as a result of Plaquemines Parish and Jefferson Parish filing coastal suits in November 2013.

**Number of Wells Drilled during 34 months before and after 2013:
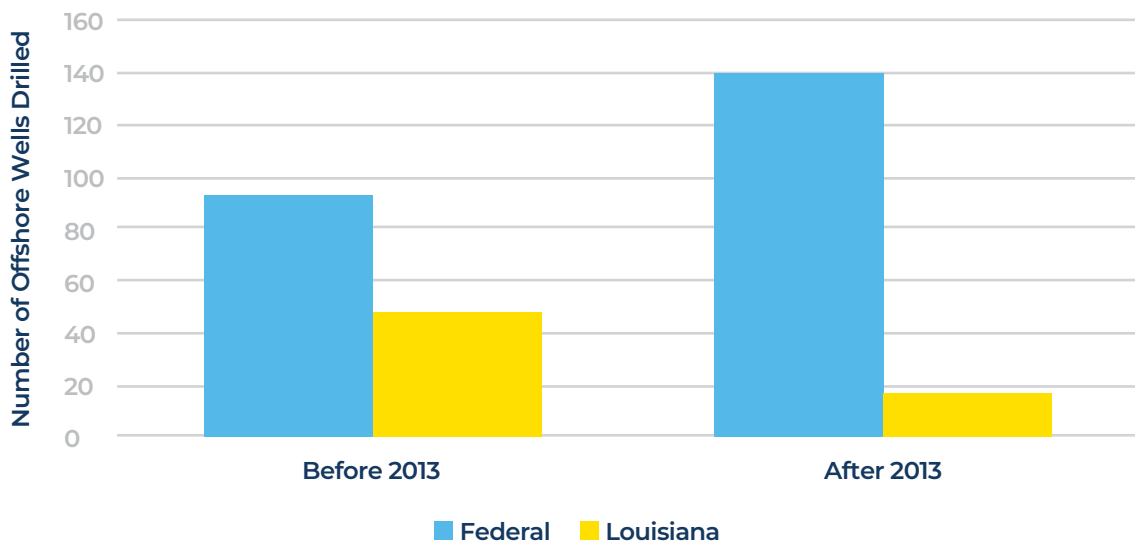Federal Offshore vs. State of LA Offshore**

Figure 2. Comparison of cumulative number of oil and gas wells drilled in Federal offshore and state of Louisiana offshore regions between March 2010 and December 2012 (Before 2013) and between January 2014 and October 2016.

" We estimate that increased litigation risk led to 94 − 17 = 77 fewer wells in the offshore Louisiana region during the 34 months after 2013.

The split between the "Before 2013" and the "After 2013" monthly data is indicated by the red line in Figure 1. The effect of increased litigation risk is apparent from the changing relationship between the number of federal offshore wells drilled and the number of Louisiana offshore wells drilled per month. Wells are drilled in the Louisiana offshore region at a slightly lower rate than in the federal offshore region before 2013, but the number of wells drilled in Louisiana decreased significantly after litigation risk increased even though the number of wells drilled in the federal offshore region increased. Even though wells are drilled at a slightly lower rate in Louisiana than in the federal offshore region before litigation risk increased, the relationship between the number of wells drilled in Louisiana relative to the number drilled in the offshore region appears relatively steady, while there is a clear break in the relationship after the initial coastal lawsuits were filed.

Figure 2 shows the total number of wells drilled between March 2010 and December 2012, the "Before 2013" period, and between January 2014 and October 2016, the "After 2013" period for both the Louisiana offshore region and the federal offshore region. Figure 2 makes the relative change in drilling activity across the two regions more clear. The federal offshore region experienced an increase in drilling over the time period when litigation risk associated with coastal suits increased in Louisiana. There were 93 total wells drilled in the federal offshore region in the 34 months prior to 2013, while there were 139 total wells drilled in the federal offshore region in the 34 months immediately after 2013, so the number of federal wells increased by 46. In the absence of increased litigation risk, we would expect a similar increase in drilling in Louisiana as these two regions have similar characteristics. However, the total number of wells drilled in Louisiana decreased from 48 in the "Before 2013" period to just 17 in the "After 2013" period, so there were 31 fewer wells drilled in the 34 months after litigation risk increased relative to the 34 months before litigation risk increased. However, this decrease of 31 wells ignores the fact that drilling increased in the control group (federal offshore), so drilling should have increased in the treatment group (Louisiana offshore) in the absence of the increased litigation risk. In fact, we should have expected an increase of approximately 46 wells in the Louisiana offshore region, as this would have maintained the relatively stable relationship between federal offshore and Louisiana offshore drilling rates that existed before 2013, and is apparent in Figure 1. Therefore, we would have expected approximately 48 + 46 = 94 wells drilled in the Louisiana offshore region in the 34 months after 2013. Since we observed drilling of only 17 wells in the Louisiana offshore region in the 34 months after 2013, we estimate that increased litigation risk led to 94 − 17 = 77 fewer wells in the offshore Louisiana region during the 34 months after 2013. This is the difference-in-differences estimate described above. Mathematically we have,

$$DiD = (X_{LA,a} - X_{LA,b}) - (X_{O,a} - X_{O,b}) = (48 - 17) - (93 - 139) = -77.[1]$$

The standard error associated with this difference-in-differences estimate is approximately 3 wells, so the 95% confidence interval for the effect of increased litigation on drilling is (-83, -71) wells during the 34 months after 2013.

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1 This difference-in-differences estimate is highly statistically significant with a p-value < 0.01.

Figures 1 and 2 aggregate crude oil and natural gas wells. However, we can decompose the effect of litigation risk into the effect on gas drilling and the effect on oil drilling. The majority of the impact of litigation risk was felt in drilling for crude oil. Focusing on oil wells only, the difference-in-differences estimate of the effect of increased litigation risk on oil wells in the 34 months following 2013 is -74 oil wells, while the analogous estimate for natural gas drilling is -3 wells. Note that these two difference-in-differences estimates sum to the original -77 wells arrived at in the all wells estimate above. The relatively small effect on gas drilling probably reflects the relatively low levels of gas drilling in each region prior to 2013 that is related to low gas prices throughout the sample period. Figure 3 and Figure 4 display the oil drilling data used to arrive at the -74 estimate of the effect of litigation risk on oil drilling. Figure 3 displays a similarly stable relationship between federal offshore oil wells and Louisiana offshore wells prior to the occurrence of increased litigation risk in 2013 that we observed in Figure 1 above, and a similar divergence in drilling after the appearance of increased litigation risk.

Oil Wells Drilled per Month during 34 months before and after 2013: Federal Offshore vs. State of LA Offshore
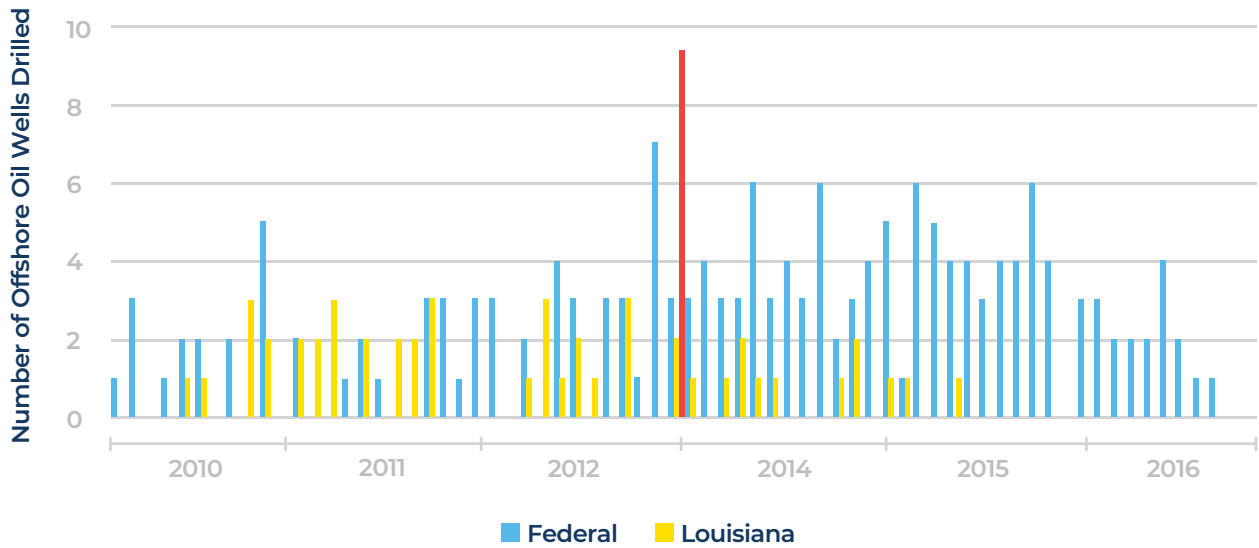
Figure 3. *Number of offshore oil wells drilled per month during 34 month before and after 2013. The red line indicates 2013 when litigation risk associated with coastal lawsuits increased as a result of Plaquemines Parish and Jefferson Parish filing coastal suits in November 2013.*

Number of Oil Wells Drilled during 34 months before and after 2013: Federal Offshore vs. State of LA Offshore
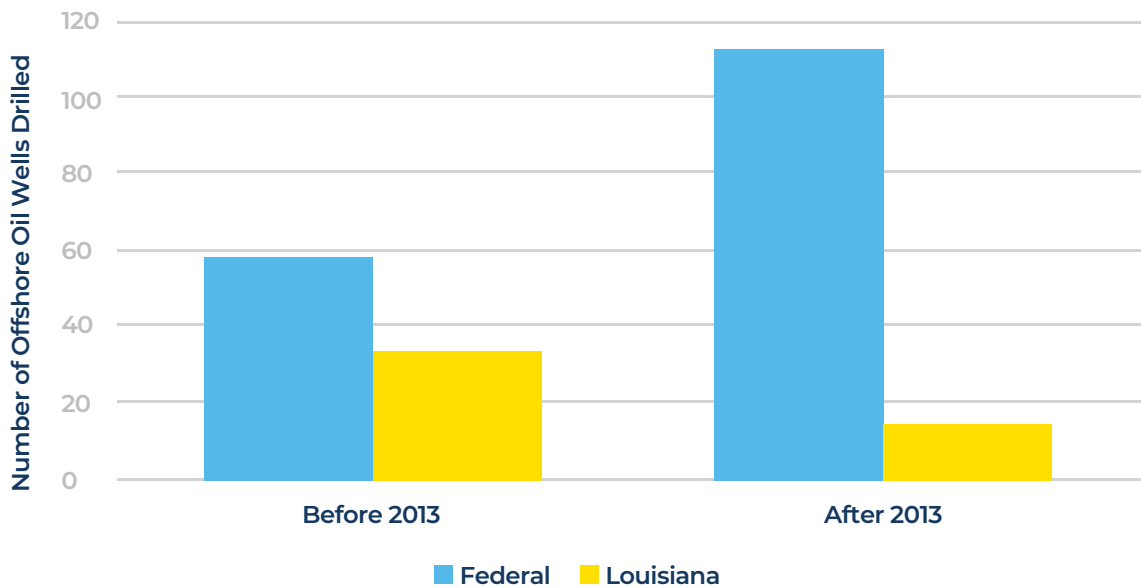
Figure 4. *Comparison of cumulative number of oil wells drilled in Federal offshore and state of Louisiana offshore regions between March 2010 and December 2012 (Before 2013) and between January 2014 and October 2016.*

The difference-in-differences estimates of the effect of increased coastal litigation risk on drilling activity in the Louisiana state offshore area indicate large negative effects associated with increased litigation risk. Recall that the assumption underlying these estimates is that Louisiana offshore drilling would have changed at a similar rate to federal offshore drilling in the absence of increased litigation risk. In fact, this drove our choice of the federal offshore region as the best control group with which to compare Louisiana offshore drilling activity, as the two regions have similar geological characteristics, use similar drilling technologies, and are subject to the same time-varying market forces such as oil prices. One factor that does vary slightly between these two regions is the productivity and total depth of the wells. The average depth and average productivity (peak oil production in bbl per foot of well drilled) are both larger for federal offshore oil wells than for Louisiana state offshore wells. This makes sense, as in order to induce drilling in deeper waters that are farther from shore, wells must be more productive.

	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
State Depth	9919	3753	3563	24990
State Productivity	1.27	1.28	0.02	7.75
Federal Depth	15372	5862	4532	31026
Federal Productivity	5.02	7.12	0	45.45
Fed Trim Depth	13813	5133	4532	31026
Fed Trim Productivity	1.81	1.72	0	7.52

Table 1. Summary statistics for oil wells in federal offshore and state of Louisiana offshore regions between January 2005 and November 2016.

Table 1 provides summary statistics for oil wells drilled in the Louisiana state offshore region and the federal offshore region from the sample of wells used to derive our difference-in-differences estimate of -74 oil wells. The first two rows display summary statistics for total depth and productivity of wells drilled in the Louisiana state offshore region, while the third and fourth rows show the analogous summary statistics for oil wells drilled in the federal offshore area. Productivity is measured by dividing a well's peak oil production rate by its total depth. The mean depth and productivity for Louisiana state offshore are 9,919 feet and 1.27 barrels of initial production per foot; and the mean depth and productivity for federal offshore are 15,372 feet and 5.02 barrels of initial production per foot. The fact that federal offshore wells tend to be deeper makes perfect sense, as they tend to be further offshore, but the much higher productivity of wells in the federal area might be problematic.

In order to investigate the influence of these total depth and productivity differences on our difference-in-differences estimate of -74 wells displayed above, the analysis was redone after trimming federal-offshore oil wells with productivities greater than the maximum Louisiana-state-offshore oil well productivity (7.75 barrels of initial production per foot of depth). The summary statistics associated with the trimmed sample are provided in the last two rows of Table 1. The average productivity of federal wells in the trimmed sample is much closer to the average productivity of state offshore wells. Further, the trimmed sample of wells in the Louisiana state offshore region and the federal offshore region cover a smaller geographic region: the full sample of wells covered a rectangular area with an east-west distance of more than 300 nautical miles and a north-south distance of more than 100 nautical miles, while the trimmed sample of wells covered a rectangular area with an east-west distance of approximately 115 nautical miles and a north-south distance of approximately 60 nautical miles. Note that the east-west distance associated with the trimmed sample is less than the width of the Louisiana coastline, and a large part of the north-south distance reflects variation in the Louisiana coastline.

Figure 5 displays the original time series of Louisiana state offshore oil wells, along with federal offshore oil wells from the trimmed sample, while Figure 6 displays the cumulative wells drilled in the Louisiana offshore region alongside cumulative wells drilled in the federal offshore region from the trimmed sample. Reapplying the difference-in-differences methodology using the trimmed federal sample, we find that increased litigation risk decreased the number of wells drilled in the Louisiana state offshore region by 53 oil wells in the 34 months beginning in January 2014.

Oil Wells Drilled per Month during 34 months before and after 2013: Federal Offshore (trimmed sample) vs. State of LA Offshore
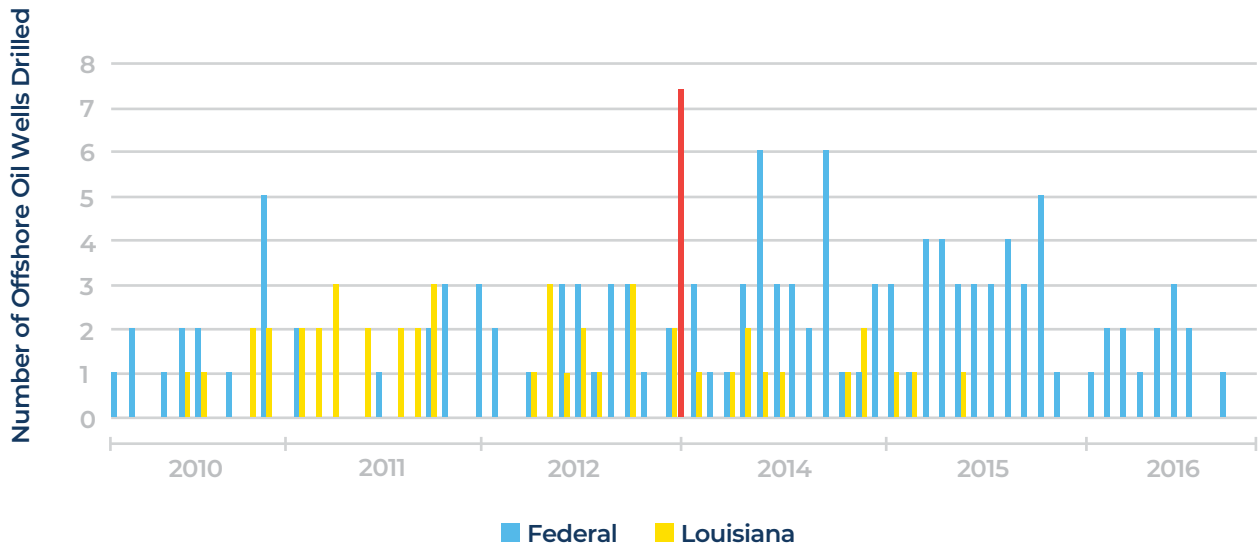

Figure 5. Number of offshore oil wells drilled per month during 34 months before and after 2013. Federal wells from trimmed sample. The red line indicates 2013 when litigation risk associated with coastal lawsuits increased as a result of Plaquemines Parish and Jefferson Parish filing coastal suits in November 2013.

Number of Oil Wells Drilled during 34 months before and after 2013: Federal Offshore (trimmed sample) vs. State of LA Offshore
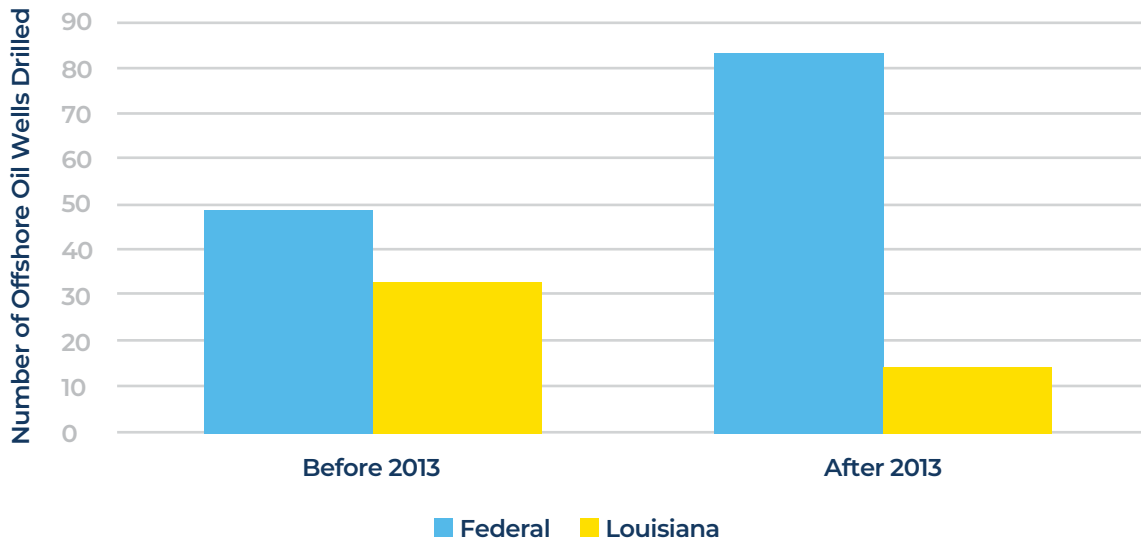

Figure 6. Comparison of cumulative number of oil wells drilled in Federal offshore (trimmed sample) and state of Louisiana offshore regions between March 2010 and December 2012 (Before 2013) and between January 2014 and October 2016.

> *We found that increased litigation risk that occurred in 2013 led to lower drilling activity in Louisiana's state offshore region.*

In this section, difference-in-differences analysis was applied to measure the effect of increased litigation risk from coastal lawsuits on oil and gas development activity in the state of Louisiana's offshore drilling region. We found that increased litigation risk that occurred in 2013 led to lower drilling activity in Louisiana's state offshore region. The main analysis indicated that 77 fewer wells were drilled in Louisiana's state offshore region between January 2014 and October 2016 as a result of increased litigation risk related to coastal lawsuits. The majority of this impact was felt through decreased oil drilling (74 fewer oil wells), while the impact on gas wells was much more muted (3 fewer gas wells). This low impact on gas wells likely reflects the very low gas prices that prevailed over the sample period. Noting that some federal offshore oil wells are more productive than Louisiana state offshore oil wells, we also calculated a difference-in-differences using a trimmed sample of federal wells with more similar productivities to oil wells in the Louisiana state region. This latter estimate indicated that 53 fewer oil wells were drilled in the Louisiana state offshore region than would have been drilled in the absence of increased litigation risk, confirming the result that increased litigation risk associated with coastal lawsuits had a large negative impact on oil development activity in the Louisiana state offshore region. Given the difference between our result using the full federal sample as a control group (74 fewer oil wells), and our result using the trimmed federal sample (53 fewer oil wells), we will conclude that the true impact of increased litigation risk on drilling in the Louisiana state offshore area was to decrease the number oil wells drilled somewhere in the range [53, 74] in the 34 months beginning in January 2014. We will apply this range in the next subsection where we quantify the economic impact of this decrease in drilling activity.

QUANTIFYING THE ECONOMIC IMPACT

In this section, we will use our difference-in-differences estimates from above to estimate economic losses in the oil industry in Louisiana related to increased litigation risk from coastal lawsuits. We also investigate the effect of the decrease in drilling on employment and total earnings in Louisiana's oil and gas sector. In order to estimate economic losses, we estimate the production that would have occurred from the wells that were not drilled as a result of increased litigation risk, and then we multiply the foregone production by prevailing market prices for crude oil and natural gas. This procedure will produce an estimate of the economic value of crude oil and natural gas production that was foregone as a result of increased litigation risk (Kellogg and Hausman, 2015). The market price represents the intersection of the supply and demand curves in the US oil and natural gas markets. The supply curve represents the quantities of crude oil and natural gas that will be brought to market by producers at different prices, as prices increase, producers will increase the quantity supplied. The supply curve will be below the market price for producers that are in the market. Points below the supply curve represent costs to the producers such as wages to employees and payments to contractors such as oil-field services companies, so payments to these entities are captured in the procedure outlined here. Points between the supply curve and the market price represent profits to producers, which also represents economic value that is lost when wells are not drilled and these profits will be captured by our procedure. We assume that Louisiana state offshore production is not large enough to have an impact on market prices for oil and natural gas.

In the previous section we concluded that between 53 and 74 fewer oil wells were drilled in the state of Louisiana offshore area during the 34 months beginning in January 2014. We also found a small negative impact on gas wells (-3 gas wells), but we will focus on oil wells here as the vast majority of the impact was on oil-well drilling.

	MEAN	MEDIAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
Crude Oil (barrels)	59294	36737	74643	24	378567
Natural Gas (MMcf)	213	38	458	18	2652

Table 2. Summary statistics for the first 12 months of oil and gas production from the 108 oil wells drilled in the Louisiana state offshore area between January 2005 and June 2015.

Table 2 displays summary statistics associated with crude oil and natural gas production from the first 12 months of a well's life from the 108 oil wells drilled in the Louisiana state offshore area between January 2005 and June 2015. (All of the oil wells in the Louisiana offshore area also produced natural gas.) These oil wells produced an average of 59,294 barrels of crude oil, and 213 million cubic feet (MMcf) of natural gas during their first 12 months of operation. The median is also presented, because the well-level production data is very dispersed and right-skewed. The median first-year oil production for oil wells in the Louisiana state offshore area is 36,737 barrels of oil and the median for gas is 38 MMcf.

We will focus on the 34 months starting in January 2014 for the estimate of the economic impact of increased litigation risk to match the range used in the calculation of our difference-in-differences. The average nominal crude oil benchmark price (West Texas Intermediate) over this time period was approximately $62.50 per barrel, while the average nominal natural gas price was approximately $3.20 per thousand cubic feet (Mcf). Multiplying these average prices by the production statistics from Table 1, we find that the average oil well drilled in the Louisiana state offshore area produced approximately $3.71 million worth of crude oil in its first year of production, and produced approximately $0.68 million worth of natural gas in its first year of production, so the average total first-year production value of oil wells drilled into the Louisiana state offshore area is approximately $4.39 million dollars. Applying this average value to our difference-in-differences range of 53 to 77 foregone oil wells, we find a range of economic loss of $228.1 million to $320.3 million, and this accounts only for the first year of production of these 53 to 77 foregone oil wells. The range of economic losses is $125.7 million to $176.5 million for the 34 months beginning in January 2014 if we apply the median first-year production values from Table 2. These economic loss estimates are 34-month rates of economic loss, so it is convenient to multiply them by a factor of 12/34 in order to make them annual rates: our estimated annual rate of economic losses is $80.5 million per year to $113.0 million per year using average first-year production, and is $44.4 million per year to $63.2 million per year using median first-year production. Applying these estimates, we conclude that economic losses to the Louisiana oil and gas industry in the range of $44.4 million per year (based median first-year production and our lowest difference-in-differences estimate) to $113.0 million per year (based on average first-year production and our high-end difference-in-differences estimate). This is a somewhat large range of losses, which reflects the underlying uncertainty associated with several of our parameters, but the low end of our range represents a large economic loss.

Our estimated range of likely economic losses covers the total first-year revenue of wells that we expect would have been drilled in the absence of litigation risk. These revenues go to capital costs (e.g., bidding on new mineral leases, drilling equipment, etc.), production costs (e.g., well maintenance), taxes, and profits. Policymakers in the state of Louisiana should be particularly interested in lost royalty revenue associated with decreased drilling in the Louisiana offshore region. The average state royalty rate in the Coastal Zone region of Louisiana was slightly more than 20% in 2012 (Purpera, 2013). Applying this rate to our range of economic losses, we find a range of losses related to state royalties of $8.9 million per year to $22.6 million per year. This does not account for all tax revenues lost by the state, as it does not include revenues lost in the mineral leasing process, or lost income taxes.

Our estimated range of losses to Louisiana's oil and gas industry likely underestimates the total economic losses related to increased litigation risk. We estimated the impact of increased litigation risk on oil development activity using new oil well counts in the Louisiana state offshore area, because a good control group existed by which to compare Louisiana state offshore drilling – federal offshore drilling in close vicinity to the state offshore area that is subject to similar geology and uses similar drilling technology. However, in all likelihood, increased coastal lawsuits have affected drilling in other parts of Louisiana. For example, inland water rig counts have fallen dramatically in Louisiana in recent years, and some of this fall in development is likely associated with increased litigation risk. However, inland water drilling is relatively unique to the state of Louisiana, so it is difficult to identify a feasible control group by which to compare Louisiana's inland water rig count. Further, our estimate is based on first-year production, while production from these wells will continue for much longer periods of time. Therefore, the low-end of our range of $44.4 million per year reflects a conservative estimate of the minimum impact of increased coastal litigation risk on the oil and gas sector in Louisiana.
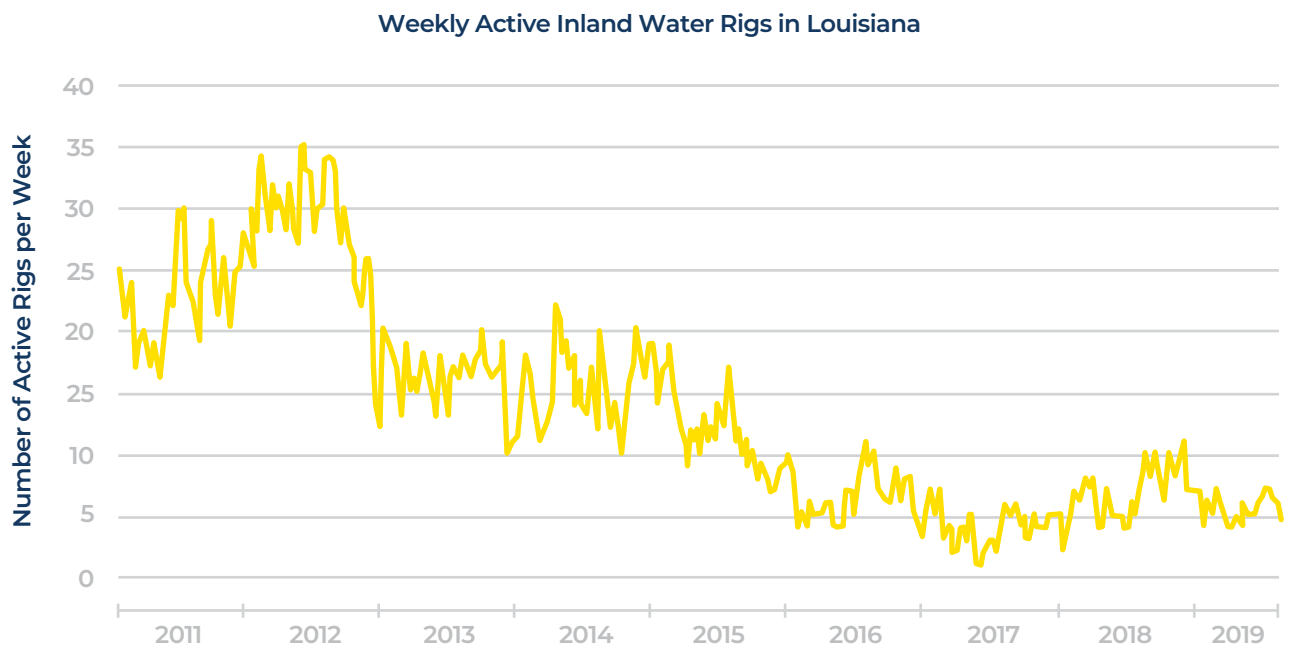
> **Applying this rate to our range of economic losses, we find a range of losses related to state royalties of $8.9 million per year to $22.6 million per year.**

Weekly Active Inland Water Rigs in Louisiana

Figure 7. Weekly active rotary drilling rigs in Inland Waters in Louisiana.

Further, when firms face increased litigation risk, they tend to hold more cash invest less, which could affect development more broadly (Arena and Julio, 2011). Our preferred estimates of economic losses are the larger range that use the average first-year production due to the likelihood that we are underestimating losses for the reasons mentioned here.

The decrease in drilling we have identified in this section also likely has employment effects, as oil and gas producing firms will hire fewer employees when they drill fewer wells. Unfortunately, we do not have the data with the level of granularity necessary to make a causal claim about the effect of increased litigation risk on employment in the oil and gas sector in Louisiana, but we can still investigate employment trends to determine if they are consistent with decreased drilling activity.

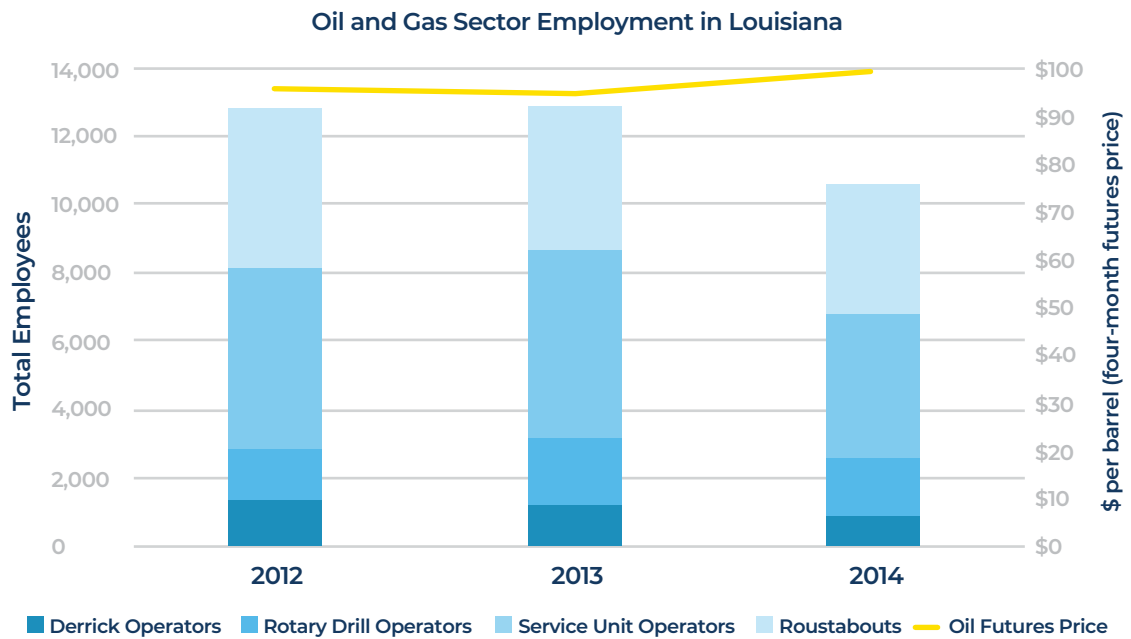**Oil and Gas Sector Employment in Louisiana**

Figure 8. Total employees in different occupations associated with Louisiana's oil and gas industry in May of each year. Four-month oil futures price shown on secondary axis.

Figure 8 displays total employment in a subset of occupations associated with Louisiana's oil and gas sector collected from the Bureau of Labor Statistics. These occupations include derrick operators, rotary drilling rig operators, service unit operators, and general laborers ("roundabouts"). These data represent a snapshot of the employment situation in the month of May in each year. Total employment across these four occupations was steady in May 2012 and May 2013 at 12,850, but by May 2014 it had fallen by more than 2,000 employees to 10,620. Importantly, oil prices were actually slightly higher in May 2014 than in the two previous years. Although oil prices fell dramatically later in Summer 2014, the futures market was not predicting this fall in prices when this employment data was collected. Also, the initial claims associated with coastal lawsuits were not filed until November 2013, so we would not expect them to be affecting employment in May 2013. Therefore, the fall in employment in 2014 relative to 2012 and 2013 is consistent with our finding of less offshore drilling resulting from increased litigation risk.

The 2,000 fewer jobs in the four oil and gas sector occupations displayed in Figure 8 represent a large loss of earnings in the form of wages and salaries of employees. Figure 9 shows estimates of the total earnings of employees in these four oil and gas occupations in 2012, 2013 and 2014. These estimates are derived by multiplying median annual earnings in each occupation by the total number of employees in that occupation.
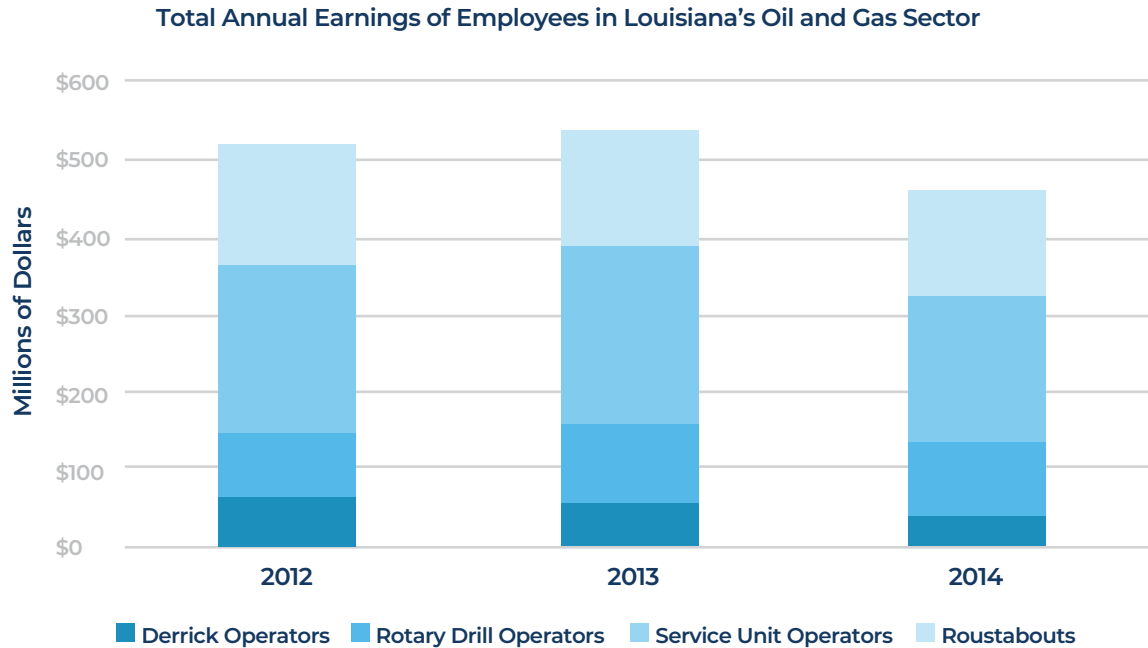
Total Annual Earnings of Employees in Louisiana's Oil and Gas Sector

Figure 9. Estimated total annual earnings of employees in Louisiana's oil and gas sector n=based on employment and salaries and/or wages measure in May of each year.

Total earnings based on May 2012 and May 2013 employment and annual salary/wage numbers were approximately $518 million and $537 million, respectively, while total earnings based on May 2014 employment and annual salary/wage numbers after litigation risk increased was around $458 million, which represents a decrease of almost $70 million relative to the May 2012 and May 2013 average of $528 million. This decrease in earnings is consistent with our economic loss estimates from decreased drilling in the Louisiana offshore area described above. This loss in earnings is higher than what we might have expected if only the state offshore area was affected, but as pointed out above, increased litigation risk likely decreased drilling in Louisiana's inland waters as well.

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