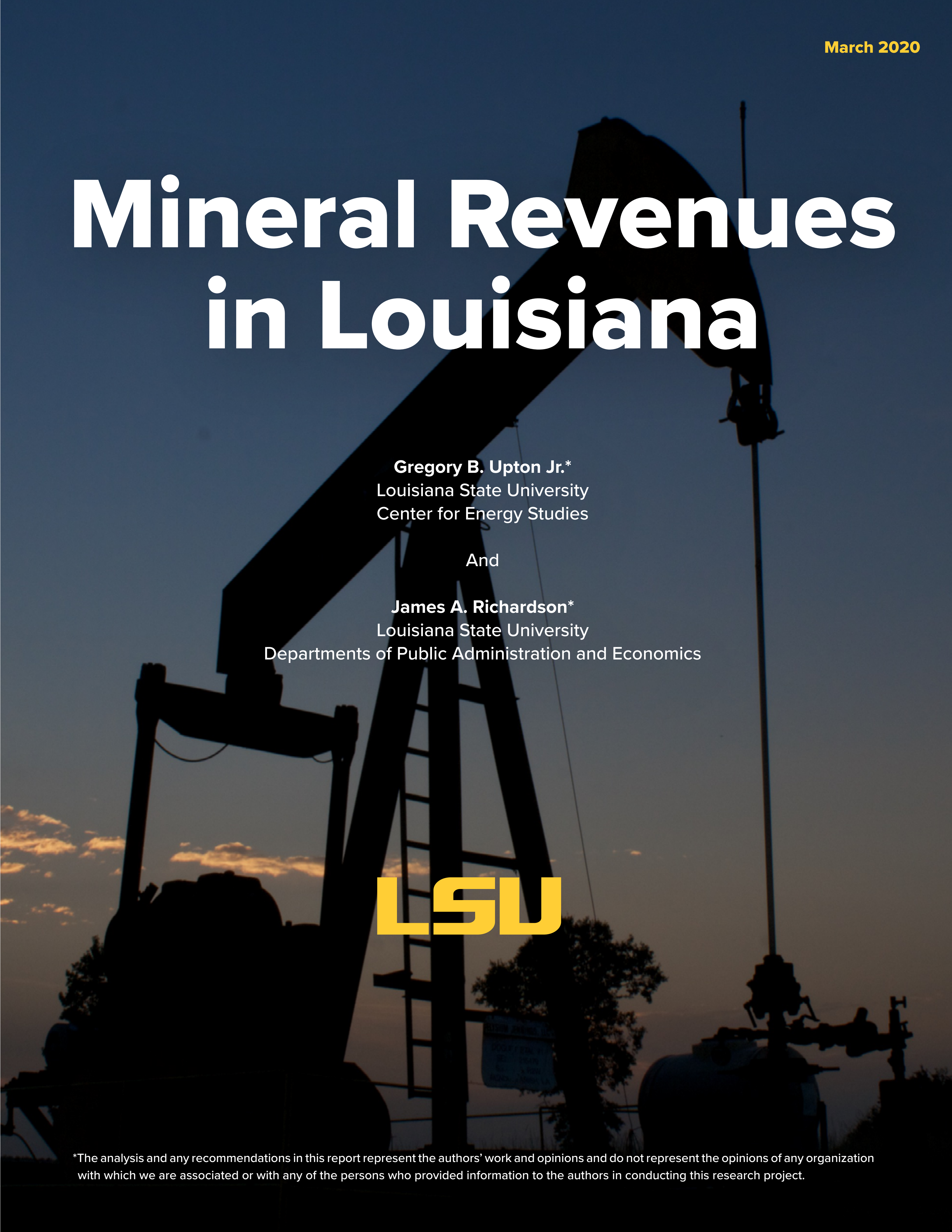

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# Mineral Revenues in Louisiana

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*The analysis and any recommendations in this report represent the authors' work and opinions and do not represent the opinions of any organization with which we are associated or with any of the persons who provided information to the authors in conducting this research project.

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## List of Abbreviations and Acronyms

| | |
|---|---|
| **Bcf** | Billion cubic feet |
| **DNR** | Louisiana Department of Natural Resources |
| **EOR** | Enhanced Oil Recovery |
| **Gas** | Where not specified, gas will refer to natural gas |
| **LDR** | Louisiana Department of Revenue |
| **LLS** | Louisiana Light Sweet Crude Oil |
| **LMOGA** | Louisiana Mid-Continent Oil and Gas Association |
| **LOGA** | Louisiana Oil and Gas Association |
| **MCF** | Thousand Cubic Feet (referring to natural gas) |
| **Oil** | Where not specified, oil will typically refer to crude oil and condensates. |
| **HCSR 10** | House Concurrent Study Request No. 10. Of 2009 Regular Session of the Louisiana Legislature |
| **MMBTU** | Million British Thermal Units |
| **REC** | Louisiana Revenue Estimating Conference |
| **SCR 4** | Senate Concurrent Resolution No. 4. 2018 Second Extraordinary Session |
| **Task Force** | Task Force on Structural Changes in Budget and Tax Policy |
| **TLF** | Louisiana's Taxes, Licenses and Fees as defined by Louisiana Revenue Estimating Conference |
| **WTI** | West Texas Intermediate Crude Oil |

# 1 | Executive Summary

It has been three decades since significant changes were made to Louisiana's natural gas tax structure and five decades since any significant changes in the state's oil tax structure. As with all tax systems, the current system stems from historical events. For example, oil is taxed at approximately three times the rate of natural gas, a decision made when interstate price controls on natural gas were present during the 1970s and when oil prices were escalating due to OPEC's policy activities. Natural gas, as of 1990, is taxed at a volumetric rate indexed to a market price, while oil and condensate, as of 1973, is taxed as a percent of the value at the wellhead. "Posted field prices" for oil were available in establishing the value of oil at one time but these no longer exist. When the oil and gas taxes were changed in the 1970s OPEC was a major force in determining the price of oil. Presently, the power of OPEC has been challenged and plausibly reduced due to oil production throughout the world and especially in the United States. In the early 2000's the United States was preparing to import natural gas from other countries. In 2020 the United States is an exporter of natural gas.

This report is in response to Senate Concurrent Resolution 4 of the 2018 second extraordinary session and is a continuation of work from the Task Force on Structural Changes in Budget and Tax Policy created by House Concurrent Resolution 11 of the first extraordinary session of 2016. We take a broad and long-term look at Louisiana's severance tax system. After meetings with public and private stakeholders, reviewing the literature on the taxation of oil and gas, and analysis of statistical information, we present our recommendations on how the legislature might simplify the tax system as well as general information and analysis to aid in policy decisions.

**Major Recommendations:**

We recommend the following:

1. Institute an equivalent volumetric tax rate for oil and natural gas with rate to be established semi-annually;
2. Remove exemptions associated with horizontal drilling, tertiary wells, and deep wells for new activity;
3. Implement recommendations (1) and (2) simultaneously while maintaining revenue neutrality with respect to current severance tax projections;
4. Implement the new severance tax rates for oil and gas production from new activity; activity originated before tax law change will comply with the current tax structure.

These recommendations are consistent with a broad base and low rate philosophy, revenue neutrality for severance tax collections, and administrative efficiency.

**Alternative Recommendations:**

- Establish a volumetric tax rate for oil with the rate to be established semi-annually;
- Remove the verbiage "posted field price" from R.S. 47:633 (7);
- Review and simplify the calculation of the volumetric rate for natural gas and establish the rate semi-annually;
- Remove exemptions associated with horizontal drilling, tertiary wells, and deep wells while maintaining revenue neutrality with respect to current severance tax projections.

# 2 | Background

Lawmakers have paid significant attention to Louisiana's tax system over the past several years. In 2014, the Louisiana legislature asked a group of economists, led by Dr. Jim Richardson of Louisiana State University and Dr. Steve Sheffrin and Dr. Jim Alm of Tulane University to prepare a report regarding the Louisiana tax structure. Authors of the report made presentations to the House Committee on Ways and Means and the Senate Committee on Revenue and Fiscal Affairs in March of 2015. This study was updated and published in November 2018 by the LSU Press with the title of ***Exploring Long-term Solutions for Louisiana's Tax System.*** Dr. Greg Upton of the LSU Center for Energy Studies completed the chapter on mineral revenues.

In the first extraordinary session of 2016, the state legislature passed House Concurrent Resolution 11 creating the Task Force on Structural Changes in Budget and Tax Policy. Dr. Richardson with Secretary of Revenue Kimberly Robinson served as co-chairs of this Task Force along with 11 other participants from business, labor, and state and local governments. The Task Force provided an analysis and review of the overall Louisiana tax structure and budgeting process and relied on economic experts and tax professionals to provide their perspectives and opinions about the Louisiana tax structure. Dr. Upton attended the meetings of the Task Force and was asked to present information to the Task Force, specifically pertaining to the history of mineral revenues in the state's budgeting process. Hereafter, we will simply refer to "the Task Force."

Throughout legislative sessions over the course of this study process[2] a number of changes were made by the legislature to the tax code for individual and corporate income and franchise taxes, the state sales tax, and taxes on tobacco, beer, and wine and liquor.[3] Many of the tax changes were increases to allow the state to balance its budget, but others, such as the changes in the corporate income tax dealt with reforms related to the appropriate definition of corporate income generated within Louisiana.

The Task Force did not make any major suggestions for the overall taxation of oil and gas given that oil and gas prices had just declined substantially starting in the later part of 2014, and the oil and gas sector of the Louisiana economy had a reduction of about 20,000 jobs from the end of 2014 to 2016. The Richardson, Sheffrin, and Alm study and the Task Force did suggest the placing of a mechanism for a reduced horizontal drilling exemption as the price of oil and natural gas rises.[4]

Oil and gas tax laws in Louisiana had not been reviewed or amended since 1973 for the severance tax on oil and since 1990 for the severance tax on natural gas, with the exception of changes to specific exemptions.[5] Most notably, the horizontal drilling exemption was passed in 1994. The market for oil and gas has undergone a substantial change from the 1970s, when the major changes in oil and gas tax laws were adopted. Federal price constraints on the price of oil and the price of natural gas as existed in the 1970s have been terminated, with prices now being determined by the global marketplace. Any characteristics related to oil and gas production in Louisiana, such

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[2]Regular legislative session 2015; first extraordinary legislative session 2016; second extraordinary session 2016; first extraordinary legislative session 2017; regular 2017 legislative session; first extraordinary session 2018; second extraordinary session 2018; and the third extraordinary session 2018.

[3]For a summary of these changes, see Chapter 1 of *Exploring Long-Term Solutions for Louisiana's Tax System* by James A. Richardson, Steven M. Sheffrin and James Alm. LSU Press, published in November 2018.

[4]Act No. 120; 2015 Regular Session.

[5]Notable examples include the Louisiana Economic Acceleration Plan (LEAP) and the Severance Tax Exemption Plan (STEP) enacted in 1986. See Troy & McClanahan (1992) for a historical discussion of drilling incentives.

as transportation costs, the quality of the oil, tax policy, and other such special characteristics, will have to be accommodated by the local oil and gas markets within the context of the global market. The marketplace has changed dramatically, but the tax laws have largely remained as they were. Other states, similarly, have not made many changes to their mineral tax laws since the 1970s either. Changes in the marketplace may not necessarily be a reason to change the oil and gas laws, but it is a reason to review and analyze the tax laws.

Hence, in the 2018 second extraordinary session, Senate Concurrent Resolution 4 asked Dr. Richardson and Dr. Upton, in connection with their academic affiliation with Louisiana State University, to make specific recommendations to the legislature regarding mineral taxes in Louisiana while balancing the following goals:

1. Preserve or improve the competitiveness of the oil and gas extraction sector in Louisiana.
2. Decrease or remove the difference in tax rates for oil and gas.
3. Create an equitable system of severance tax exemptions on all wells, not just horizontal wells.
4. Hold constant or increase mineral revenues for the state.
5. Explore other reasons oil and gas production is fluctuating in the state of Louisiana and any changes that need to be made to increase production.

SCR 4 requested a preliminary status report by February 1, 2019; a final written report by February 1, 2020; and specific bills implementing these recommendations by February 1, 2021. A preliminary status report was submitted by February of 2019. This document serves as the final written report.

## 2.1 Study Process

From the beginning of the study process, we have focused on gathering information from two sources. First, recommendations should be made based on sound economic analysis, so we have made every effort to get information from all public sources to ascertain overall economic activity in the oil and gas sector, what is occurring in other states, and other statistical information regarding oil and gas activities. Second, we have listened to both government and industry to understand how potential changes might impact stakeholders, knowing that statistical information alone is not always sufficient for good policy making. By nature, changes in taxes that are aimed at revenue neutrality will increase the tax burden for some taxpayers and decrease the tax burden for others. The tax incidence will also change over time, meaning that whoever is legally responsible for remitting the tax to the government may be able to shift the tax to other participants in the oil and gas sector, but this shifting of the tax burden takes time. Further, changes may impact the administrative burden of taxpayers and state government charged with collecting these taxes. For these reasons, conclusions presented here represent the balance of listening carefully to stakeholders, examining alternative oil and gas structures in other states, reviewing the changing nature of the oil and gas industry in Louisiana, applying economic analysis to the current oil and gas tax structure in Louisiana, and considering the short- and long-term impacts of any changes in this tax structure.

In the first year of this process, we conducted meetings with a number of stakeholders from both government and industry. We found it prudent to go on this "listening tour" before jumping straight into "crunching the numbers." The starting point for these discussions was Chapter 8 of **Exploring Long-Term Solutions for Louisiana's Tax System** entitled *Mineral Revenues in Louisiana* and Chapters

8 and 9 of **Louisiana's Fiscal Alternatives: Finding Permanent Solutions to Recurring Budget Crises**.[6] We then allowed the conversations to proceed based on the informant's prerogative.

In February of 2019, we submitted a preliminary status report to the Senate Committee on Revenue and Fiscal Affairs and House Committee on Ways and Means. The status report categorized the potential areas where changes to mineral tax laws in Louisiana might be appropriate and in the long-term interests of the state. At that time, no recommendations were made. The status report was also posted on the LSU Center for Energy Studies' website and disseminated to our broad email list of over 2,000 stakeholders. Physical copies were distributed at two LSU Center for Energy Studies events; the Oil & Gas Symposium in April of 2019 and the Energy Summit in October of 2019. Further, we have sat down with dozens of stakeholders, both before the status report was submitted and since. While we have solicited feedback from a wide group of stakeholders, the analysis and views expressed are our own.

After listening to a broad group of stakeholders, the next step was to collect and analyze the data. Data used in this report will come from many sources, including the U.S. Energy Information Administration and Louisiana Department of Natural Resources. The Louisiana Department of Revenue has also provided data on oil and gas severance tax payments and detailed data on oil and gas production from *Enverus* (formerly *DrillingInfo*) will be utilized.

6 Edited by James A. Richardson, (LSU Press, 1988).

# 3 | History of Louisiana Oil and Gas Revenues

We begin with an historical examination of mineral revenues collected by Louisiana's government. Figure 3-1 shows the contribution of mineral revenues to the total taxes, licenses, and fees collected by the state. Hereafter, this will be referred to as either "TLF", or simply, "total state revenues."

Figure 3-1 shows three data series, all in nominal dollars across Louisiana fiscal years:[7] (1) total Louisiana state revenues (TLF), (2) mineral revenues, and (3) mineral revenues as a share of TLF. This graph shows not only severance taxes, but also royalty payments and other fees on oil and natural gas production.

Three trends are noticeable. First, there is a noticeable increase in the state revenues over time. This is unsurprising given general economic growth, inflation, and population growth.[8] Second, while mineral revenues have gone up and down (a keen observer will notice these changes move with the price of oil), there is no noticeable trend over time. And third, as a result of the first two trends, the relative share of mineral revenues to the total state budget has declined over time due to the state's longer-term trend of declining oil and gas production.

In terms of the relative contribution of mineral revenues to total state revenues, there are two noticeable epochs. The first was in the 1970s to early 1980s. During this time and given the major tax changes in 1973,[9] mineral revenues oscillated between approximately 30 and 40+ percent of total state revenues. These oscillations were primarily driven by oil price swings. But, in the mid-1980s, mineral revenues as a share of total revenues dropped dramatically. And since then, mineral revenues have accounted for less than 20 percent of total state revenues. In the most recent fiscal year, July 2018 to June 2019, mineral revenues made up 5.7 percent of total state taxes, licenses, and fees. This is up from the 4.3 percent of TLF in fiscal year 2016-17 but is still low relative to historical standards.

It is important to note that the numbers above do not include other taxes paid by the up-stream oil and gas industry. Nor does this account for "multiplier" effects that also indirectly impact tax revenues. While beyond the scope of this analysis, which focuses specifically on severance taxes, it has been estimated that the oil and gas industry supports, either directly or indirectly, over 14 percent of earnings in the state (Scott, 2018). Therefore, any changes to the tax code have the potential to impact revenues directly, but also indirectly through the effects on economic activity. Thus, while mineral revenues, directly, are at historic lows in percentages for state government, this is still an important industry for our state's broader economy. For this reason, and per the request of the resolution motivating this study, tax recommendations should balance improving or preserving the economic competitiveness of the industry on net and holding constant or increasing mineral revenues to the state.

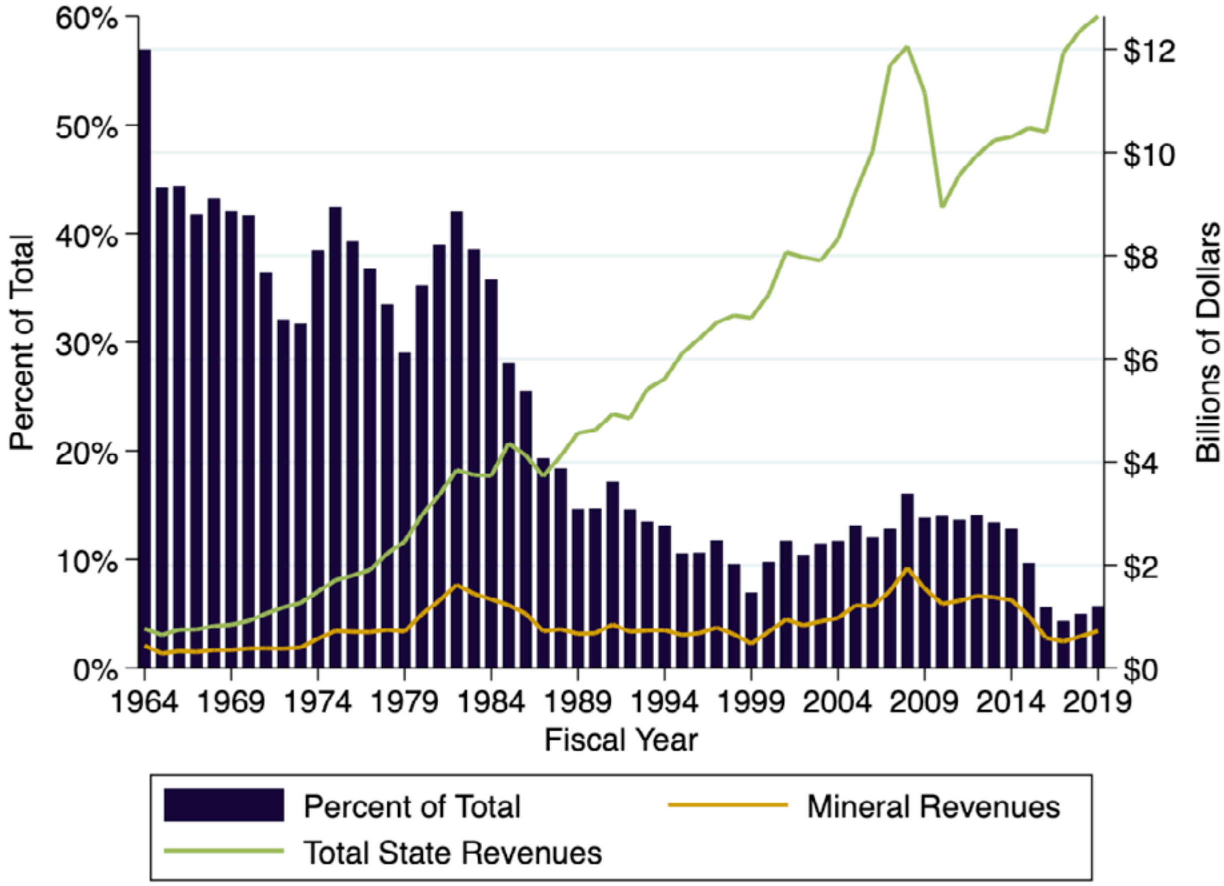
7 The Louisiana fiscal year goes from July 1 to June 30. For example, the 2018 fiscal year is from July 1, 2017, to June 30, 2018.

8 The relative size of government in terms of purchasing power or relative to Louisiana economic activity is beyond the scope of this research. For a discussion of this, see Upton (2016).

9 The 1973 tax changes included reductions in the general sales tax and individual income tax as well as increases in mineral taxes.

## Figure 3-1: Louisiana State Budget and Mineral Revenues

Note: Total State Revenues include Revenue Estimating Conference (REC) definition of taxes, licenses and fees (TLF). Mineral revenues include severance, royalties, bonuses and rental payments.



# 4 | Louisiana's Tax Structure and Comparison with Other States

Next we provide an overview of Louisiana's mineral tax system and compare the tax structure to other states with significant oil and gas production. A fairly exhaustive and up-to-date, state-by-state description of severance taxes has been compiled by the National Conference of State Legislatures (NCSL, 2018).[10] The purpose of this discussion is not to duplicate an exhaustive comparison across states, but instead to discuss broadly similarities and differences in Louisiana's tax structure to other states. Special attention is given to Louisiana's neighboring states, Texas, Arkansas, and Mississippi.

## 4.1 Severance Tax Rate

Louisiana has the highest severance tax rate for oil of any state in the continental United States; 12.5 percent of its value at the time and place of severance [R.S. 47:633(7)(a)]. Alaska has a 35 percent tax rate on oil and gas but this is on the value at the point of production allowing for the deduction of certain qualified capital and operating expenditures.[11] By comparison, Louisiana has a relatively low tax rate for natural gas: approximately 4 percent [R.S. 47:633(d)(i)]. Texas taxes oil at 4.6 percent and natural gas at 7.5 percent. Texas's oil tax is *lower* than the natural gas tax. Other neighboring states, Arkansas and Mississippi, have a 5 percent and 6 percent tax rate for oil and natural gas, respectively. Most states in the continental United States tax oil and natural gas at the same (or very similar) rates. Louisiana and Texas are unique in this regard.

**Conclusion: Louisiana severance tax on oil is high relative to neighboring states and severance tax rate on natural gas is low relative to these states. Louisiana is unique in that oil is taxed at approximately three times the rate of natural gas.**

## 4.2 Valuation for Tax Purposes

Louisiana taxes oil at a rate of 12.5 percent of its value at the time and place of severance. This value is the higher of (1) the gross receipts received from the first purchaser, less transportation charges, or (2) the posted field price [R.S. 47:633(7)(a)].[12] Posted field prices no longer are an industry practice, therefore the laws should be updated to reflect the current state of the industry.

Louisiana is unique in that natural gas is taxed at a volumetric rate adjusted to the Henry Hub natural gas price in the preceding year period [R.S. 47:633(d)(i)].[13] For instance, at the time of this writing, the full severance tax rate for natural gas in Louisiana is 12.5 cents per thousand cubic feet (MCF).

In 1973 Louisiana increased its severance tax on natural gas from 3.3 cents per MCF to 7 cents per MCF. The state decided not to tax natural gas on a value basis since in the 1970s there were federal price controls on interstate natural gas transactions so natural gas from Louisiana being used in other

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[10] A detailed description of the laws surrounding oil and gas drilling and a comparison to Texas can be found in Martin & Yeates (1992).

[11] Alaska has made a number of changes in its mineral tax policy over the years including rates changes and a number of tax credits dealing with Alaska's geography. Alaska is a state with no state sales tax (local governments do have a sales tax) and no personal income tax. As of 2022 oil will be taxed at 35 percent and natural gas at 13 percent of gross value

[12] In the absence of an arm's length transaction or posted field price, the value is based on the server's gross income from the property as determined by R.S. 47:158(C).

[13] Specifically, the natural gas volumetric rate is adjusted for the applicable 12-month period to the average of the New York Mercantile Exchange (NYMEX) Henry Hub settled price on the last trading day for the month, as reported in the *Wall Street Journal*, for the pervious 12-month period ending on March 31 [R.S. 47:633(d)(i)]. See Appendix A1 for specifics on how this calculation is performed.

states had federal price controls while natural gas produced in Louisiana and consumed in Louisiana (intrastate) was not subject to these price controls.

In 1990 the state discussed moving to a value tax on natural gas. The discussion centered around the complications of securing a good estimate of the value of natural gas at the wellhead, which is where the severance tax is based. Natural gas is not valued at the wellhead in the marketplace. The natural gas is transported within the state, processed at various facilities, and then a market price is determined, but, for tax purposes, the state would have to eliminate the transportation costs and other costs of processing the natural gas to derive the market value of the natural gas at the wellhead. As a result, the legislature decided to tax natural gas on a volume basis, but the rate of taxation would vary with the price of natural gas. Natural gas is now taxed on a volume basis but with the tax rate per MCF changing over time. This tax rate can never be lower than 7 cents per MCF, but there is no limit to how high it can be. See Appendix A1 for specifics on how this calculation is performed.

In most other states, severance taxes are based on the value of both oil and natural gas sold.[14] North Dakota is similar to Louisiana in that it sets a volumetric rate for natural gas that changes annually, starting July 1. Thus, Louisiana is similar to other states with regards to taxing oil, but different in how it taxes natural gas.

**Conclusion: Louisiana, along with North Dakota, are unique in taxing natural gas at a volumetric rate indexed to a market price in the prior fiscal year. Louisiana taxes oil similar to other states based on the value of the oil at the point of severance from the ground.**

## 4.3 Ad Valorem Tax

Unlike Texas, Louisiana does not assess ad valorem taxes on the value of reserves of oil and natural gas. While property tax can be assessed on the value of equipment that is above ground, the below-ground equipment and reserves themselves are not taxable via the Louisiana Constitution [VII-§4.(B)].[15] **In Texas, ad valorem taxes are levied on oil and gas reserves in the ground in addition to state severance taxes**. While beyond the scope of this analysis (that focuses on Louisiana), the Texas Comptroller of Public Accounts is given the task of developing and distributing to each appraisal district an appraisal manual that specifies the methods and procedures to calculate the present value of oil and gas properties using discounted future income.[16] Each year the county appraisal district mails mineral owners an assessment of the value on their minerals for which the tax rate is based. Texas is not unique in assessing ad valorem taxes on oil and natural gas reserves. Other states such as California, Colorado, New Mexico, and Wyoming assess similar taxes.

Academic literature has found that applying property taxes to oil and gas reserves can incentivize producers to extract a resource at a faster rate (Hotelling, 1931; Burness, 1976; Conrad & Hool, 1984; Gamponia & Mendelsohn, 1985). The welfare effects of severance taxes and property taxes have also been compared in the academic literature and property taxes have been found to result in more than two times the deadweight loss of severance taxes (Conrad & Hool, 1984; Gamponia & Mendelsohn, 1985).

[14] Some states do have additional fees assessed at a volumetric rate, but these make up a relatively small share of mineral revenues.

[15] While beyond the scope of this report, which focuses on severance taxes, an overview of property taxes on oil and gas properties can be found in Chapter 9 of the L*ouisiana Tax Commission's Rules and Regulations*.

[16] Texas Tax Code Section 23:175 and noted in the publication, Discounting Oil and Gas Income, April 2015, Texas Comptroller of Public Accounts.

**Conclusion: Louisiana cannot assess ad valorem taxes on oil and natural gas reserves given the current constitutional restrictions. At least five other states assess ad valorem taxes in addition to severance taxes, including Texas.**

## 4.4 Exemptions

One of the broad recommendations made by the Task Force was to keep rates as low as possible and the tax base as broad as possible. Part of broadening the base for any tax is removing exemptions. In this section we highlight the exemptions available to Louisiana producers and compare to other states.

### 4.4.1 Horizontal Drilling Exemption

Louisiana has a horizontal drilling exemption that is 100 percent of taxes owed for the first two years or until well payout whichever occurs first [R.S. 47:633(7)(d)]. This horizontal drilling exemption was created in 1994 when horizontal drilling was an infant industry. In the 2015 regular session, the legislature put a price cap on this exemption.[17] When the price of oil exceeds $110 per barrel, the horizontal drilling exemption is removed in its entirety. When price exceeds $70 per barrel, but is less than $110 per barrel, the horizontal drilling exemption is reduced [R.S. 47:633(7)(d)(i)(aa-ff)]. The similar thresholds for natural gas are $4.50 per million BTU to $7 per million BTU [R.S. 47:633(7)(d)(ii)(aa-ff)]. Given that oil and natural gas prices are relatively low at the time of this writing, neither has reached these price thresholds for any horizontal drilling exemption reduction.

Louisiana is unique in its broad horizontal drilling exemption. Texas does have a "high cost well exemption" (Texas Railroad Commission's Statewide Rule SWR 101) for natural gas, but the exemption differs from Louisiana's in several ways. First, the exemption applies to only natural gas (not oil). Natural gas in Texas has a severance tax rate of 7.5 percent (almost double that of Louisiana). Second, the amount of the exemption is based on the cost of the well. So, low cost wells receive less exemption than higher cost wells.[18] For example, in Texas a $10-million well will receive a reduced tax rate of 0.8 percent, while a $5-million well will receive a tax rate of 4.1 percent.[19] Louisiana's exemption is for all wells regardless of cost. Third, the Texas exemption lasts for 10 years or until the well accumulates tax savings of 50 percent of the actual drilling and completion costs, whichever occurs first. Louisiana's exemption is for two years, or until well payout, whichever occurs first. At least two other states have reduced rates for horizontal wells. Oklahoma has a reduced severance tax rate for three years for horizontally drilled wells. Montana has a reduced rate for the first 18 months of production.

According to a 2015 Legislative Auditor report, the severance tax suspension for horizontal wells in Louisiana resulted in more than $1.1-billion revenue loss for the state from fiscal years 2010 to 2014 (Purpera, Edmonson, and Leblanc, 2015), assuming that the same activity would have occurred even without the exemption. The value of the horizontal exemption fluctuates significantly from year to year. From FY14-18, the value of the horizontal drilling exemption averaged $127.5 million per year.

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[17] Act No. 120; 2015 Regular Session.

[18] The reduced tax rate on each well is based on its associated drilling and completion (D&C) costs. This creates the possibility of a different reduced tax rate for each well. The formula for calculating the reduced tax rate for a well is: (.075 - (.075 X D&C Costs)) ÷ (2 X median D&C costs for all high-cost gas wells in the previous fiscal year). Median D&C costs for the prior fiscal year are used in calculations for the following fiscal year.

[19] Based on the Texas Comptroller High Cost Gas (HCG) tax rate calculator. Calculation based on a well completed in January of 2019. <https://mycpa.cpa.state.tx.us/ngrate/ >

**Conclusion: Louisiana is not the only state with an exemption or reduced tax rate on horizontal wells, but we are unique in the size of this exemption; one hundred percent of production exempt for two years or until well payout and applies to both oil and natural gas wells given, that the price of oil is below $70 per barrel and the price of natural gas is less than $4.50 per MCF. The horizontal exemption was placed in the law in 1994 and had no price limitations until 2015.**

### 4.4.2 Stripper and Incapable Well Tax Rates

Stripper wells and incapable wells have been taxed at different rates since the change in the severance tax laws in the 1970s. Stripper oil wells are incapable of producing an average of more than 10 barrels of oil per day during the entire taxable month [R.S. 47:633(7)(c)]. Incapable oil wells are incapable of producing an average of more than 25 barrels of oil per day during the entire taxable month, and which also produces at least 50 percent saltwater per day [R.S. 47:633(7)(b)]. Stripper wells are taxed at 3.125%, while incapable at 6.25%. There are similar tax differences for natural gas with specific requirements depending upon whether the natural gas is produced from an oil or natural gas well [R.S. 47:633(9)(b-c)].

Louisiana is not unique in having lower tax rates for marginal wells. Texas also has a lower tax rate for marginal wells, but this rate has a price cap ($30 per barrel of oil and $3.50 per MCF of natural gas). Specifically, if the price of oil is between $25 and $30, the tax rate in Texas is 3.45% as opposed to 4.6%; a tax rate of 2.3% if the price of oil is between $22 and $25; and, no tax at all if the price of oil is below $22 per barrel. A marginal well is defined as one producing 15 barrels per day or less.[20] This law was passed in 2005 and updated in 2007. A number of other states, including Michigan, Montana, Nebraska, New Mexico, North Dakota, Utah, and Wyoming, also provide exemptions for marginal wells. Most states focus on lower taxes for stripper or incapable wells since the cost of production is steady while the price of oil and gas can be volatile which means a company's revenue stream is volatile. Lower tax on stripper and incapable well costs the state about $50 million per year assuming the production would have occurred with a higher tax rate.

**Conclusion: A number of states have severance tax relief for stripper and incapable wells due to the relatively stable costs of producing the oil and gas but with a volatile revenue stream.**

### 4.4.3 Tertiary

Tertiary recovery, also known as enhanced oil recovery (EOR), involves extracting oil from a reservoir through carbon dioxide injection. These large-scale carbon dioxide injection projects are approved by the DNR and do not pay severance tax until the project has reached payout [R.S. 47:633(4)]. Other states with tax reductions for tertiary production include Mississippi, Oklahoma, New Mexico, Wyoming, and Utah. Oklahoma is the only other state with a 100 percent exemption.[21] The value of the tertiary well exemption averages about $20 million per year.

**Conclusion: A number of states have severance tax relief for tertiary production, but Louisiana's is more generous than most.**

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[20] **Present Texas Severance Tax Incentives,** rrc.state.tx.us

[21] Exemption lasts for five years.

### 4.4.4 Deep

In Louisiana, wells drilled to a true vertical depth of 15,000 feet or more are exempt from severance tax for 24 months from first production, or until payout of well cost, whichever comes first [R.S. 47:633(9)(d)(v)]. Oklahoma has a reduced rate for wells below 15,000 feet. To our knowledge, no other states have exemptions for deep wells. The value of the deep well exemption averages about $9 million per year.

**Conclusion: Louisiana and Oklahoma provide severance tax relief for deep wells.**

### 4.4.5 Reclaimed Oil

Reclaimed oil is the reclamation of waste oil or slop crude oil and condensate from open pits, tanks, or other collectors at the lease production site. Any person or company engaged in severing oil from the ground or actually operating oil or gas properties is not eligible for the special tax rate for reclaimed oil. Reclaimed oil has a tax rate of 3 1/8 percent.

## 4.5 Overall Competitiveness of Louisiana's Tax Structure

An overarching conclusion of comparing Louisiana's tax structure to other states is that oil is taxed at a high rate compared to other states, while natural gas is taxed at a low rate. But in net, the tax burdens across states are similar.

For instance, compare natural gas taxes in Texas and Louisiana. Louisiana natural gas will pay an approximate 4 percent severance tax rate, while a well in Texas will pay almost twice that rate, 7.5 percent. Thus, Louisiana has a significant comparative tax advantage from the perspective of a prospective producer here. What further exacerbates that advantage is that the Texas well will also be subject to ad valorem taxes in addition to the higher natural gas severance tax rate. In addition, a horizontal well in Louisiana will receive a 100 percent severance tax exemption for two years, or until well payout, whichever occurs first. So, for natural gas in the Haynesville Shale, Louisiana clearly has a meaningful tax advantage over our neighbor Texas. **For natural gas, there is clearly a tax advantage in Louisiana**, though as we have previously stressed, there are other economic and geographic factors that are significant in making decisions about where to explore, develop, and produce.

In comparison, for oil, whether Louisiana has a tax advantage or disadvantage from the perspective of a prospective producer relative to Texas is ambiguous. First, Louisiana's severance tax rate is 12.5 percent of value compared to 4.6 percent of value in Texas. But second, Louisiana oil wells are not subject to ad valorem taxes. Third, horizontal wells in Louisiana are eligible for horizontal drilling exemptions, while this is not the case in Texas. While Louisiana's horizontal drilling activity to date has been concentrated in natural gas wells (as will be discussed later), this could impact the development of the Austin Chalk play in central Louisiana for instance, an oil formation that runs across Louisiana and Texas lines. Fourth, stripper and incapable oil wells in Louisiana receive tax relief, while Texas wells do not at current market prices.

### 4.5.1 Empirical Estimates of Cross-State Tax Burden

Prior studies have conducted cross-state estimates of the tax burden for oil and gas producers. SCR 4 tasked this report with the goal of deriving revenue neutrality for the state while preserving or improving the competitiveness of the sector in Louisiana. The market for oil and natural gas, and products derived from oil and natural gas, are global in nature. But the tax burdens on extraction can differ across states. A profit maximizing firm will choose to extract hydrocarbons from reservoirs that maximize after-tax profits. And therefore, tax burdens across states may alter where companies choose to extract. There are many other factors that affect a company's decision to explore, develop, and produce oil and gas from certain fields, but taxes or changes in taxes may affect this decision. Therefore, it is important for Louisiana policy makers to understand their tax burden relative to other states and to appreciate the economic incidence of the oil and gas taxes.

There are two studies that are worth mentioning that provide an apples-to-apples comparison to other states. These studies were conducted almost three decades apart and used very different approaches. But both studies addressed a fundamental question: *What is the tax burden on oil and gas extraction across states?*

While dated, Pulsipher (1991) analyzed detailed tax information on oil and gas drilling across eleven states. This analysis included more than just severance taxes, but also sales taxes, property taxes, and corporate income taxes. The main results of Pulsipher (1991) are shown in Figure 4-1 (a). According to results of this study, while the tax structures across states varied, the effective total tax liability across states was very similar, and Louisiana fell right in the middle of the distribution. Interestingly, the effective tax rate was almost identical to Texas.[22]

A more recent study, Newell & Raimi (2018), compared severance taxes, fees, and local property taxes (including ad valorem) across 17 U.S. states.[23] The results of this analysis are shown in Figure 4-2 (b). Interestingly, this analysis was published almost three decades after Pulsipher (1991) and used different techniques but had an almost identical result.

Both results of Pulsipher (1991) and Newell & Raimi (2018) lead to the same conclusion; Louisiana's tax system is competitive on net relative to other states. We fall in the middle of the pack in terms of overall tax burden.

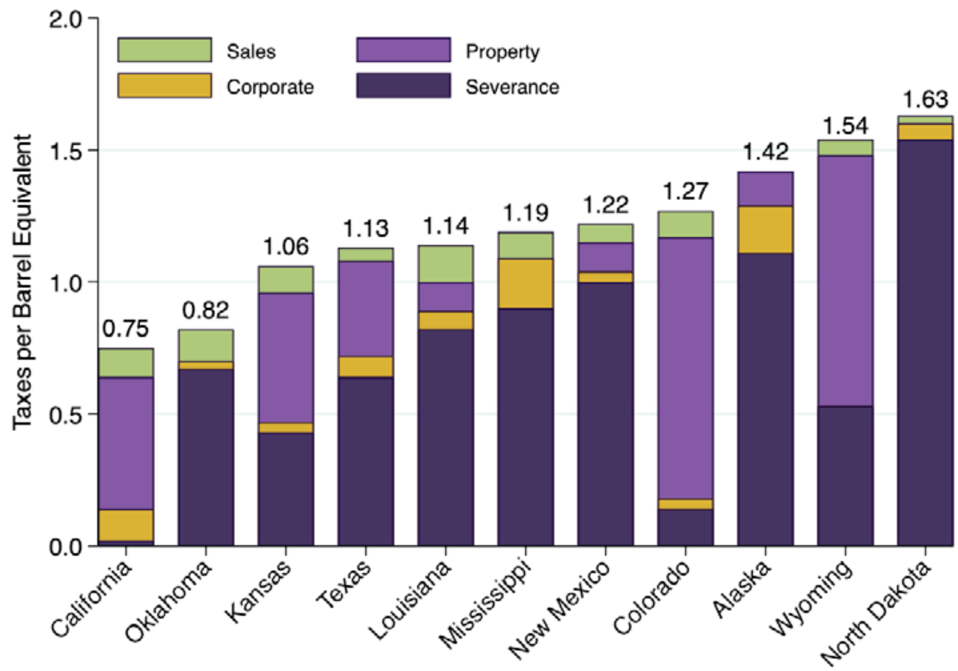
**Conclusion: Louisiana's tax structure is on net competitive. The goal of this analysis is to make recommendations to improve the tax structure without disturbing the revenues received by the state.**

[22] With any difference said to be clearly within the margin of error of the analysis.

[23] This analysis did not include differences in sales tax and corporate income taxes.

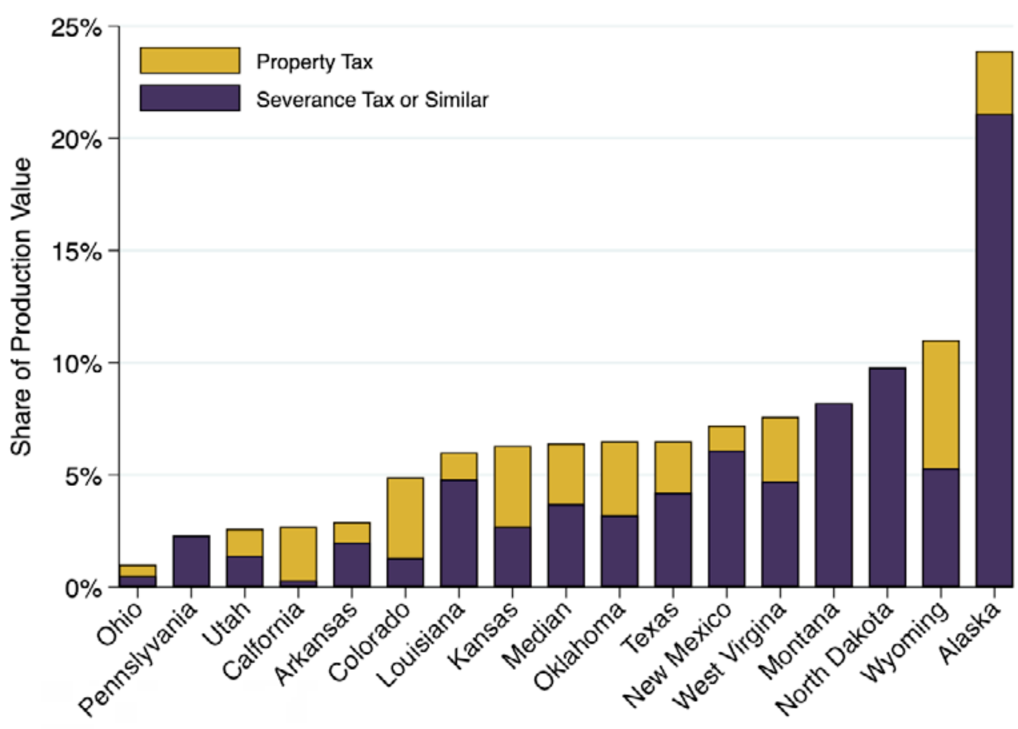
## Figure 4-1: Comparison of Tax Structures

Adapted from Pulsipher (1991)




**(a) Taxes per Barrel Equivalent by State**

Adapted from Newell & Raimi (2018)




**(b) Share of Production Value by State**

# 5 | Data

In this whitepaper we utilize data from a number of data sources. While each data source will be described alongside each respective analysis as appropriate, we provide context for these sources.

## 5.1 Enverus

We utilized detailed well-level production estimates from more than 1 million wells in the United States going back almost 30 years, as compiled by Enverus (formerly DrillingInfo). Enverus collects data from state agencies such as the Department of Natural Resources in Louisiana and the Railroad Commission in Texas. In different states, oil and gas production is reported at different levels of aggregation.[24] Enverus compiles all of this data across different states and produces well-level production estimates by month going back decades. We sum up production for each month across these geographic regions based on the time of first production for each well. Thus, we know in a given month the production of both oil and natural gas from wells that began production within the past year within a geographic region. This detailed information will be used in estimating responsiveness in oil and natural gas production to price changes.

## 5.2 Louisiana Department of Revenue

Louisiana Department of Revenue (LDR) provided detailed information on severance tax collections for oil and natural gas. These data were provided for FY16-FY18.[25] Specifically, relevant data from Form R-9015 (Form Sev. O-1d) and R-9036 (Form Sev. G-1d) were provided. All taxpayer information was anonymized.

We also utilized data from the State of Louisiana Tax Exempt Budget. Tax Exempt Budgets can be found on LDR's website from FY2000 until the present. We collected data from tax exempt budgets back to Fiscal Year 1982 at the David R. Poynter Legislative Research Library located at the State Capitol.[26]

## 5.3 Louisiana Department of Natural Resources

We utilized data series from DNR's website. These include state oil and natural gas production, prices, and severance tax collections. These data were cross checked with data from LDR, Enverus, and EIA as appropriate for apples-to-apples comparisons.

## 5.4 Federal Government Data Sources

We utilized data from the U.S. Energy Information Administration (EIA) and Bureau of Labor Statistics (BLS).

[24] For instance, in Louisiana's SONRIS system, producers can report at either the well, lease or unit level. While in Texas, all reporting is done at the lease.

[25] These fiscal years encompass July of 2015 to June of 2018.

[26] As far as we can tell, this is when the state began compiling tax exempt budgets in their current form.

# 6 | Trends in Production by Well Age

We examine production of oil and natural gas in Louisiana. Due to the detailed well-level production data from Enverus, we break down this production by well age. Trends are shown in Figure 6-1. We show trends both in absolute level and as a share of production. We highlight a few notable items.

First, oil production in Louisiana has been consistently falling for the past 40 years. While there are fluctuations (mostly in response to oil price shocks), these oscillate around a consistent downward trend.

Second, while natural gas production declined for about the first 30 years of the sample, in the last 10 years, there has been a significant increase. While not explicitly shown here, essentially all of this increase has come from production in the Haynesville Shale in northwest Louisiana. This increase came in two waves. The first wave occurred from 2008 until 2013. In this first wave, areas were leased, and producers drilled and produced on each unit in order to hold the lease by production. But when the price of natural gas fell in 2009, new drilling slowed and the production from these areas dropped off with a lag.[27] Over the last two years, production has begun to pick up again in the Haynesville, driving the observed increase in production.[28] Louisiana is not unique in this regard, as essentially all of the oil and natural gas production increases in the United States over the past decade have been from horizontal wells drilled in shale geological formations similar to the Haynesville.

The third observation is related to Figure 6-1 and has to do with the relative share of oil and gas production by well age. Today, approximately 40 percent of oil production is coming from wells that are greater than 15 years old, and this share from "old" wells has been increasing steadily for the past 20 years. Natural gas production, though, looks very different, with less than 4 percent of production from wells more than 15 years old. [29] This has significant implications if tax changes are made that grandfather in production from old wells, as the stock of production from new gas wells will be replenished faster than for oil wells if historic trends continue. This also illustrates how the short and long run effect of a tax change might be different depending on the relative change in production of oil and natural gas.

No one can provide a precise estimate of what will happen to oil and natural gas production over the next 40 years. In the 1970s, the prevailing wisdom was that oil production would decline, not just in Louisiana but worldwide. Oil production has declined in Louisiana but has increased within the United States and worldwide. Oil prices and natural gas prices are also difficult to project for long periods of time. In the late 1970s oil prices at around $40 per barrel were considered to be extraordinarily high, but $40 per barrel in 2020 is considered to be below a breakeven price for many oil producers.

The tax structure has to accommodate the volatility in oil and gas prices in the short and long run and the long-term uncertainties about oil and gas production. In fact, this volatility in prices and production has also stimulated discussion about the use of oil and gas revenues.[30]

[27] A well drilled right before the price drop in 2009 will likely continue production in the following several years despite the price drop, as drilling and completion costs were already incurred. Further, producers paid bonus payments to landowners and might choose to produce natural gas in order to hold the lease. Therefore, they might drill an uneconomic well after the price drop. For these two reasons, production changes occur with a several year lag to natural gas price changes.

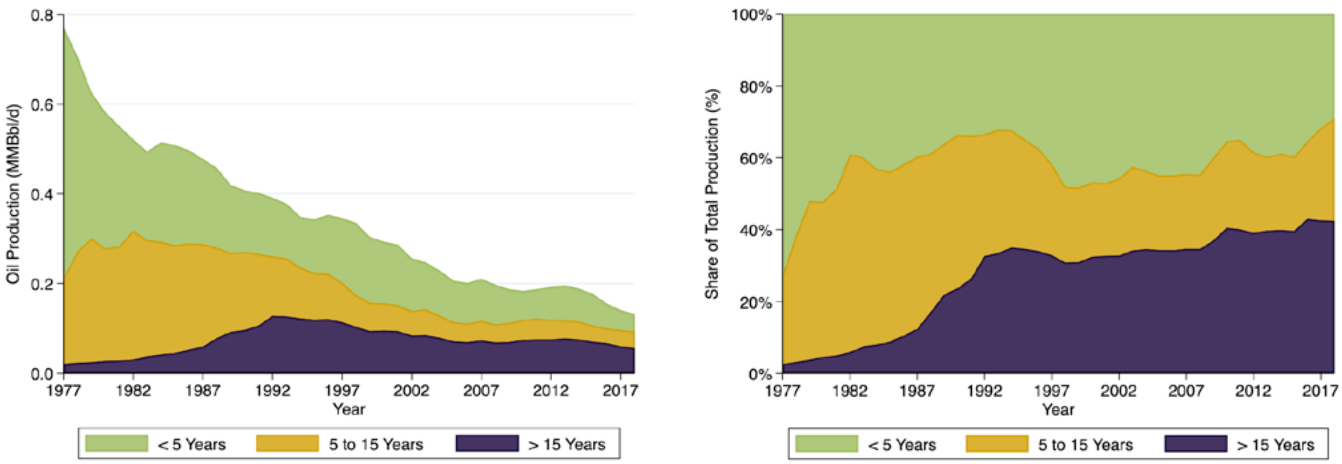
[28] We are told by landmen that some leases did expire and are currently being re-leased.

[29] This is likely for two reasons. First, Louisiana has experienced increases in natural gas production recently, while oil production has continued down the consistent long-term decline curve. Second, oil wells can produce for decades, while the life of natural gas wells is significantly shorter.

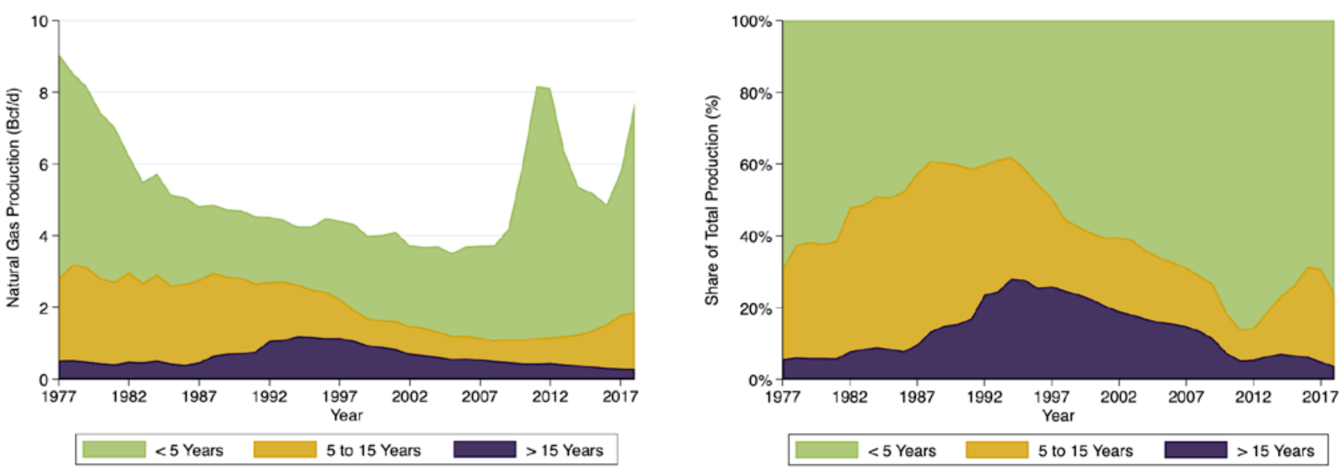
[30] Norway has developed a Sovereign Wealth Fund and Alaska has a Sovereign Wealth Fund connected to their mineral wealth. Louisiana created a Budget Stabilization Fund in 1990 and a Revenue Stabilization Fund in 2016. Louisiana's stabilization funds are very different from the Sovereign Wealth Funds, but Louisiana stabilization funds are aimed at protecting the state's general fund from swings due to the volatility of certain revenue sources such as oil and gas revenues.

## Figure 6-1: Louisiana Oil and Natural Gas Production by Well Age

Source: Enverus and Authors' Calculations




**(a) Louisiana Oil Production by Well Age**




**(b) Louisiana Natural Gas Production by Well Age**

# 7 | Estimating Sensitivity of Oil and Gas Production to Price Changes

Next, we assess the sensitivity of changes in prices to changes in production. Any changes in the tax burden will impact how much producers receive (after taxes are paid) for the oil and gas produced or how they are able to distribute the tax change to other participants in the chain of discovering, producing, and then consuming the product. An *increase* in taxes may lead to a decrease in oil and gas production, especially if the tax cannot be passed on to other participants in the chain of producers and consumers. On the other hand, if a tax *reduction* were to occur, this may lead to an *increase* in production, all else held equal.

Economic theory does not tell us the relative sensitivity of oil and gas production to prices; empirical research is needed. If production is relatively sensitive to the price received net of taxes, then policy makers should be particularly careful when making any changes to the tax system, as this might have a meaningful impact on the amount of production. In fact, it is theoretically possible that an *increase* in the tax rate on a good or service (in this case oil and natural gas) could reduce the amount of that good or service produced so much that tax revenues could actually *decrease* in the long run.

Thus, it is crucial to understand the sensitivity of oil and gas production to price changes in order to understand how a change in taxes can impact revenues for the state and producers that employ Louisiana workers.

The academic literature on the supply price elasticity of oil production suggests elasticities from zero to 0.6 in the long run (Jones, 1990; Dahl & Duggan, 1996; Kilian, 2009). A 0.6 elasticity means that for a permanent 10 percent increase in the price received for oil, we can anticipate a 6 percent increase in production in the long run. Brown et al. (2018) estimates the response of new drilling of oil wells to severance tax differences across states and finds that a one-dollar-per-barrel increase in severance tax leads to an 8 percent decrease in wells drilled when comparing wells drilled very close to state borders with variation in severance tax rates. Newell & Prest (2019) find that drilling is the most important margin of adjustment, with price elasticities of 1.3 and 1.6 for conventional and unconventional drilling, respectively. Thus, price changes in the short run are important for drilling decisions, but the culmination of these drilling decisions over many years impacts total production slowly.

## 7.1 Empirical Specification

Using historical data from oil and natural gas production changes and prices in Louisiana, we estimate the sensitivity of production to price swings. For this analysis, we will consider monthly oil and gas production data from 2000 until the end of 2018. We run the following model:

$$\Delta Prod_t = \alpha(L)\Delta Prod_t + \beta(L)\Delta P_t + \gamma_i M_t \quad (7.1)$$

Where $\Delta Prod_t$ is the monthly change in oil and natural gas production, respectively. $\Delta P_t$ is the change in price. For all analyses we will use the price of oil and natural gas as the WTI spot price and Henry Hub spot price as reported by EIA respectively.[31] Oil and natural gas prices are inflation

[31] While oil and natural gas prices can vary across locations (Agerton & Upton, 2019; McRae 2017), we take the natural log of price and quantity variables to estimate elasticities that are interpreted as a percent change in production in response to a percent change in price.

adjusted to 2018 prices using a Bureau of Labor Statistics CPI calculator. $\alpha(L)$ and $\beta(L)$ represent 12 monthly lags of each of these variables. $M_t$ are monthly fixed effects to pick up yearly variation in production throughout seasons of the year. The long run elasticity of supply can be obtained from these parameters as follows:[32]

$$\varepsilon_S = \frac{\sum \beta(1)}{1 - \sum \alpha(1)} \quad (7.2)$$

We run analyses on total oil and natural gas production in United States, Texas, and Louisiana separately. We also consider sensitivity of production from wells by age. Specifically, we consider (1) wells less than one year from first production date, (2) wells less than two years from first production date and (3) wells greater than 20 years from first production date. Detailed well-level production data provided by Enverus allows for this analysis.[33]

We consider well age to examine plausible margins of adjustment for production. If prices increase, companies might choose to drill more wells and therefore production from relatively new wells will increase (with a lag). For older wells, if the price is relatively high, producers can continue to produce. But, if the price drops and remains low for an extended period of time, the costs of maintaining the well might exceed the revenues, and eventually the well will be shut in.

Figure 7-1 shows this data for production and prices for Louisiana.

**Joint Estimation** Running the analysis above allows us to calculate standard errors for the coefficients in (7.1) as well as the combined coefficients and resulting supply elasticity presented in (7.2). But this approach does not allow for conducting a statistical test for whether the elasticity of supply is different for oil and natural gas. Namely, we want to test the null and alternative hypotheses below:

$$H_O: \varepsilon_{s,oil} = \varepsilon_{s,gas}$$

$$H_1: \varepsilon_{s,oil} \neq \varepsilon_{s,gas}$$

Where $\varepsilon_{s,oil}$ and $\varepsilon_{s,gas}$ are the long run supply elasticities for oil and natural gas, respectively. We want to test this hypothesis, because if the elasticity of supply of oil and natural gas are not the same, this could be a reason to tax the commodities at different rates and also impact the estimated tax rate changes that would be revenue neutral. In order to conduct this hypothesis test, we examine a dynamic panel with monthly observations from January 2000 to December 2018 for oil and natural gas separately. We set this up as a seemingly unrelated regression (SUR) model and estimate Equation (7.3) using a linear regression with panel-corrected standard errors.[34]

$$\Delta Prod_{t,oil|gas} = \alpha(L)\Delta Prod_{t,oil} + \beta(L)\mathrm{Oil} \times \Delta P_{t,oil} + \alpha(L)\Delta Prod_{t,gas} + \beta(L)\Delta Gas \times P_{t,gas} + \gamma_{i,oil}M_{t,oil} + \gamma_{i,gas}M_{t,gas} \quad (7.3)$$

Where $Oil$ and $Gas$ are indicator variables for oil and natural gas respectively. By definition, point estimates from (1) and (3) are identical (and this is confirmed empirically), but this SUR panel approach allows for a direct test on the hypothesis on whether the elasticity of supply of oil and natural gas are the same.[35]

---

[32] Standard lagged operator notation is used. $\beta$ and $\alpha$ is equal to the sum of all twelve $\beta$ coefficients estimated from equation (7.1). This long run elasticity of supply equation can be found in any standard time series analysis text book.

[33] Different states have different reporting requirements for oil and gas production. For instance, in Louisiana producers report to DNR at either the lease, unit or well (LUW). In Texas, all reporting is done at the lease level. Enverus implements empirical models to estimate oil and gas production at the individual well level based on each state's reporting.

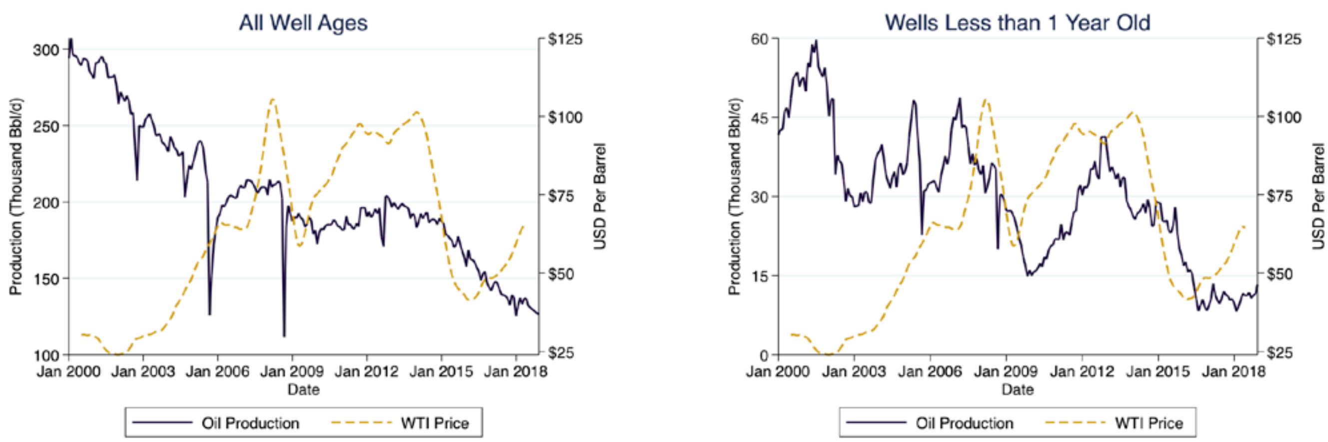
[34] Standard errors are calculated using a panel-specific AR1 autocorrelation structure.

[35] Newey West standard errors were not calculated for SUR models, and therefore additional empirical tests for autocorrelation in the errors were conducted. A special thanks to Mark Agerton (University of California and Davis) and Ben Gilbert (Colorado School of Mines) for feedback on standard errors.

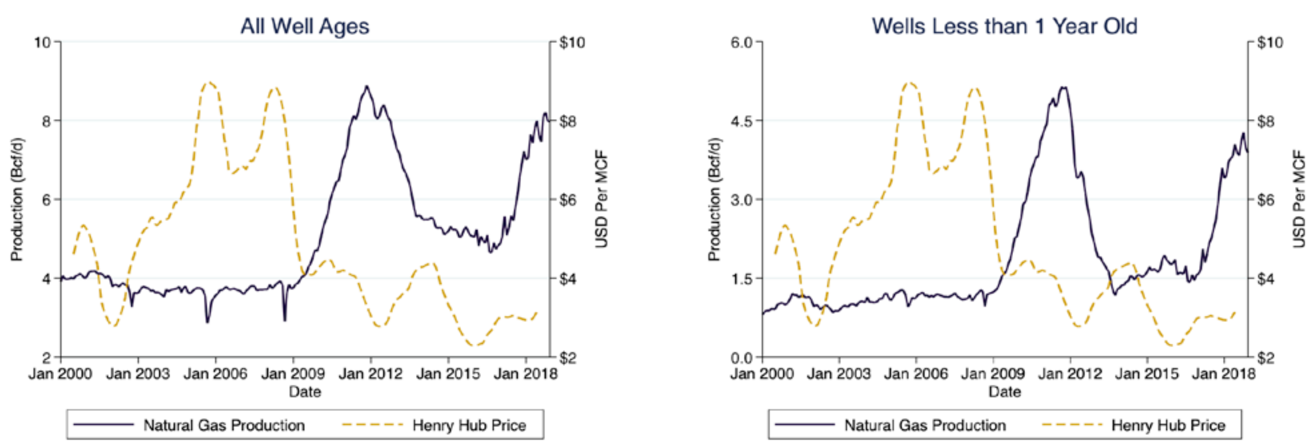
## Figure 7-1: Louisiana Oil and Natural Gas Production and Prices

Note: Price is +/- 6 month moving average

Source: Enverus, EIA, and Author's calculations.




**(a) Oil**




**(b) Natural Gas**

## 7.2 Results

Table 7-1 shows the price elasticity of oil and natural gas wells by well age across three geographic regions: the United States, Texas and Louisiana. We highlight a few notable items.

First, there is no statistically significant difference in the long run supply elasticity in any of the three geographic areas for all production. For Louisiana and Texas, there is no statistically significant difference in the elasticities for any disaggregation of production (i.e. production from all wells, wells less than 1 year from first production, wells less than 2 years from first production, and wells greater than 20 years from first production). For purposes of breakeven calculations, as will be discussed below, we will therefore consider $\varepsilon_{s,oil} = \varepsilon_{s,gas}$. Point estimates generally suggest that oil is more price responsive than natural gas.

Second, total oil production and natural gas production in Louisiana do not exhibit a statistically significant response to prices. This makes sense because mature basins that continue down their long run decline curves are likely not particularly responsive to price shocks. But for the entire U.S. and Texas, we estimated a supply elasticity of 0.52. and 0.58 for oil, respectively, and 0.1 and 0.22 for

### Table 7-1: Price Elasticity of Oil and Natural Gas

| | United States | | | Texas | | | Louisiana | | |
|---|---|---|---|---|---|---|---|---|---|
| | Oil | Natural Gas | ϵOil - ϵGas | Oil | Natural Gas | ϵOil - ϵGas | Oil | Natural Gas | ϵOil - ϵGas |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| All Production | 0.52* | 0.10* | 0.42 | 0.58* | 0.22** | 0.36 | -0.02 | 0.13 | -0.15 |
| | *(0.31)* | *(0.06)* | *(0.30)* | *(0.35)* | *(0.10)* | *(0.33)* | *(0.05)* | *(0.19)* | *(0.17)* |
| Less Than 1 Year | 0.79*** | 0.27*** | 0.52** | 0.89*** | 0.44*** | 0.45 | 0.62*** | 0.54 | 0.08 |
| | *(0.22)* | *(0.09)* | *(0.21)* | *(0.28)* | *(0.13)* | *(0.26)* | *(0.24)* | *(0.43)* | *(0.44)* |
| Less Than 2 Years | 0.99** | 0.26** | 0.73 | 1.03** | 0.44** | 0.59 | 0.36* | 0.24 | 0.12 |
| | *(0.47)* | *(0.13)* | *(0.45)* | *(0.43)* | *(0.20)* | *(0.42)* | *(0.19)* | *(0.32)* | *(0.32)* |
| Greater than 20 Years | 0.04** | -0.02 | 0.06** | 0.04*** | 0.02* | 0.02 | -0.03 | -0.01 | -0.01 |
| | *(0.02)* | *(0.02)* | *(0.03)* | *(0.01)* | *(0.01)* | *(0.01)* | *(0.05)* | *(0.03)* | *(0.04)* |

Note: Standard errors reported are for the non-linear combination of coefficient estimates used to produced elasticity estimate in columns; panel-correcte standard errors with AR1 autcorrelation structure reported. Offshore production only includes Louisiana state waters and excludes Federal OCS. *, **, and *** represent significance at p < .10, p < .05, and p < .01 respectively.

natural gas, respectively. In other words, U.S. oil production changes by 5.2 percent in the long run in response to a 10 percent increase in price. U.S. natural gas production is less sensitive, changing 1 percent in response to a 10 percent increase in price. While point estimates suggest that oil is more elastic than natural gas, these are not statistically significantly different.

Third, production is generally more responsive from new wells (wells less than one year from first production or less than 2 years from first production). This is logical, as when the price increases, drilling activity responds, leading to new production. Furthermore, wells naturally have front loaded production that declines over time. Horizontal wells in shale formations generally have particularly steep decline curves compared to conventional reservoirs. This result is also consistent with Newell & Prest (2019) and Anderson, Kellogg & Salant (2018), who find that the margin of adjustment to price shocks is new drilling. In Louisiana, we estimate that oil (natural gas) production has a 6.2 percent (5.4 percent) change in response to a 10 percent change in prices. For wells less than two years from first production, the point estimates are a 3.6 percent for change in oil production and 2.4 percent change in natural gas production in response to a 10 percent change in price.

Finally, we estimate supply elasticities for wells greater than 20 years from first production. Producers might decide to end production on these relatively old wells due to price changes. Unsurprisingly, while we do observe response to price changes in some jurisdictions, these elasticity estimates are close to zero, indicating production is inelastic.

From this analysis, we reach three broad conclusions. First, while total production of oil and gas moves in response to price changes in the long run, production changes take time. This is because the margin of adjustment is drilling new wells, and therefore production from new wells. Second, this analysis shows that price elasticity of supply in Louisiana is inelastic, even for new wells. Third, there is not a statistically significant difference in the price elasticity of oil and natural gas in Louisiana. All of these factors will be considered when estimating a breakeven level tax rate for oil and natural gas in Section 10.

# 8 | Valuation of oil and gas for tax purposes

## 8.1 An Inherent Tradeoff

Article 7, Section 4(B) of the Louisiana Constitution of 1974 allows the state to assess a severance tax based "upon either the quantity or value of the products at the time and place of severance" (underline added for emphasis). As previously discussed, Louisiana's current laws tax oil at 12.5 percent of the value of the oil sold, less transportation costs (unless the production qualifies for an exemption). Natural gas is taxed based on the quantity sold (indexed to a market price).

Taxing quantity versus value presents an inherent tradeoff. Quantity taxes are relatively straightforward. A volumetric rate is published. Producers report how much is produced and multiply the volumetric rate by the quantity produced to arrive at the tax liability. Auditing is also straightforward, as LDR only needs to audit the quantity produced. Taxing based on quantity, though, has a downside: different producers and/or fields may receive different prices which means these different barrels of oil will pay different effective tax rates. For example, "heavy sour" crude oil historically has a lower market value than "light sweet" crude oil. Thus, if both the heavy sour and light sweet crude are assessed the same volumetric rate, the heavy sour crude will be taxed at a higher effective rate.

> The inherent tradeoff is illustrated in a careful reading of the statute on valuation itself:
>
> *R.S. 47:633 (7)(a) On oil twelve and one-half percentum of its value at the time and place of severance. Such value shall be the higher of (1) the gross receipts received from the first purchaser, less charges for trucking, barging and pipeline fees, or (2) the posted field price. In the absence of an arms length transaction or a posted field price, the value shall be the severer's gross income from the property as determined by R.S. 47:158(C).*

The value is based on the time and place of severance. This value can be the gross receipts received from the first purchaser less charges for transportation, or the posted field price. But there are a few complications.

First, posted field prices are a historical artifact, and simply no longer exist. Historically, oil companies published a price they were willing to pay for oil of a certain type at a given field or location during a stated time period. This is no longer the case.[36] Today producers and buyers typically negotiate a formula for the price of oil based on current market prices and adjustments. There are a number of trucking companies with standard formulas for calculating the price.

Second, gross receipts less transportation costs can be difficult to audit from LDR's perspective. LDR must audit not only the price received for the oil at first purchase, but also transportation costs.[37] Multiple companies can be involved in these transactions, and paper trails can be laborious to audit. For instance, LDR might observe two producers paying different amounts of severance tax per barrel. Does one producer have lower cost transportation? Is the quality of the crude different? Perhaps one producer has a long-term contract to sell oil at a given price. LDR might be rightly compelled to

[36] A more detailed history of posted field prices can be found in the *Industry Position on Severance Tax* in response to HCSR 10 discussed below.

[37] Avanti Exploration, LLC v. Kimberly Robinson, Secretary, Louisiana Department of Revenue is a recent court case involving the determination of the transportation costs of transporting oil from the wellhead to the point where a market price is established. The courts ultimately ruled in favor of Avanti Exploration.

audit a producer that is reporting a relatively low price; this can be burdensome for both LDR and the producer.

Third, vertically integrated companies create an additional challenge, as the statute requires the company report the gross income for the property.

The issue of the valuation of oil for purposes of levying a severance tax in not a new issue. In the Regular Session of 2009, House Concurrent Study Request No. 10 (HCSR 10) charged the House committee on Ways and Means and the Senate committee on Revenue and Fiscal Affairs to meet and function as a joint committee to study the factors considered in the determination of the value of oil for purposes of severance taxes.[38] HCSR 10 and the subsequent joint committee was motivated by issues raised on audits by the Louisiana Department of Revenue.

One way to mitigate this potential for confusion and legal challenges is to create a volumetric rate that is indexed with a specific formula to a market price of oil, similar to natural gas. Based on our discussions with industry and LDR, similar disputes on taxes owed are far less common for natural gas, which is taxed at a volumetric rate. Moving oil to a volumetric rate would make calculating severance tax liabilities relatively simple and remove many auditing and legal challenges. But the tradeoff is that different producers and fields will be impacted differently by this change.

## 8.2 Policy Questions

Whether it is prudent to move to a volumetric rate indexed to a market price for oil comes down to a tradeoff. Charging a tax rate based on a percent of value produced allows for consistency in the tax burden. But on the other hand, charging a tax rate on a percentage of value is more difficult to audit for the state and requires more complex accounting for companies. Moving to a set volumetric rate is simplistic. But is the simplicity worth the tradeoff of potentially adverse effects on different areas and producers? This comes down to a few empirical questions that can be addressed.

### 8.2.1 Does All Oil Command the Same Price?

The first basic question we pose is whether there is significant variation in the price received for oil. As previously mentioned, LDR provided detailed information on severance tax collections for oil and natural gas for FY16-FY18 to assist in this analysis.[39] For each (anonymized) company and each (anonymized) field, we know the amount of oil sold, the average price over the month, transportation costs, and the severance taxes paid.

To address the price difference received across producers, we collect daily West Texas Intermediate Spot prices from the U.S. Energy Information Administration consistent with the time period of data provided by LDR. We calculate the coefficient of variation (CV) for the daily spot prices for each month and ranked the months based on the value of the CV. We present results for bottom five “low price variability” months in an attempt to pick up on actual differences across producers in the same time period. We present results for both oil and condensate.

[38] The Joint Committee accepted testimony from industry representatives such as LOGA and LMOGA. An Industry Position Paper on Severance Tax was submitted to the committee by LOGA and LMOGA and proposed specific legislative changes in relevant sections of R.S. 47:633(7) to address this valuation issue. Conversations with tax experts suggest that while this case might settle some disputes moving forward, disagreement on interpretation are likely to continue until the verbiage of “posted field price” is R.S.:633(7) updated.

[39] Form R-9015 (Form Sev. O-1d) and R-9036 (Form Sev. G-1d)

We then sum up all sales and barrels produced reported to LDR across approximately 2,200 producers observed in these months. We then subtract the average price received across each of these producers from the average LLS spot price reported by EIA in that same month.[40]

$$Premium_m = Price_m - LLS_m \quad (8.1)$$

Where $Premium_m$ is the premium received by a producer in month $m$, and can be either positive or negative. Table 8-1 shows summary statistics. As can be seen, the median producer receives within 13 cents of the average Louisiana Light Sweet spot price. For condensate, the median producer receives $0.47 less than LLS. There is notable variation across producers: the 25th and 75th percentile oil producer received $2.89 below and $1.62 above the average LLS spot price. The 25th and 75th percentile condensate producer receives $3.45 below and $1.50 above LLS.

### Table 8-1: Price Variability

| | Oil | Condensate |
|---|---|---|
| | (1) | (2) |
| Percentile | Price Received less LLS | |
| 5% | -$6.35 | -$6.74 |
| 25% | -$2.89 | -$3.45 |
| 50% | -$0.13 | -$0.47 |
| 75% | $1.62 | $1.50 |
| 95% | $2.94 | $2.66 |
| N | 2,226 | 517 |
| Barrels | 18,833,770 | 3,097,894 |

Source: Individual tax records provided by LDR and LLS market prices from EIA. Note: The unit of observation is producer by month. There are a maximum of five low price volatility months across 1,126 producers. Not all producers sell to the market in all months. Not all producers sell both oil and condensate.

This variation can come from a number of sources that we cannot disentangle.

(1 ) Some of the difference might simply have to do with the day that the oil was sold.[41] We remove some of this effect by analyzing months with relatively low daily variability in prices.

[40] At times, there can be significant differences in West Texas Intermediate and Louisiana Light Sweet Spot Prices (Agerton & Upton, 2019). Daily spot price data is available on EIA for WTI, but not LLS. Therefore, we use daily WTI prices to identify the volatility of prices in individual months. Monthly data is available for LLS, and therefore we use this for calculating the difference in price received by individual producers.

[41] We are told that contracts for prices often consider the average of daily spot prices with adjustments. Thus, oil sold just days apart from the same field can receive different prices.

(2) Oil has different qualities, with different sulfur content and API gravity. We do not observe crude properties.

(3) Some fields are closer to markets for their oil.

(4) Oil might be sold on long-term contracts with different formulas to calculate the price received in that month.

(5) Transportation costs can vary across producers.

There are likely other factors not listed here. Thus, while it is not possible to tease out all of the reasons different barrels of oil will receive different prices, this analysis provides us a reasonable snapshot of the distribution of price differences received. Figure 8-1 further illustrates this concept for oil and condensates.

To see the implications of this variability, consider the following simple algebra. Consider an oil producer receiving the 5th percentile price compared to the 95th percentile price. These producers receive approximately $9.29 per barrel difference. A 12.5 percent tax rate yields a $1.16 per barrel difference in taxes owed between the producers. In other words, if the legislature were to move to a set volumetric rate based on market price, the $5^{th}$ and $95^{th}$ percentile producers would now pay the same tax per barrel; today the producer who receives the higher price pays $1.16 more in severance tax than the producer who receives the lower price. Note that if the legislature were to simultaneously levelize the tax rate for oil and natural gas (as will be discussed in Section 10), this difference would be less pronounced.

### 8.2.2 Do Larger Producers and Larger Fields Receive Better Prices?

In the prior section we quantified the variation in prices received by producers. Next, we assess the extent to which larger producers might receive higher prices than small producers. One of the concerns brought up by industry stakeholders when discussing a volumetric rate for oil is that it might benefit large producers and fields on average. Fortunately, this is an empirical question that can be addressed. Using data provided by LDR, we assess the extent to which larger (a) fields and (b) producers command higher prices for oil sold.

Table 8-2 compares the top 10 largest producers and fields in Louisiana to all other producers and fields, respectively. This analysis includes both oil and condensate together. Interestingly, the top 10 producers in Louisiana produce 53 percent of all oil and condensate. The top 10 fields produce more than 26 percent. Over the sample of data provided by LDR, the top 10 producers receive approximately $50.08 per barrel, compared to $49.77 from all other producers. Thus, these largest producers received about 0.6 percent more for their average barrel than other producers. Larger fields, similarly, received about a 1.6 percent price advantage.

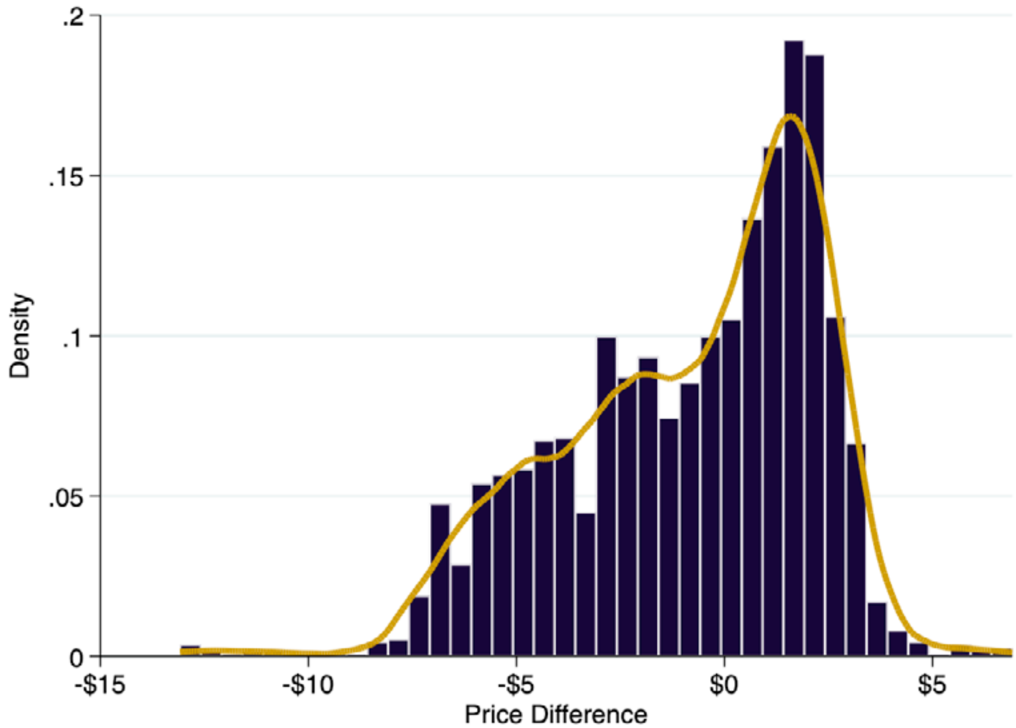
We next estimate the following regression equation:

$$P_{i,t} = \alpha + \beta Share_i + \gamma_t$$

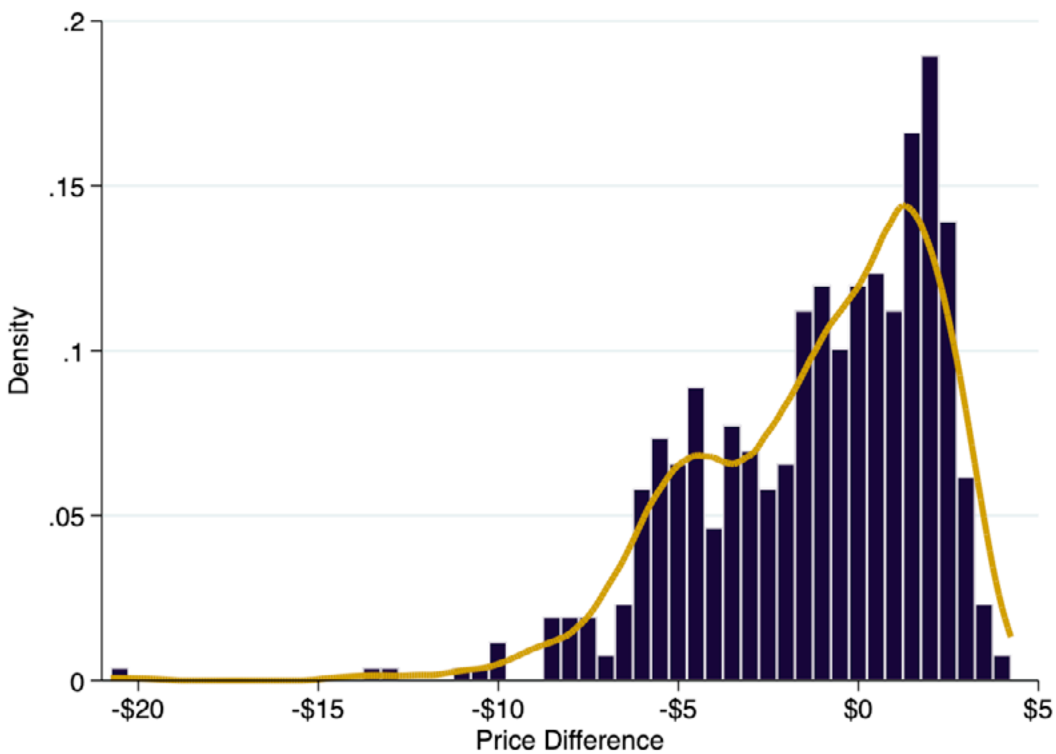
Where $P_{i,t}$ is the average price received by producer or field $i$ in month $t$. $Share_i$ is the share of production in the entire state for each producer or field $i$, over the sample period (2015-2018). $\gamma_t$

## Figure 8-1: Distribution of Prices Received for Oil and Condensate

Includes five calendar months with lowest daily price volatility across sample time period.




**(a) Oil**




**(b) Condensate**

**Table 8-2: Top Ten Producers and Fields by Share of Total Production**

| Average Price per Barrel | Producers | Fields |
|---|---|---|
| | (1) | (2) |
| Top Ten | $50.08 | $51.78 |
| All Others | $49.77 | $50.94 |
| Price Difference | $0.31 | $0.84 |
| *Percent Difference* | *0.62%* | *1.64%* |
| Share of Total Production | | |
| Top Ten | 53.2% | 25.7% |
| All Others | 46.8% | 74.3% |
| Observations | 561 | 661 |

Source: Individual tax records provided by LDR and author's calculations.

**Table 8-3: Do Larger Producers and Fields Receive Better Prices?**

| | Producers | Fields |
|---|---|---|
| Average Price per Barrel | (1) | (2) |
| Share of Barrels Produced | 0.219** | 0.283* |
| | (0.093) | (0.151) |
| Observations | 23,271 | 28,498 |

Standard Errors Clustered at by producer and field respectively. Year by month fixed effects included but coefficients not shown. Unit of observation is monthly observation by producer or field.

is a dummy variable for each of the 48 months over the sample time period to pick up changes in the market price and other factors that vary over time for all producers and fields. The coefficient of interest is $\beta$ and represents the additional dollars per barrel received for a producer that increase its market share by one percentage point.

Results are presented in Table 8-3. We estimated that a one percentage point increase in the producer's share of total production in the state is associated with about $0.22 per barrel higher price. Similarly, a one percentage point increase in the field's share of total production in the state is associated with a $0.28 increase in the price per barrel. Therefore, we do find evidence that larger producers and larger fields receive a better price, on average, than smaller producers and fields. Any change in the tax structure will create some producers paying slightly less in severance taxes and others paying slightly more—this is true of any major tax reform process.

**Conclusion: These differential prices represent a tradeoff that must be considered in examining the benefits to moving to a volumetric rate for oil indexed to a market price. The tradeoff is that some producers will pay higher/lower effective tax rates.**

# 9 | Exemptions

One of the overarching recommendations of the Task Force was to lower rates and broaden the base. The way to broaden a base is to remove or limit exemptions. Therefore, in this section, we will assess the value of severance tax exemptions. An overview of these exemptions can be found in Section 4.4.

## 9.1 History of Exemptions

As previously mentioned, data was collected from Tax Exempt Budgets from FY-1982 to FY-2018.[42] These dollar values are indexed to the U.S. Consumer Price Index (CPI) from the U.S. Bureau of Labor Statistics (BLS) to account for inflation. From 1982 to the mid-2000s, the value of exemptions varied from less than $50 million per year to approximately $125 million per year. There are noticeable changes that match price changes and changes in exemptions.

But in 2007, the value of severance tax exemptions began to increase precipitously above historic levels. As will be discussed below, essentially all of this increase is due to the horizontal drilling exemption passed in 1994 alongside the advent of natural gas production from the Haynesville Shale formation in northwest Louisiana. A comparison of Figures 9-1 and 6-1 shows that the value of exemptions coincides almost perfectly with the natural gas production increases. And essentially all of this increase in natural gas production is from the Haynesville Shale formation.

**Figure 9-1: Historical Value of State Imposed Severance Tax Exemptions**

*Source: Louisiana Tax Exempt Budget. Adjusted to Consumer Price Index. Base year 2018.*[43]


[42] Tax Exempt Budgets are not available pre-FY1982.

[43] It is important to note that in many instances, a producer might up-front taxes and received a credit in a future tax year. In this sense, yearly calculations should be taken with caution. For this reason, we present five year averages.

## 9.2 Value of Exemptions

Table 9-1 provides an overview of the severance tax receipts and exemptions for oil and natural gas, respectively. Data on revenues received come from Louisiana Department of Revenue Annual Reports and value of exemptions from Tax Exempt Budgets. To smooth year-to-year fluctuations, the average values from fiscal year FY14-FY18 are shown, the most recent five fiscal years available.

Panel A of Table 9-1 shows the revenues received and value of exemptions. Over this five year period, an average of $558 million in severance tax revenues was collected per year, with $417 million coming from oil and $141 million from natural gas. Over this five-year period, the value of state-imposed exemptions averaged $230 million per year, or approximately 29 percent of the potential revenue received. We define potential revenues received as the sum of the total severance tax revenue received plus the severance tax revenue loss as reported in the Tax Exempt Budgets that includes all exemptions and exclusions.

Panel A also shows the value of exemptions for oil and natural gas separately. There is a noticeable discrepancy in the value of exemptions; the value of exemptions for oil is approximately 19 percent of potential revenues, while the value of exemptions for natural gas is 47 percent of potential revenues. Revenues and potential value of foregone revenues for oil and natural gas respectively are shown graphically in Figure 9-2.

Panel B of Table 9-1 further disaggregates these exemptions. What is most noticeable is that the value of horizontal exemptions for natural gas is 83 percent of the total natural gas exemptions, or $110 million. For oil wells, the largest exemptions are stripper, tertiary, and inactive wells in that order.

While not empirically analyzed, it is important to address the potential effect of the horizontal exemption on the production in the Haynesville shale region given the sheer value of the exemption. One could argue that this exemption was necessary to spur activity in the Haynesville. If this is true, perhaps the exemption could have actually increased revenues on net for the state for a number of reasons. First, these wells are not exempt from severance taxes for the life of the well, only for the first two years or until well payout, whichever occurs first. Second, other tax revenues are generated from the activity. Landowners that receive bonus and royalty payments will pay income taxes; exploration and production companies are estimated to have paid out over $3.1 billion in up-front lease payments in 2008 (Scott, 2009). These landowners will spend money in the local community generating additional tax revenues and multiplier effects. The economic activities associated with leasing, drilling, completing, and producing from these wells also generate tax revenues in the form of sales taxes, personal income taxes, corporate income taxes, etc. These activities also create multiplier effects (Scott, 2018). Fossil fuel extraction has also been associated with long run economic growth more broadly in the academic literature (Oliver & Upton, 2019; Alexeev and Conrad, 2009; Michaels, 2010; Smith, 2015).

This type of narrative, though, is predicated on the argument that the Haynesville Shale would not have been developed, or development would have been significantly less, in the absence of this horizontal drilling exemption. We find this argument implausible for several reasons.

First, Haynesville Shale production was spurred by technological advancements in horizontal drilling and hydraulic fracturing that allowed for oil and natural gas production from specific geological formations thousands of feet below the surface. Similar economic "booms" occurred in other areas with these geological formations.[44] These other shale boom regions include Anadarko, Appalachia, Bakken, Eagle Ford, Niobrara, and Permian.[45] Thus, it is unlikely that Louisiana's specific tax climate spurred this investment, as it simultaneously occurred in other areas with similar geology across the country.

Second, the Haynesville Shale overlaps the Texas border. As discussed in Section 4 above, Louisiana has both a *lower* natural gas severance tax rate than Texas (7.5 percent in Texas and approximately 4 percent in Louisiana). Louisiana also does not assess ad valorem taxes on oil and natural gas reserves. Further, industry experts in leasing have told us that the unitization and leasing process in Louisiana is more straightforward and easier than Texas.[46] Finally, the "sweet spots" of the Haynesville Shale are located on the Louisiana side of the border. Thus, while the lion's share of Haynesville production occurred on the Louisiana side of the border, this is a combination of geological and policy reasons.

Finally, during the initial leasing of the Haynesville Shale, the price of natural gas averaged $5.45 per MCF in 2004, 7.32 per MCF in 2005, $6.40 per MCF in 2006, $6.26 per MCF in 2007, and $7.98 per MCF in 2008.[47] These prices were substantially above the average price of $3.88 per MCF from 2000 through 2003. The market was signally that it needed additional natural gas through historically high prices.

**Conclusion: All of these factors taken into account, it is unlikely that the horizontal drilling exemption was needed to spur production in the Haynesville Shale region.**

[44] While too large to review here, the economic effects of these shale boom areas have been studied extensively. Feyrer et al (2017) find that for every million dollars of oil and gas extracted is estimated to generate $243,000 in wages, $117,000 in royalty payments, and 2.49 jobs within a 100-mile radius. In total, the authors estimate that the shale boom was associated with 725,000 jobs in aggregate and a 0.4 percent decrease in the unemployment rate during the Great Recession. Marchand (2012) similarly finds both direct and indirect impacts of production on employment; for every 10 jobs created in the energy sector, 3 construction, 4.5 retail, and 2 service jobs are created. Other studies corroborated the positive impact of oil and gas on local labor markets both in the context of shale booms and more broadly (Agerton, et al 2017; Weber 2012; Cosgrove et al. 2015; Komarek 2016; McCollum & Upton 2018; Decker et al 2018; Upton & Yu 2019).

[45] Based on EIA's Drilling Productivity Report definitions of shale areas.

[46] While beyond the scope of this White Paper, Louisiana law transfers mineral rights to surface owner after 10 years of property being transferred with no production, regardless of whether mineral rights were transferred with property initially. In Texas, land men sometimes have to find generations of heirs that still own a (many times small) share of a mineral interest in Texas. Further, we have been told that Louisiana's unitization process is more straightforward. For a in depth discussion of these legal differences, see Martin & Yeates (1992).

[47] Source: average prices from the Energy Information Administration in the U.S. Department of Energy.

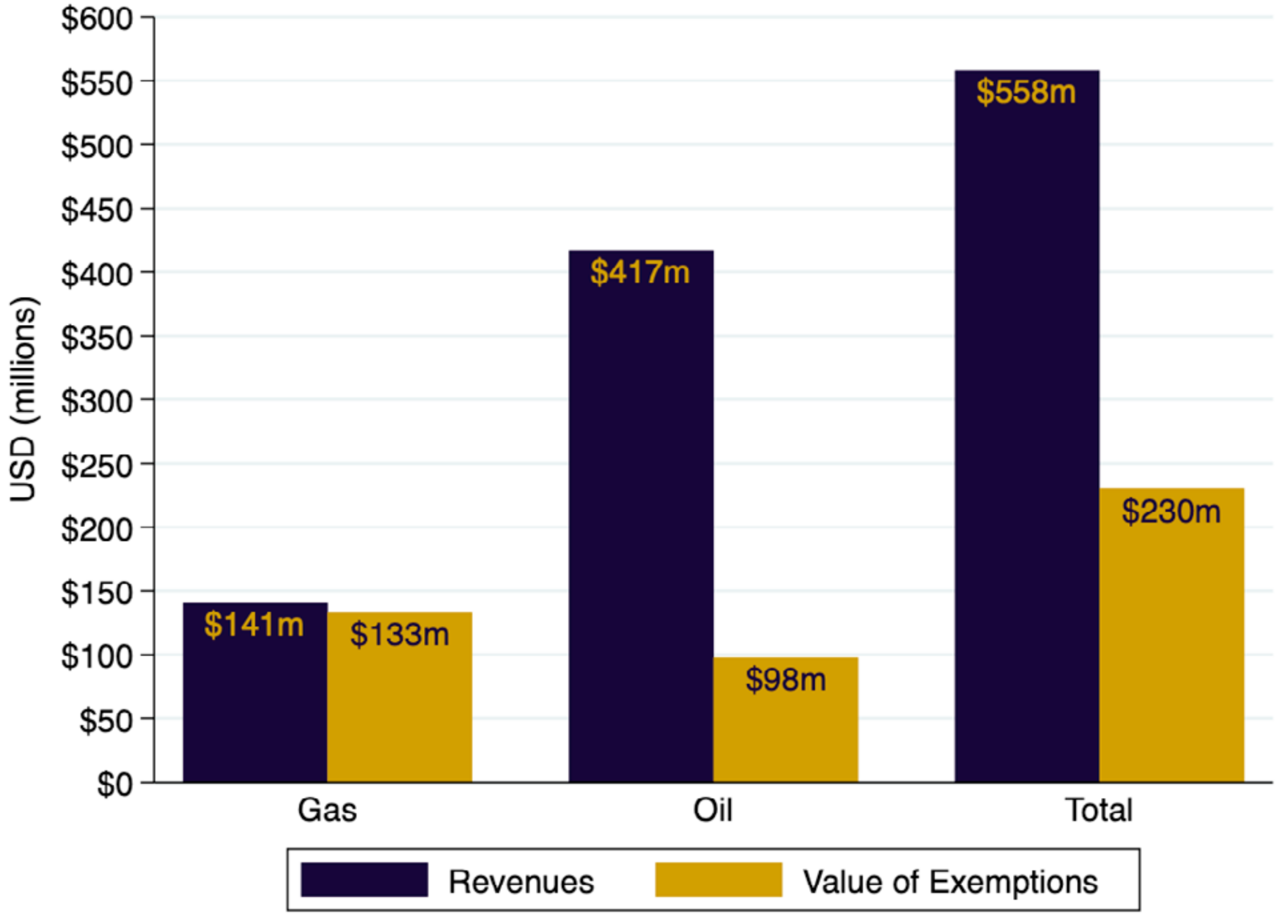
### Table 9-1: Severance Tax Collections and State Exemptions

| | Oil | Gas | Total |
|---|---|---|---|
| **Panel A: Revenues Received and Value of Exemptions** | | | |
| | (1) | (2) | (3) |
| Severance Tax Revenue Received | $417,152,511 | $140,648,731 | $557,801,242 |
| Severance Tax Revenue Loss | $ 98,613,940 | $140,980,217 | $239,594,155 |
| *Share of Potential Revenue* | *19.12%* | *50.06%* | *30.05%* |
| Value of State Exemptions | $97,553,865 | $132,676,978 | $230,230,843 |
| *Share of Potential Revenue* | *18.91%* | *47.11%* | *28.87%* |
| **Panel B: Value of State Exemptions by Well Type** | | | |
| Incapable Wells | $7,963,786 | $18,016,205 | $25,979,992 |
| *Share of Exemption Value* | *8.16%* | *13.58%* | *11.28%* |
| Inactive Wells | $18,062,741 | $615,181 | $18,677,922 |
| *Share of Exemption Value* | *18.52%* | *0.46%* | *8.11%* |
| Stripper Wells | $29,506,605 | $0 | $29,506,605 |
| *Share of Exemption Value* | *30.25%* | *0.00%* | *12.82%* |
| Horizontal Wells | $17,263,146 | $110,246,026 | $127,509,171 |
| *Share of Exemption Value* | *17.70%* | *83.09%* | *55.38%* |
| Deep Wells | $5,123,026 | $3,799,566 | $8,922,592 |
| *Share of Exemption Value* | *5.25%* | *2.86%* | *3.88%* |
| Tertiary Wells | $19,634,560 | $0 | $19,634,560 |
| *Share of Exemption Value* | *20.13%* | *0.00%* | *8.53%* |

Source: Louisiana Department of Revenue; Annual Report and Tax Ememption Budget. The five year average is calculated using 2014-2018. Potential Revenue estimated by combining the values of Severance Tax Revenue Received and Severance Tax Revenue Loss.

### Figure 9-2: Value of State Severance Tax Exemptions Relative to Total Tax Collections

Source: State of Louisiana Tax Exempt Budget and Louisiana Department of Revenue Annual Reports



# 10 | Differential Tax Rate for Oil and Natural Gas

Oil is taxed at approximately three times the rate of natural gas in Louisiana. This large difference is not observed in other states. A basic question that we need to ask is: Does this differential still serve any purpose and, if so, what purpose?

As previously mentioned, oil is taxed at approximately 12.5 percent of its value, while natural gas is taxed at approximately 4 percent. This differential tax rate was determined in the 1970s under very different market conditions with respect to federal policies on oil and natural gas pricing. This is not necessarily problematic per se, but it certainly opens up a discussion about the appropriateness of the policy in 2020 given the fundamental changes that have taken place in oil and gas markets since the 1970s as noted previously in the report.

After our analysis of the tax differentials, we have identified several potential distortions that taxing at different rates can cause. Further, a survey of other states reveals that Louisiana is unique in taxing oil at approximately three times the rate of natural gas. In fact, our neighbor Texas taxes natural gas at a *higher rate* than oil (4.6 percent of oil and 7.5 percent for natural gas).[48] Most other states tax oil and natural gas at approximately the same rate.

Leveling the rates would be a major change in oil and gas tax policy and might only be justified if there are meaningful economic benefits to the state, but it is appropriate to carefully explore such changes and to consider processes to implement such changes if the benefits are deemed sufficient.

## 10.1 Potential Benefits of Leveling Oil and Gas Tax Rate

### 10.1.1 Less Distorting

The potential benefit of having the same (or closer to the same) tax rate for oil and natural gas is that there will be less distorting incentives between production of the two hydrocarbons. The first potential distortion caused by a difference in tax rates for oil and natural gas is on what hydrocarbons producers decide to pursue. This can impact what areas of the state are developed, which part of a specific play (i.e. areas that have more oil or more gas) and the specific drilling strategies in a reservoir. Investment decisions should be made based on the economics of the cost to produce and value of these resources—not differences in tax rates. In other words, we want the tax structure to be as neutral as possible in terms of the investment decisions to be made.

The second potential distortion comes from the Louisiana and Texas border. While Louisiana and Texas on average have historically had similar tax burdens on oil and gas companies (Pulsipher, 1991a; Pulsipher, 1991b; Pulsipher, Baumann & Iledare, 1993), the way in which the taxes are implemented is very different. Louisiana taxes oil at 12.5 percent and natural gas at approximately 4 percent (indexed to value as previously mentioned). Texas, on the other hand taxes oil at 4.6 percent and gas at 7.5 percent but also taxes the reserves of oil and gas still in the ground as property. Thus, while on average the tax burden might be similar, the relative burden on oil and gas are quite different. In particular, at the state line, a company might be incented to drill for oil on the Texas side of the border. Leveling the tax rate for oil and natural gas could reduce this distortion. Obviously, Louisiana controls only its tax rates.

[48] As previously discussed, Texas also has an ad valorem tax on reserves in the ground, which Louisiana does not have.

### 10.1.2 Equity Concerns

The concept of horizontal equity implies that a tax code should give the same treatment to individuals or companies that are in similar situations, assuming all other economic factors are the same. In the 1970s all other factors affecting oil and natural gas were not the same so it might have made economic sense to have different tax rates. In 2020 the market factors are essentially the same. Differential tax rates are not justified by market and/or federal policies differences. Taxing the production of oil at three times the rate of natural gas creates concerns around horizontal equity.

## 10.2 Potential Challenge of Leveling Oil and Gas Tax Rate

### 10.2.1 Transition

The most challenging aspect of any major change in oil and gas tax rates is that the state has been working with the current tax structure for approximately 50 years. Long-term decisions have been made by oil and gas producers, and the tax incidence has been incorporated into these decisions. Unlike a lease for which the terms of the lease do not change, oil and gas producers have no right to rely on a particular regulatory regime or tax structure (Martin, 1993). Although this is legally the case, both equity concerns and economic frictions can be created if tax rates are changed for producers that have already made an investment decision. This challenge does not suggest that leveling oil and gas tax rates is impossible or not necessarily in the state's long-term best interest, but it does suggest we have to be aware of short-term adjustment frictions.

For this reason, any changes to tax rates should be made on production from new activity. This will mitigate concerns about creating uncertainty for the business community but will also make any changes to the state's revenues a relatively smooth transition. Special attention should be paid to the Haynesville shale, given that it would experience both the removal of the horizontal drilling exemption and a higher tax rate under these proposals. This transition will be considered in drafting sample legislation. The potential disadvantage to applying new tax rate on new activity only is the increased administrative burden of defining how new activity for tax purposes and documenting production under the different tax regimes. This, in and of itself, could open up additional auditing questions that should be considered.

### 10.2.2 Relative Elasticity of Supply

One question raised in this report is whether the production of oil and natural gas are relatively sensitive to changes in tax rates. Economists refer to this concept as the elasticity of supply. Specifically, the elasticity of supply is defined as the percent change in the quantity suppled in response to a percent change in the price received by the producer. If supply is very elastic, then policy makers should be careful not to raise taxes too high, as the tax burden might reduce production so much that the revenues actually decrease when the tax rate increases. But on the other hand, if the elasticity of supply is relatively *inelastic*, then a change in tax rates will have a relatively small impact on the production.

Results in Section 7 present estimates of the elasticity of supply for both oil and natural gas in Louisiana. The results are twofold: (1) Consistent with the academic literature we find that supply of both oil and natural gas are relatively inelastic in the long run; (2) Oil and natural gas in Louisiana have approximately the same elasticity of supply. Thus, for purposes of our analysis, we will assume that the relative price elasticity of oil and natural gas is the same.

### 10.2.3 Downstream Impacts and Tax Incidence

One potential concern of leveling the tax rate on oil and natural gas is that it might impact the current investment boom in the refining and petrochemical industry in Louisiana. According to the *Gulf Coast Energy Outlook*, since 2011 Louisiana has had more than $62 billion in investments in refining and chemical manufacturing. Perhaps a change in the tax rate of oil and natural gas production could impact these downstream industries. While no empirical analysis is conducted to address this concern directly, we find this concern minimal. Louisiana accounts for a small share of both oil and natural gas production and these products are sold into a competitive global marketplace; economists refer to producers therefore as a “price taker.” Empirical studies have shown that oil markets have converged over time globally (Plante & Strickler, 2019), and that price differences that are observed can be explained by transportation bottlenecks (Agerton & Upton, 2019). Thus, it is unlikely that a change in the tax rate on severance tax will have a meaningful impact on this investment. The burden of the taxes would more plausibly be borne by the oil and gas producers and landowners.

## 10.3 Breakeven Tax Rate

In this section, we empirically examine the leveling of the tax rate for oil and natural gas. The goal is to calculate a tax rate that would bring in approximately the same amount of revenues for the state while taxing both oil and natural gas at the same rate and removing exemptions. Before embarking on these estimates, though, it is important to be upfront about three facts.

### 10.3.1 Revenue Neutrality

Any tax changes that are meant to be revenue neutral will by definition increase tax liability for some taxpayers and decrease tax liability for others. Therefore, a position that taxes must not increase for *any* taxpayer is inherently contradictory to the fundamental concept of broad based, low rate, and revenue neutral tax reform. Tax reform that lowers taxes for some taxpayers and does not increase taxes for others will inherently reduce revenues for the state. In this specific context, leveling the tax rate for oil and natural gas will by definition *increase* the rate for natural gas and *decrease* the rate for oil. Producers that focus on oil will be impacted differently than those that focus on natural gas.

### 10.3.2 Forecasting Precision

Predicting the future is inherently difficult. There are simply too many factors that are out of the control of the forecaster. What if the Austin Chalk or Tuscaloosa Marine Shale in central Louisiana experiences a Haynesville like boom over the next few years? What if technological advancements lead to an increase in conventional production in southern Louisiana? What if deep wells become responsible for the growth in production in coming decades? Severance tax revenues, and differences in tax revenues under different tax regimes, will be impacted based on these different scenarios. For this reason, we take a historical approach to analysis.

### 10.3.3 Short Run and Long Run Effects Can Be Different

The revenue estimating process and fiscal notes produced by the Legislative Fiscal Office inherently are short-term in nature. Both Revenue Estimate Conference (REC) projections and fiscal notes are projected for five years. Particular attention is paid to the budget for the current and upcoming fiscal years as to minimizing mid-year surpluses or deficits.

But unlike the state's revenue forecasting and budgeting process, the goal of this analysis is not for specific revenue estimation in a given year; instead we take a long-term view. For this reason, the breakeven rate analysis will consider long-time horizons and how a change in the tax code today will impact revenues in the long run. This is important to state upfront, as a revenue neutral change in the long run will have positive and negative impacts on collections in specific years. As shown in Section 4 of this report, Louisiana's tax burden is on average competitive relative to other states. The goal of these recommendations is to keep this tax burden at approximately this level.

### 10.3.4 Calculating Breakeven Tax Rate

The goal is to find a relatively low tax rate that is the same for both oil and natural gas while simultaneously removing exemptions. This is consistent with the broad base and low rate mentality. We will consider a long-time horizon that will bring in approximately the same amount of revenues. No specific assumptions will be implemented for future production trends in this analysis.

Oil is currently taxed at 12.5 percent, while natural gas is taxed at approximately 4 percent indexed to prior prices. The goal is to estimate the tax rate (that will necessarily fall between 4 percent and 12.5 percent) that if assessed on both oil and natural gas would yield approximately the same amount of revenues for the state.

In Appendix A2, we present some algebra on how to estimate this breakeven tax rate. Results of this algebra yield equation (10.1).

$$\tau = \frac{R}{\sum_{O,G} V_{O,G}(1-E_{O,G})} \qquad (10.1)$$

This formula simply states that the tax rate is the desired revenues divided by the value of oil and gas produced that is subject to severance tax. Where $R$ is the desired revenues to be collected by the state, $V_{O,G}$ is the value of oil and natural gas produced, respectively (where value is defined as the quantity produced times the market price) and $E_{O,G}$ is the percent of oil and natural gas production value that is excluded, exempt or deducted from taxation. This simple formula is convenient in that the state's revenues from severance taxes, the quantity and price of oil and natural gas, and the value of exclusions, exemptions and deductions are all known information in prior years. This allows us to estimate the tax rate, $\tau$, needed to achieve that level of revenues, $R$. We can also estimate how much lower the rate could be if exemptions are removed.

### 10.3.5 Breakeven Tax Rate Results

Results from this analysis are presented in Table 10-1. We present three time periods of analysis; 1992-1999, 2000-2009, and 2010-2018.[49] We consider three scenarios; (1) All exemptions are removed. (2) All exemptions are removed except stripper and incapable wells exemptions. (3) No changes to

[49] Due to data availability, conducting this analysis consistently pre fiscal year 1992 was not feasible.

current exemptions.

Calculations in Table 10-1 are made as follows: Revenue from equation (10.1) is the total revenue from severance tax (available for oil and natural gas) by fiscal year from Louisiana Department of Revenue Annual Reports. The value of production for oil and natural gas is estimated by multiplying the oil and natural gas production, from Louisiana Department of Natural Resources, times the severance tax price of oil and spot market average price for natural gas. Specific calculations on exclusions, exemptions and deductions are discussed and shown in Appendix A2.

Column (1) calculates the tax rate needed if all state-imposed exemptions are removed. The tax rate for both oil and natural gas in the long run needed to bring in equivalent revenues is 5.5 percent. We note that the tax rate with all state exemptions removed in the most recent decade is 5.2 percent, while in the 1990s was 6.7 percent. This is due to the changing share of oil relative to natural gas being produced and relative prices of oil and natural gas.

Column (2) considers a case where all state-imposed exemptions are removed except for the stripper and incapable well exemptions. In this scenario, the average tax rate needed would be approximately 6 percent. In the most recent decade, the estimated breakeven rate under this scenario is 5.6 percent.

Column (3) considers no change to the tax structure except to tax oil and natural gas at the same rate. The long run tax rate would need to be 7.1 percent historically, but this rate in the most recent decade is 7.7 percent.

Our recommendation is to remove all state-imposed exemptions except for stripper and incapable well exemptions. We reach this conclusion for several reasons. First, Louisiana is not unique in having severance tax exemptions on marginal wells. Thus, keeping these exemptions will keep Louisiana more in line with other states. Second, keeping these exemptions has a relatively small impact on the overall tax rate needed to break even. Third, these marginal well exemptions have been part of Louisiana's tax code for decades.

**Table 10-1: Levelized Severance Tax Rate for Oil and Natural Gas**

| | All State Exemptions Removed | Keeping Only Stripper/Incapable Exemptions | No Change to Exemptions |
|---|---|---|---|
| | (1) | (2) | (3) |
| All Years | 5.5% | 5.9% | 7.1% |
| 1992 - 1999 | 6.7% | 7.1% | 7.5% |
| 2000 - 2009 | 5.4% | 5.8% | 6.3% |
| 2010 - 2018 | 5.2% | 5.6% | 7.7% |

**Recommendation: Remove all exemptions except for stripper and incapable wells and set tax rate for both oil and natural gas as to be approximately revenue neutral in the long run.**

# 11 | Conclusions and Recommendations

It has been three decades since significant changes were made to Louisiana's natural gas tax structure and five decades since any significant changes in the state's oil tax structure. The purpose of this report is to assess the current tax structure and propose specific recommendations. This report is in response to Senate Concurrent Resolution 4 of the 2018 second extraordinary session and is a continuation of work from the Task Force on Structural Changes in Budget and Tax Policy created by House Concurrent Resolution 11 of the first extraordinary session of 2016. After meetings with public and private stakeholders, reviewing the literature on the taxation of oil and gas, and analysis of statistical information, we present the following recommendations on how the legislature might simplify and improve the tax system:

**Major Recommendations:**

We recommend the following:

1. Institute an equivalent volumetric tax rate for oil and natural gas with rate to be established semi-annually;
2. Remove exemptions associated with horizontal drilling, tertiary wells, and deep wells for new activity;
3. Implement recommendations (1) and (2) simultaneously while maintaining revenue neutrality with respect to current severance tax projections;
4. Implement the new severance tax rates for oil and gas production from new activity; activity originated before tax law change will comply with the current tax structure.

These recommendations are consistent with a broad base and low rate philosophy, revenue neutrality for severance tax collections, and administrative efficiency.

**Alternative Recommendations:**

- Establish a volumetric tax rate for oil with the rate to be established semi-annually;
- Remove the verbiage "posted field price" from R.S. 47:633 (7);
- Review and simplify the calculation of the volumetric rate for natural gas and establish the rate semi-annually;
- Remove exemptions associated with horizontal drilling, tertiary wells, and deep wells while maintaining revenue neutrality with respect to current severance tax projections.

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# A1 | Natural Gas Volumetric Rate Calculations

The natural gas severance tax is computed yearly by DNR as specified in R.S. 47:633(9)(d)(i). The calculation begins with a base rate of $0.07 per MCF of natural gas and is adjusted annually on July 1st for the ensuing twelve calendar months. Specifically, the formula used to calculate the severance tax rate per MCF of natural gas produced is:

$$\tau_{MCF} = BST\frac{P_{PY}}{P_{BY}} \qquad \text{(A1.1)}$$

$\tau_{MCF}$ is the tax per MCF of natural gas severed. $BST$ is the base natural gas severance tax rate which is $0.07/MCF and does not change over time. The numerator, $P_{PY}$ is the present year price and is calculated as the average of the New York Mercantile Exchange (NYMEX) Henry Hub settled price on the last trading day for the month, as reported in the Wall Street Journal for the previous twelve-month period ending on March thirty-first. The denominator, $P_{BY}$, is base year price and is calculated as the average of the monthly average spot market price of gas fuels delivered into the pipelines in Louisiana as reported by the Natural Gas Clearing House for the twelve-month period ending March 31, 1990. This is $1.7446/MMBTU and does not change over time.

Thus, the only item that changes from year to year in this calculation is the present year price, which can be described simply as the average price in the preceding fiscal year.

The Secretary publishes both the "gas base rate adjustment" and the "gas tax rate" by May first of each year for the following fiscal year that begins on July 1st.

**Example: Fiscal Year 2018-2019 Natural Gas Severance Tax Rate**

$BST$ = $0.07 (does not change over time)

$P_{BY}$ = $1.7446 (does not change over time)

$P_{PY}$ = $3.030 (updated yearly)

Where $P_{PY}$ is the average NYMEX Henry Hub natural gas spot price per MMBTU on the last day of each month from April of 2017 to March of 2018. The value of $P_{PY}$ was $3.030/MMBTU according to FY18-19 Severance Tax Letter Attachment 1 published by DNR.

$$\$0.07\ \frac{P_{PY}}{1.7446} = \tau_{MCF} = \$0.1216 \qquad \text{(A1.2)}$$

Therefore, the natural gas tax rate is $0.1216 per MCF for natural gas production in the 2018-2019 fiscal year which runs from July 1st 2018 to June 31st 2019.

**Simplification**

Rearranging (A1.2) with basic algebra, we find that

$$\frac{\$0.07}{\$1.7446} = \frac{\tau_{MCF}}{P_{PY}}$$

Where $\frac{\$0.07}{\$1.7446}$ = .040123810615614. And $\frac{\tau_{MCF}}{P_{PY}}$ can be interpreted as the tax rate as a percent of the present year market prices. Thus, in words, the natural gas tax rate is simply 4.01238%. R.S. 47:633(9)(d)(i) can be simplified considerably to state a tax rate to be applied to an average market price.

# A2 | Breakeven Tax Rate Appendix

### A 2.1 Base Case: No Exemptions

Revenues are the sum of the value of oil and gas production multiplied by the tax rate on each respectively.

$$R = P_O Q_O t_O + P_G Q_G t_G \qquad \text{(A2.1)}$$

For simplicity, we write $V_O \equiv P_O Q_O$ and $V_G \equiv P_G Q_G$ . This states that the value of oil and gas is the price of the commodity times the quantity produced. Rewriting (A2.1), we get:

$$R = V_O t_O + V_G t_G \qquad \text{(A2.2)}$$

We want to choose a tax rate $\tau$, that is the same for oil and natural gas. Because oil is taxed at 12.5 percent and gas at approximately 4 percent, $\tau_o > \tau > \tau_g$. We can write the change in tax revenues that will come from a change in the tax rate to $\tau$ as follows:

$$\Delta R = V_O \frac{(\tau - \tau_O)}{\varepsilon_O} + V_g \frac{(\tau - \tau_G)}{\varepsilon_G} \qquad \text{(A2.3)}$$

Where $\varepsilon_o$ and $\varepsilon_g$ are the long run elasticity of supply associated with a change in the price received by the producer. From Section 7 of the paper, we conclude that the supply elasticity of oil and gas are approximately the same, therefore $\varepsilon_o = \varepsilon_g$. We want to choose $\tau$ such that revenues do not change, i.e. $\Delta R = 0$. Doing some algebra:

$$0 = V_O(\tau - \tau_O) + V_G(\tau - \tau_G)$$

Because $\tau_o > \tau > \tau_g$, we can re-write this as:

$$0 = -V_O(\tau_O - \tau) + V_G(\tau - \tau_G)$$

$$V_O(\tau_O - \tau) = V_G(\tau - \tau_G)$$

$$V_O \tau_O - V_O \tau = V_G \tau - V_G \tau_G$$

$$V_O \tau_O + V_G \tau_G = V_G \tau + V_O \tau$$

$$V_O \tau_O + V_G \tau_G = \tau(V_G + V_O)$$

$$\tau = \frac{V_O \tau_O + V_G \tau_G}{V_O + V_G} \qquad \text{(A2.4)}$$

Where $V_o + V_G = V$. In words, the total value of production is the sum of the value of oil and value of gas. We can also write $V_O \tau_O + V_G \tau_G = R$, meaning that the value of this oil and gas times their respective tax rates is the revenues received by state government. Thus, if we want to choose a tax rate $\tau$, to collect revenues, $R$, we simply divide the desired revenues by the value of oil and gas produced.

$$\tau = \frac{R}{V} \qquad \text{(A2.5)}$$

### A 2.2 Exclusions and Exemptions

In reality though, not all oil and gas is taxed at the full rate. Some of this oil and natural gas is either excluded or exempt from severance tax. Some of the production is taxed at a reduced rate. To encompass these exemptions:

$$R = V_O(1 - E_O)t_O + V_G(1 - E_G)t_G \qquad \text{(A2.6)}$$

Where $E_O$ and $E_G$ are the percent of the value of oil and natural gas respectively that are exempt from severance tax. This could include some production at a reduced rate, and other production at no rate. All of these exemptions are encompassed in $E_O$ and $E_G$ where $0 > E_{O,G} > 1$. If none of the oil or gas is exempt, this reduces into the base case with no exemptions in (A2) above.

We can now conduct the same algebra to calculate the breakeven tax rate. We can also consider a breakeven tax rate with the current level of exemptions kept as well as if all exemptions are removed. We will be interested in answering the following question: *What is the lowest tax rate that can be set to keep revenues the same if all exemptions are removed?*

$$\Delta R = V_O \frac{(1-E_O)(\tau - \tau_O)}{\varepsilon_O} + V_g \frac{(1-E_G)(\tau - \tau_G)}{\varepsilon_G} \qquad \text{(A2.7)}$$

After a review of the literature and analysis, we find that elasticity of supply with respect to changes in exemptions and tax rates are approximately the same. If, for instance, horizontal wells, deep wells, stripper wells, etc., are more or less sensitive to tax burden than wells taxed at the full rate, then the algebra would be complicated and empirical estimates would require specific estimates of the sensitivity of production to each exemption considered.

Setting $\varepsilon_G = \varepsilon_G$, we solve for the tax rate $\tau$ that will be revenue neutral; $\Delta R = 0$.

Again, doing some algebra:

$$0 = V_O(1 - E_O)(\tau - \tau_O) + V_G(1 - E_G)(\tau - \tau_G)$$

Because $\tau_o > \tau > \tau_g$, we can re-write this as:

$$0 = -V_O(1 - E_O)(\tau_O - \tau) + V_G(1 - E_G)(\tau - \tau_G)$$

$$V_O(1 - E_O)(\tau_O - \tau) = V_G(1 - E_G)(\tau - \tau_G)$$

$$V_O(1 - E_O)\tau_O - V_O(1 - E_O)\tau = V_G(1 - E_G)\tau - V_G(1 - E_G)\tau_G$$

$$V_O(1 - E_O)\tau_O + V_G(1 - E_G)\tau_G = V_G(1 - E_G)\tau + V_O(1 - E_O)\tau$$

$$V_O(1 - E_O)\tau_O + V_G(1 - E_G)\tau_G = \tau[V_O(1 - E_O) + V_G(1 - E_G)]$$

$$\tau = \frac{V_O(1-E_O)\tau_O + V_G(1-E_G)\tau_G}{(1-E_O)V_O + (1-E_G)V_G} \qquad \text{(A2.8)}$$

Equation (A2.8) is the corollary to (A2.4), but with the exemptions taken into account. If we want to choose a tax rate to get a specific amount of revenue, we will choose $\tau$ such that:

$$\tau = \frac{R}{\sum_{O,G} V_{O,G}(1-E_{O,G})} \qquad \text{(A2.9)}$$

This is intuitive. As the share of oil and gas exempt increase, this will reduce the magnitude of the denominator, therefore increasing the tax rate needed to achieve that level of revenue. Consider the extreme where $E_{O,G} \to 1$, $\sum_{O,G} V_{O,G}(1 - E_{O,G}) \to 0$, and therefore tax rate would need to be very large; as more value is exempt, the rate on non-exempt production must be higher. Of course, the tax rate is bound by $\tau \leq 100\%$. And at a tax rate of 100%, production of oil and natural gas would certainly reduce to, essentially, zero. Thus, this can be thought of as the breakeven tax rate within reasonable values of $12.5\% > \tau > 4\%$.

### A 2.3 Empirical Estimates

In section 10, we present empirical estimates of the tax rate needed on both oil and natural gas that would be revenue neutral for the state. Three specific scenarios are considered. (1) All state-imposed exemptions are removed, (2) all state-imposed exemptions are removed less stripper and incapable well exemptions, and (3) there are no changes to exemptions.

In order to estimate these values, we consider Equation (A2.10) adapted from (A2.9) above.

$$\tau = \frac{R}{V(1-E)} \qquad \text{(A2.10)}$$

Where again $\tau$ is the tax rate that would be needed to be imposed on both oil and natural gas in order to bring in Revenues, $R$. Specifically, revenues come directly from the Louisiana Department of Revenues Annual Tax Collection Reports. We include the total severance tax receipts for both oil and natural gas. Severance tax from timber and minerals are not included in this analysis.

The value of oil and natural gas is calculated from the Louisiana Department of Natural Resources website.[50] We refer to Table numbers below from Louisiana Energy Facts and Figures from DNR's Technology Assessment Division.

Oil production is Louisiana State Crude Oil and Condensate Production (Excluding OCS) from Table 4. Natural Gas production includes Louisiana State Gas Production, Wet, after lease separation from Table 11. This includes both natural gas and casinghead gas and excludes OCS production.

In order to estimate the value of production, we multiply these production values times the average price received. For oil prices, we use the severance tax prices of oil reported on Table 17. For natural gas we use the average spot market prices from Table 19. We multiply monthly values of production times prices to obtain the estimated value of oil and gas produced.

In Table 10-1, $R$ and $V$ are the same across columns (1) – (3). What changes is the different share of value of production that is not taxed, $E$. We calculate $E$ in each of the scenarios. These calculations are shown in Table A2-1.

We calculate three values of exemptions yearly. All data on exemptions comes from the Tax Exempt Budget. The calculations used to arrive at Table 9-1 are shown in Appendix Table A2-1 corresponding to Equation A2.10.

[50] Data on prices and production are periodically updated. These data were pulled on February 4, 2020.

### Table A2-1: Levelized Severance Tax Rate for Oil and Natural Gas

| | All State Exemptions Removed | Keeping Only Stripper/Incapable Exemptions | No Change to Exemptions |
|---|---|---|---|
| | (1) | (2) | (3) |
| | Severance Tax Revenue Received *(R)* | | |
| All Years | | $15,166,729,448 | |
| 1992 - 1999 | | $2,929,415,712 | |
| 2000 - 2009 | | $6,286,879,804 | |
| 2010 - 2018 | | $5,950,433,932 | |
| | Estimated Value of Production *(V)* | | |
| All Years | | $279,541,165,088 | |
| 1992 - 1999 | | $44,842,735,296 | |
| 2000 - 2009 | | $118,352,479,840 | |
| 2010 - 2018 | | $116,345,949,952 | |
| | Share of Value Subject to Tax $(1 - E)$ | | |
| All Years | 98.49% | 91.89% | 76.83% |
| 1992 - 1999 | 97.44% | 92.46% | 87.65% |
| 2000 - 2009 | 98.40% | 91.55% | 84.92% |
| 2010 - 2018 | 98.95% | 91.96% | 66.15% |
| | Breakeven Tax Rate $(\tau)$ | | |
| All Years | 5.5% | 5.9% | 7.1% |
| 1992 - 1999 | 6.7% | 7.1% | 7.5% |
| 2000 - 2009 | 5.4% | 5.8% | 6.3% |
| 2010 - 2018 | 5.2% | 5.6% | 7.7% |

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- Steve Sheffrin. Professor of Economics and Director of the Murphy Institute. Tulane University. Member of the Louisiana Tax Institute.
- Phyllis Sims. Attorney. Kean Miller.
- Eric Smith. Interim Director. Tulane Energy Institute.
- Ben Vincent. Economist. Legislative Fiscal Office.

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