Small-Tract Mineral Owners vs. Producers: The Unintended Consequences of Well-Spacing Exceptions

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October 25, 2016
Introduction to Well Spacing

• Mineral rights owners in Texas protected by well-spacing laws which prohibit drilling near property boundaries

• However, Texas could a grant spacing exception to a producer that can’t negotiate a lease with a mineral owner for any reason

• Spacing exception allows producer to drill close enough to unleased property to capture oil and gas (no compensation required)
Question:

- What is the effect of spacing exceptions on royalty rates?

Answer:

- Spacing exceptions have lowered royalty rates paid to mineral owners

Intuition:

- You are a landowner
- Nearby owners recently lost oil and gas because of a spacing exception
- Will you play hardball in negotiations, or just accept whatever royalty rate the producer offers?
Who Cares?

- Spacing exceptions are rising
- This determines how oil and gas revenue pie is split
  - \( \sim 4 \) million people receive royalty checks in Texas
  - Billions of dollars paid annually in royalties
  - Energy producers use exceptions to pay less to poor old retirees living off royalties
Outline

1. Introduction
2. Texas Well Spacing Law
3. Theoretical Model
4. Empirical Model
5. Conclusion and Policy Implications
Texas Well Spacing Law

- Imagine a producer wants to extract oil and gas beneath properties owned by A and B
- Texas law encourages producers to negotiate lease agreements with A and B
- A negotiates a lease with the producer

- B is unwilling/unavailable to negotiate a lease

- Rule 37: Producer can’t drill within 467 feet of the property line

  - Prevents uncompensated capture of B’s oil and gas
• Producer has two options:

1. Drill away from the property boundary

2. Apply for a well-spacing exception

   • Protesting costly, if no protest, spacing exception automatically granted
• A spacing exception removes all spacing restrictions on A’s property

• Producer can drill anywhere on A’s property (and capture B’s oil and gas)

• B would not be compensated
Why have well-spacing laws?

- Avoid inefficiency

- Protect mineral owner’s property rights by preventing uncompensated capture through drainage
Why have well-spacing exceptions?

- Avoid inefficiency
- RRC’s charge, “Prevent waste of the state’s natural resources.”
- A single holdout could prevent a multi-million dollar energy development project
Well-Spacing Exceptions Rising

Source: Texas Railroad Commission
Exceptions as a Share of Permits Jumped

Source: Texas Railroad Commission
Fraction of Spacing Exceptions for Horizontal Wells

Horizontal wells driving exception increase

Source: Texas Railroad Commission, Author's calculations
Model of Oil and Gas Leasing

- Three agents (1 owner and 2 producers) and two periods (1 and 2)
- Mineral rights owner can lease to a producer in period 1 or period 2
- In period 1, owner receives royalty offer of $R_1$ from producer
- Owner can accept offer, or hold out until period 2 and accept $R_2$ from another producer
Let,

- $E_1[R_2]$ be the expected value of $R_2$ in period 1
- $r$ be the interest rate

The owner will lease in period 1 if

$$R_1 \geq \frac{1}{1 + r} E_1[R_2]$$

(1)

Otherwise the owner waits until period 2 to lease
Adding Spacing Exceptions

Producer can seek spacing exception in period 1 if owner holds out for a better royalty offer

\( \rho \): Probability producer granted spacing exception \((0 < \rho < 1)\)

- with probability \( \rho \): holdout owner receives no compensation
- with probability \( (1 - \rho) \): holdout owner receives \( R_2 \) in period 2
Facing a spacing exception, the mineral rights owner leases if

\[ R_1 \geq \frac{1}{1 + r} E_1[(1 - \rho)R_2] + \rho \cdot 0 \]  

(2)

For all \( \rho > 0 \),

\[ \frac{1}{1 + r} E_1[(1 - \rho)R_2] < \frac{1}{1 + r} E_1[R_2] \]

with spacing exceptions

without spacing exceptions

(3)

**Testable Implication:** Owners facing a large \( \rho \) will accept lower royalty rates than owners facing a small/zero \( \rho \)
**Note:** This only applies to small-tract owners

- Small Tract: a tract which loses a *significant* portion of its oil and gas to a spacing-exception

- The value of small-tract mineral rights are exceeded by the costs of a prolonged exception fight (time, travel, legal fees, etc.)

Large tracts do not face the same threat from spacing exceptions

- Large tract: a tract which maintains much of its value despite exception

- The value of large-tract mineral rights larger than cost of fighting exception
Data

Texas, 2000-2015

- Lease-level Data for 184,000 small tracts in Texas from DrillingInfo (royalty rate, location, acres, etc.)

- Counts of well-spacing exceptions and drilling permits by date and county from RRC of Texas

- County-level characteristics, land use from USDA

- Oil price data from EIA
<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min.</th>
<th>Max.</th>
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<tbody>
<tr>
<td><strong>Dependent Variable</strong></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Royalty Rate</td>
<td>0.22</td>
<td>0.03</td>
<td>0.002</td>
<td>0.4</td>
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<td><strong>Main Explanatory Variable</strong></td>
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<td>Rule 37 Exceptions</td>
<td>10.933</td>
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<tr>
<td><strong>Instrument</strong></td>
<td></td>
<td></td>
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<tr>
<td>Miles to Austin</td>
<td>175.31</td>
<td>33.18</td>
<td>40.35</td>
<td>490.67</td>
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<td><strong>Control Variables</strong></td>
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<tr>
<td>Acres</td>
<td>0.64</td>
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<td>1</td>
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<td>0</td>
<td>1</td>
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<tr>
<td>Eagle Ford Shale</td>
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<td>Barnett Shale</td>
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<td>Haynesville Shale</td>
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<td>WTI Price (real $)</td>
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<td>10.44</td>
<td>10.4</td>
<td>62.44</td>
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<td><strong>Observations</strong></td>
<td></td>
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<td></td>
<td>184,091</td>
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</table>
I want to estimate this relationship

\[
royalty_{i,t} = \alpha + \beta \text{ spacing exceptions}_{i,t} + \theta X_{i,t} + \nu_{i,t}
\]  \hspace{1cm} (4)

- \(royalty_{i,t}\): is the royalty rate negotiated for lease \(i\) at time \(t\)
- \(\text{spacing exceptions}_{i,t}\): share of wells near lease granted spacing exceptions
- \(X_{i,t}\): lease-, county-level controls, exogenous determinants of royalty rates

Theory model predicts spacing exception coefficient (\(\beta\)) will be negative
Why not just estimate with least squares?

Reverse Causality

• Suppose an area has mineral owners hold out if not paid high royalty rates which increases spacing exceptions

• Least squares estimate of Equation (4) would have positive bias

• Even if these spacing exceptions cause owners to accept lower royalty rates, I could find that frequent spacing exceptions are associated with high royalty rates
IV Model

Instrument for Spacing Exceptions: Distance from Austin

- Mineral rights owners have 10 days to protest an exception in person at an RRC hearing in Austin, Texas

- Cost of objecting increases with owner’s distance from Austin (San Antonio vs. Amarillo)

- Unchallenged spacing exception petition are (essentially) granted automatically

Claim:

- As cost of challenge ↑, likelihood of spacing exception ↑

- Distance from Austin otherwise uncorrelated with royalty rates
Spacing exceptions by distance from Austin

Source: Texas Railroad Commission, Author's calculations
IV Model: First Stage

Rule 37_{i,t} = \alpha + \gamma \text{dis}_{i} + \eta_{i,t} + \varepsilon_{i,t}

- Rule 37_{i,t}: share of exceptions by county/month (lagged, MA)
- dis_{i}: Distance from lease to Austin, in miles
- \eta_{i,t}: Includes geographic factors that co-vary with distance from RRC
  - Urban-Rural indicators, Long/Lat, shale formation indicators (Permian, Eagle Ford, Barnett, and Haynesville)
  - WTI spot price (real)
  - Tract size
  - Month, year fixed effects
## Empirical Model

### Dependent Variable: Rule 37 Exception Rate by County

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
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<tbody>
<tr>
<td>Distance to RRC</td>
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<td>0.000313***</td>
<td>0.000394***</td>
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<td></td>
<td>(9.25e-06)</td>
<td>(1.18e-05)</td>
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<tr>
<td>Permian</td>
<td>-0.00726**</td>
<td>0.00839**</td>
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<td></td>
<td>(0.00294)</td>
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<td></td>
<td>(0.00218)</td>
<td>(0.00317)</td>
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<td>Barnett</td>
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<td>-0.0275***</td>
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<tr>
<td></td>
<td>(0.00179)</td>
<td>(0.00287)</td>
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<tr>
<td>Haynesville</td>
<td>0.0314***</td>
<td>0.0405***</td>
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</tr>
<tr>
<td></td>
<td>(0.00220)</td>
<td>(0.00372)</td>
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<tr>
<td>WTI</td>
<td>0.000434***</td>
<td>0.000486***</td>
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<tr>
<td></td>
<td>(2.00e-05)</td>
<td>(1.95e-05)</td>
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</tbody>
</table>

### Other Variables

- Month-Year FE: NO, YES, YES
- Rural-Urban FE: NO, YES, YES
- Observations: 183,802, 183,802, 149,833
- R-squared: 0.048, 0.411, 0.491
- Sample: 0-5 Acres, 0-5 Acres, 0-1 Acres

Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
IV Model: Second Stage

\[ \text{royalty}_{i,t} = \theta + \beta \text{Rule 37}_{i,t} + \eta_t + \theta_{i,t} \]

- Royalty\(_{i,t}\): Lease-level royalty rates
- \(\text{Rule 37}_{i,t}\): Spacing exception predictions from first-stage using distance from Austin instrument
- \(\eta_{i,t}\): Controls
# Why are Royalty Rates in the Permian and Eagle Ford Higher than in Other Basins?

## Introduction

In recent years, the oil and gas industry has undergone significant changes, particularly in the Permian and Eagle Ford basins. This study aims to explore the factors contributing to higher royalty rates in these regions compared to other basins such as the Barnett and Haynesville. The research employs econometric models to understand the impact of various factors on royalty rates.

## Data

The dataset consists of 183,466 observations across different wells and time periods. The sample is restricted to wells within 0-5 Acres, with robust standard errors reported in parentheses. The significance levels are indicated as follows: *** p<0.01, ** p<0.05, * p<0.1.

## Empirical Model

### Dependent Variable: Royalty Rate

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rule 37</td>
<td>-0.178***</td>
<td>-0.0216***</td>
<td>-0.0400***</td>
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<tr>
<td>Permian</td>
<td>0.0156***</td>
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<td>Eagle Ford</td>
<td>0.0122***</td>
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<td>Barnett</td>
<td>0.0231***</td>
<td>0.0255***</td>
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<td>Haynesville</td>
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<tr>
<td>WTI</td>
<td>0.000517***</td>
<td>0.000524***</td>
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</tbody>
</table>

- Robust standard errors in parentheses.
- *** p<0.01, ** p<0.05, * p<0.1

### Second-Stage Estimates

- Robust standard errors in parentheses.
Economically significant?

- No effect for royalty rates within a few hundred miles of Austin

- Royalty rates further away lose 0.6 - 1.0 percentage points (bigger effects for smaller tracts)

- Mineral owner in Amarillo receives royalty payments 3-5 percent below counterpart in San Antonio because of well-spacing exception threat
Conclusion

- Horizontal drilling increased well-spacing exceptions in Texas
- These spacing exceptions cause mineral rights to accept lower royalty rates
- Trend likely to continue in near-term
  - Producers profit ↑
  - Owners profit ↓
  - State tax revenue a wash (↔)
So what?

Also a few non-obvious impacts

- Local economic multiplier for energy production ↓
  - Less money to local landowners and more money to (possibly) non-local producers

- Incentivizing inefficient production:
  - Easier to drill in suboptimal location with exception than negotiate to drill in optimal location
Solutions

Lower the cost of protesting spacing exceptions

- Allow owners to attend hearing at regional RRC offices
- Allow more than 10 days to protest
- Producer pays legal fees of owner if producer loses