19.0580.02000

# FISCAL NOTE

**Requested by Legislative Council**
**02/06/2019**

Amendment to: HB 1186

1 A. **State fiscal effect:** *Identify the state fiscal effect and the fiscal effect on agency appropriations compared to funding levels and appropriations anticipated under current law.*

| | 2017-2019 Biennium | | 2019-2021 Biennium | | 2021-2023 Biennium | |
|---|---|---|---|---|---|---|
| | General Fund | Other Funds | General Fund | Other Funds | General Fund | Other Funds |
| **Revenues** | $0 | $0 | $0 | $0 | $0 | $0 |
| **Expenditures** | $0 | $0 | $0 | $0 | $0 | $0 |
| **Appropriations** | $0 | $0 | $100,000 | $0 | $100,000 | $0 |

1 B. **County, city, school district and township fiscal effect:** *Identify the fiscal effect on the appropriate political subdivision.*

| | 2017-2019 Biennium | 2019-2021 Biennium | 2021-2023 Biennium |
|---|---|---|---|
| **Counties** | $0 | $0 | $0 |
| **Cities** | $0 | $0 | $0 |
| **School Districts** | $0 | $0 | $0 |
| **Townships** | $0 | $0 | $0 |

2 A. **Bill and fiscal impact summary:** *Provide a brief summary of the measure, including description of the provisions having fiscal impact (limited to 300 characters).*

This bill is designed as a Pilot Project that as written will impact the General Fund. The bill will allow for a limited amount of hedging to protect the state from volatile movement in oil prices.

B. **Fiscal impact sections:** *Identify and provide a brief description of the sections of the measure which have fiscal impact. Include any assumptions and comments relevant to the analysis.*

This program would have a fiscal impact of administering the program, including expenditures relating to the transactions as well as the premiums associated with entering into a hedging contract.

3. **State fiscal effect detail:** *For information shown under state fiscal effect in 1A, please:*

A. **Revenues:** *Explain the revenue amounts. Provide detail, when appropriate, for each revenue type and fund affected and any amounts included in the executive budget.*

There is no revenue associated with this legislation.

B. **Expenditures:** *Explain the expenditure amounts. Provide detail, when appropriate, for each agency, line item, and fund affected and the number of FTE positions affected.*

N/A

C. **Appropriations:** *Explain the appropriation amounts. Provide detail, when appropriate, for each agency and fund affected. Explain the relationship between the amounts shown for expenditures and appropriations. Indicate whether the appropriation or a part of the appropriation is included in the executive budget or relates to a continuing appropriation.*

Each hedge would have a premium that would vary with the amount of protection in oil price as well as the number of barrels protected. The total premiums for hedge contracts and expenses to this program will not exceed $100,000.

**Name:** Tim Porter
**Agency:** Bank of North Dakota
**Telephone:** 701-328-5650
**Date Prepared:** 02/06/2019

19.0580.01000

# FISCAL NOTE

**Requested by Legislative Council**
**01/07/2019**

Bill/Resolution No.: HB 1186

1 A. **State fiscal effect:** *Identify the state fiscal effect and the fiscal effect on agency appropriations compared to funding levels and appropriations anticipated under current law.*

| | 2017-2019 Biennium | | 2019-2021 Biennium | | 2021-2023 Biennium | |
|---|---|---|---|---|---|---|
| | General Fund | Other Funds | General Fund | Other Funds | General Fund | Other Funds |
| **Revenues** | | | | | | |
| **Expenditures** | | | | $400,000 | | $400,000 |
| **Appropriations** | | | | $95,000,000 | | $95,000,000 |

1 B. **County, city, school district and township fiscal effect:** *Identify the fiscal effect on the appropriate political subdivision.*

| | 2017-2019 Biennium | 2019-2021 Biennium | 2021-2023 Biennium |
|---|---|---|---|
| **Counties** | | | |
| **Cities** | | | |
| **School Districts** | | | |
| **Townships** | | | |

2 A. **Bill and fiscal impact summary:** *Provide a brief summary of the measure, including description of the provisions having fiscal impact (limited to 300 characters).*

This bill will allow for hedging to protect the state from volatile movement in oil prices.

B. **Fiscal impact sections:** *Identify and provide a brief description of the sections of the measure which have fiscal impact. Include any assumptions and comments relevant to the analysis.*

This program would have a fiscal impact of administering the program, including expenditures relating to the transactions as well as the premiums associated with entering into a hedging contract.

3. **State fiscal effect detail:** *For information shown under state fiscal effect in 1A, please:*

A. **Revenues:** *Explain the revenue amounts. Provide detail, when appropriate, for each revenue type and fund affected and any amounts included in the executive budget.*

There is no revenue associated with this.

B. **Expenditures:** *Explain the expenditure amounts. Provide detail, when appropriate, for each agency, line item, and fund affected and the number of FTE positions affected.*

The total of $400,000 in expenditures would cover the cost of administering the program including hiring a hedging consultant.
Most of the expenditures relate to hiring a consultant that would execute the trades, provide market advice, and provide the accounting transactions for each trade on a monthly basis.

C. **Appropriations:** *Explain the appropriation amounts. Provide detail, when appropriate, for each agency and fund affected. Explain the relationship between the amounts shown for expenditures and appropriations. Indicate whether the appropriation or a part of the appropriation is included in the executive budget or relates to a continuing appropriation.*

In addition to the cost of administration, each hedge would have a premium that would vary with the amount of protection in oil price as well as the number of barrels protected. The total premiums for hedge contracts could not exceed $95,000,000.
It is our understanding the bill sponsor is going to seek a transfer from the Strategic Investment and Improvements Fund.

**Name:** Tim Porter

**Agency:** Bank of North Dakota

**Telephone:** 701-328-5650

**Date Prepared:** 01/11/2019

**2019 HOUSE FINANCE AND TAXATION**

**HB 1186**

# 2019 HOUSE STANDING COMMITTEE MINUTES

**Finance and Taxation Committee**
Fort Totten Room, State Capitol

HB 1186
1/28/2019
31572

☐ Subcommittee
☐ Conference Committee

Committee Clerk: Mary Brucker

**Explanation or reason for introduction of bill/resolution:**

A bill relating to oil and gas tax revenue hedging.

**Minutes:** Attachments 1-3

**Chairman Headland:** Opened hearing on HB 1186.

**Representative Kempenich:** Introduced bill. Distributed written testimony, see attachments 1-3. We need to start using a way to manage the oil in the state. We're roughly managing 100 million barrels for the biennium, 50 million per year. Now we're producing around 475 million barrels a year. We're treating this money like a windfall and like it's going to show up every day. Six months ago when a lot of these bills were being drafted we were basing it on $52 oil. At that number we're short than where we were seven to eight months ago. The fiscal note is $95 million so that's basically what a dollar a barrel for the biennium would generate. This morning oil is down $2.53 so we could do a month hedge at $.02 which is basically $20 a contract. They are 1,000 barrel contracts. I handed out a two-year curve option which is a little expensive. There are opportunities throughout the biennium where you could look at the future of this. We don't know what the production is exactly but if we could even get in at half of what the state's interest is on it over the course of a biennium we could probably protect $1 billion which we don't have today. We need to get to at least of an idea of where we're at with the oil prices volatility and risk for revenues. We're using over 30% of our budget which is oil money. If we don't start managing this, we're going to be in for a big disappointment. The amendment would put in an advisory committee. There should be political people on the committee and Commissioner Goehring said he would be on it. Dr. Wilson from NDSU could be on it as well. It would be set up similar to the legacy advisory committee would be set up. It would take it out of the political arena too.

**Chairman Headland:** During the interim committee I believe Dr. Wilson advised us against hedging.

**Representative Kempenich:** Yes but it was going up. When you look at trying to hedge 10 million barrels with 1,000 contracts it would cost a lot of money just to get the contracts then you'd have to have a hedge fund on top of that for margins. A straight hedge would probably be the cheapest way you're doing it but you'd be directly into the market. It depends on the

time of year as well. It's starting to climb back up now. I think this committee would meet quarterly to keep a pulse on it. Something needs to be done.

**Chairman Headland:** Do you think there would be reluctance of someone sitting on a board putting $100 million of the taxpayer money at risk?

**Representative Kempenich:** I think it would be about half of that. If you tried to lock in right now you'd need $52 oil it would cost you that much. You'd be playing the market at that. The idea would be to put a floor and leave an upside on it. Today it would be risky. At some point we're going to have to get to a point of managing this. I think we need to gradually step up. We're looking to manage our risks. You're going to have people who are willing to make decisions.

**Representative Ertelt:** Is there another public equity in the market and how would that impact the bill?

**Representative Kempenich:** There are probably rules on some of that. We're expecting about 130,000 million barrels a day while larger companies are probably around 180,000 a day so we're right in there. Other public entities that were in the report was Mexico. The max you can do on these are around 5,000 contracts at 1,000 barrels per contract.

**Representative Trottier:** If you want to lock in your grain price you can go to your elevator and do that.

**Representative Kempenich:** Yes you can do a hedge to arrive. You lock in a price for future delivery.

**Representative Trottier:** Then the elevator puts in a basis cost for shipping and fees.

**Representative Kempenich:** Yes.

**Representative Trottier:** Has anybody ever talked to an oil company to see if they would participate with us and put a basis in there similarly?

**Representative Kempenich:** I don't know. A year ago oil was headed south again. In May we were beating west Texas and now we basically have a basis to get it out of the state again because of transportation issues. I've never had a conversation with anybody about a basis contract.

**Chairman Headland:** Is there further testimony in support? Is there opposition? Seeing none we will close the hearing on HB 1186.

# 2019 HOUSE STANDING COMMITTEE MINUTES

**Finance and Taxation Committee**
Fort Totten Room, State Capitol

HB 1186
2/5/2019
32175

☐ Subcommittee
☐ Conference Committee

Committee Clerk: Mary Brucker

**Explanation or reason for introduction of bill/resolution:**

A bill relating to oil and gas tax revenue hedging.

**Minutes:** Attachment 1

**Chairman Headland:** Can you explain your amendments?

**Representative Kempenich:** Distributed proposed amendments 19.0580.01002, see attachment 1. This amendment puts together an advisory group that would do the action. It also adds the Ag Commissioner. It would meet quarterly. They would have Dr. Wilson and a broker. The group would gather the information and go with a plan. The amendment is to show we can do something.

**Chairman Headland:** Where did you come up with the makeup of the advisory committee?

**Representative Kempenich:** We talked to the bank. We wanted people who were knowledgeable in the oil industry. We want legislators because we're spending money. The Ag Commissioner showed some interest in participating as a state official. The bank president because they've been doing this type of stuff. OMB will be there as well. It's having the ability to take it out of the political arena.

**Chairman Headland:** Do you think these people want to be on this committee?

**Representative Kempenich:** I've talked to everybody and they didn't say they weren't interested in doing it.

**Representative Mitskog:** I'm very open to this idea. I see my party's voice is left off of this committee. Would you be open to having somebody from the minority party?

**Representative Kempenich:** That could be a discussion within the committee. This would be similar to the legacy committee. I never put the party part into this.

**Representative Steiner:** This is really a big financial decision. Some of these people may not have the financial knowledge.

**Representative Kempenich:** They would take information gathered. You'd be hiring a broker to do this. It would be more collective than anything. This is just to get something started.

**Chairman Headland:** If you want to start small why don't you start with one contract?

**Representative Kempenich:** We could do that and probably will. $10,000 could be a starting point. Money isn't the biggest issue I just threw it in.

**Chairman Headland:** What do you want to do with this amendment? In my opinion the amended version is better than the original version.

**Representative Dockter: MADE A MOTION TO ADOPT THE AMENDMENT**

**Representative Fisher: SECONDED**

**Representative Trottier:** In 2014 we were urging leadership to look at it. According to statute we can only do options, I don't believe we can do hedging. In 2015 we left $1.27 billion on the table by not hedging. When we got up to $70 and $72 we thought we should lock it in because of where our budget was.

**Chairman Headland:** I think right now our forecast is at $42.50.

**Representative Trottier:** When it was $70 and $72 you could have sold it at $65 for a very minimum amount using the options. Now we're leaving on the table about $2 million a day. We're probably at around $300-350 million that we could have had in the coffers. This is a step forward.

**Chairman Headland:** Is there any further discussion on the proposed amendment?

**VOICE VOTE: MOTION CARRIED**

**Chairman Headland:** We have amended HB 1186.

**Representative Dockter: MADE A MOTION FOR A DO PASS AS AMENDED**

**Representative Trottier: SECONDED**

**Representative Kading:** There are only two legislators on there and if the board made a drastic error it would be our responsibility as an assembly. We don't really have the full say in this board and I don't know if we want to put more legislators on there or what we can do.

**Representative Dockter:** I've been on the Employee Benefits board for years in addition there's the PERS board and the State Investment board where we only have a few legislators and they make the decisions on investing of our pensions. This make up is really no different than other boards and it's working fine. Legacy Fund is the exception where there are four legislators but PERS has two and the State Investment board has different directors. They

are dealing with billions of dollars of pensions. I understand your concern but we already have these similar types of boards.

**Representative Mitskog:** I appreciate Representative Kading's comments. I wonder why we're not using members from the Legacy and Budget Stabilization fund for this study.

**Chairman Headland:** We as a committee could make the changes for this advisory committee. I'm going to resist the bill. I don't think it's a good policy for the state to get into hedging a commodity that they don't own. As a farmer I don't know that I've had a lot of success with hedging in the past. They're trying to protect a price. I understand what they're trying to do here but we don't own the commodity. I don't know how to explain this to the people we represent. I don't know that I believe it's our business. I'm going to reject it.

**Representative Trottier:** I understand what you're saying. However, I don't understand how the legislature can set a budget on a major portion of our revenue and have no clue really of what oil price is going to be. It could easily be $20 or it could be $100. If you could lock in $70 why wouldn't you do it? People say we don't own the oil but we get 10% of all the oil revenue.

**Chairman Headland:** Should we lock in $15 soybeans too when they get there? You can make the argument that at $15 soybean farmers are going to make a lot of money and there's a lot of income tax revenue at stake that we should protect in some way. To me it's not the same argument. I think it points out that we are too reliant on oil as a commodity. Are there any other comments?

**ROLL CALL VOTE: 6 YES 7 YES 1 ABSENT**
**MOTION FAILED**

**Chairman Headland:** We have a committee member absent so we can wait or I would entertain a motion in the other direction.

**Vice Chairman Grueneich: MADE A MOTION FOR A DO NOT PASS AS AMENDED**

**Representative Blum: SECONDED**

**ROLL CALL VOTE: 7 YES 6 NO 1 ABSENT**
**MOTION CARRIED**

**Representative Toman will carry this bill.**

DD 2/5/19

19.0580.01002
Title.02000

Prepared by the Legislative Council staff for
Representative Kempenich
January 30, 2019

PROPOSED AMENDMENTS TO HOUSE BILL NO. 1186

Page 1, line 1, after "A BILL" replace the remainder of the bill with "for an Act to provide for a pilot project regarding oil and gas tax revenue hedging; to provide for a report to the legislative management; and to provide an appropriation.

**BE IT ENACTED BY THE LEGISLATIVE ASSEMBLY OF NORTH DAKOTA:**

**SECTION 1. OIL AND GAS TAX REVENUE HEDGING PILOT PROJECT - ADVISORY COMMITTEE - REPORT TO LEGISLATIVE MANAGEMENT.** During the 2019-20 interim, an advisory committee shall oversee a pilot project regarding oil and gas tax revenue hedging. At the direction of the advisory committee and using funds in an oil and gas tax revenue hedging fund at the Bank of North Dakota, the Bank shall enter swap agreements or any other hedging strategies with designated counterparts approved by the advisory committee. The execution of hedging strategies must be designed to offset reduced state general fund oil and gas tax revenues due to oil and gas prices falling below selected levels included in the legislative revenue forecast at the conclusion of the most recently adjourned legislative assembly. The members of the advisory committee are entitled to receive reimbursement for reasonable and necessary expenses incurred while performing duties for the advisory committee at the same level as state officials. The advisory committee shall report the results of the pilot project and any recommendations regarding oil and gas tax revenue hedging to the legislative management before August 1, 2020. The advisory committee is composed of:

1. Two members chosen by the North Dakota petroleum council;
2. The director of the office of management and budget;
3. One member of the legislative assembly appointed by the majority leader of the senate;
4. One member of the legislative assembly appointed by the majority leader of the house of representatives;
5. One representative of the Bank of North Dakota;
6. The executive director of the Indian affairs commission; and
7. The agriculture commissioner.

**SECTION 2. APPROPRIATION.** There is appropriated out of any moneys in the general fund in the state treasury, not otherwise appropriated, the sum of $100,000, or so much of the sum as may be necessary, to the Bank of North Dakota for the purpose of conducting the pilot project regarding oil and gas tax revenue hedging, for the biennium beginning July 1, 2019, and ending June 30, 2021."

Renumber accordingly

Date: 2-5-19
Roll Call Vote #: 1

**2019 HOUSE STANDING COMMITTEE**
**ROLL CALL VOTES**
**BILL/RESOLUTION NO.** HB 1186

House Finance and Taxation Committee

☐ Subcommittee

Amendment LC# or Description: 19.0580.01002 Rep. Kempenich 1-30-19

Recommendation: ☒ Adopt Amendment
☐ Do Pass ☐ Do Not Pass ☐ Without Committee Recommendation
☐ As Amended ☐ Rerefer to Appropriations
☐ Place on Consent Calendar

Other Actions: ☐ Reconsider ☐ _____

Motion Made By Rep. Dockter Seconded By Rep. Fisher

| Representatives | Yes | No | Representatives | Yes | No |
|---|---|---|---|---|---|
| Chairman Headland | | | Representative Eidson | | |
| Vice Chairman Grueneich | | | Representative Mitskog | | X |
| Representative Blum | | | | | |
| Representative Dockter | | | | | |
| Representative Ertelt | | | | | |
| Representative Fisher | | | | | |
| Representative Hatlestad | | | | | |
| Representative Kading | | | | | |
| Representative Koppelman | | | | | |
| Representative Steiner | | | | | |
| Representative Toman | | | | | |
| Representative Trottier | | | | | |
| | | | | | |
| | | | | | |

Total (Yes) _____ No _____

Absent _____

Floor Assignment _____

If the vote is on an amendment, briefly indicate intent:

↓ Voice Vote = Motion carried

Put in an advisory committee.

Date: 2-5-19
Roll Call Vote #: 2

**2019 HOUSE STANDING COMMITTEE**
**ROLL CALL VOTES**
**BILL/RESOLUTION NO.** HB 1186

House Finance and Taxation Committee

☐ Subcommittee

Amendment LC# or Description: 19.0580.01002

Recommendation: ☐ Adopt Amendment
☒ Do Pass ☐ Do Not Pass ☐ Without Committee Recommendation
☒ As Amended ☐ Rerefer to Appropriations
☐ Place on Consent Calendar

Other Actions: ☐ Reconsider ☐ _____

Motion Made By Rep. Dockter Seconded By Rep. Trottier

| Representatives | Yes | No | Representatives | Yes | No |
|---|---|---|---|---|---|
| Chairman Headland | | ✓ | Representative Eidson | | ✓ |
| Vice Chairman Grueneich | | ✓ | Representative Mitskog | ✓ | |
| Representative Blum | | ✓ | | | |
| Representative Dockter | ✓ | | | | |
| Representative Ertelt | | ✓ | | | |
| Representative Fisher | ✓ | | | | |
| Representative Hatlestad | ✓ | | | | |
| Representative Kading | ✓ | | | | |
| Representative Koppelman | A | | | | |
| Representative Steiner | | ✓ | | | |
| Representative Toman | | ✓ | | | |
| Representative Trottier | ✓ | | | | |
| | | | | | |
| | | | | | |

Total (Yes) 6 No 7

Absent 1

Floor Assignment _____

If the vote is on an amendment, briefly indicate intent:

Motion failed.

Date: 2-5-19
Roll Call Vote #: 3

**2019 HOUSE STANDING COMMITTEE**
**ROLL CALL VOTES**
**BILL/RESOLUTION NO.** HB 1186

House Finance and Taxation Committee

☐ Subcommittee

Amendment LC# or Description: 19.0580.01002

Recommendation: ☐ Adopt Amendment
☐ Do Pass ☒ Do Not Pass ☐ Without Committee Recommendation
☒ As Amended ☐ Rerefer to Appropriations
☐ Place on Consent Calendar

Other Actions: ☐ Reconsider ☐ _____

Motion Made By Rep. Grueneich Seconded By Rep. Blum

| Representatives | Yes | No | Representatives | Yes | No |
|---|---|---|---|---|---|
| Chairman Headland | ✓ | | Representative Eidson | ✓ | |
| Vice Chairman Grueneich | ✓ | | Representative Mitskog | | ✓ |
| Representative Blum | ✓ | | | | |
| Representative Dockter | | ✓ | | | |
| Representative Ertelt | ✓ | | | | |
| Representative Fisher | | ✓ | | | |
| Representative Hatlestad | | ✓ | | | |
| Representative Kading | | ✓ | | | |
| Representative Koppelman | A | | | | |
| Representative Steiner | ✓ | | | | |
| Representative Toman | ✓ | | | | |
| Representative Trottier | | ✓ | | | |
| | | | | | |
| | | | | | |

Total (Yes) 7 No 6

Absent 1

Floor Assignment Rep. Toman

If the vote is on an amendment, briefly indicate intent:

**REPORT OF STANDING COMMITTEE**

**HB 1186: Finance and Taxation Committee (Rep. Headland, Chairman)** recommends **AMENDMENTS AS FOLLOWS** and when so amended, recommends **DO NOT PASS** (7 YEAS, 6 NAYS, 1 ABSENT AND NOT VOTING). HB 1186 was placed on the Sixth order on the calendar.

Page 1, line 1, after "A BILL" replace the remainder of the bill with "for an Act to provide for a pilot project regarding oil and gas tax revenue hedging; to provide for a report to the legislative management; and to provide an appropriation.

**BE IT ENACTED BY THE LEGISLATIVE ASSEMBLY OF NORTH DAKOTA:**

**SECTION 1. OIL AND GAS TAX REVENUE HEDGING PILOT PROJECT - ADVISORY COMMITTEE - REPORT TO LEGISLATIVE MANAGEMENT.** During the 2019-20 interim, an advisory committee shall oversee a pilot project regarding oil and gas tax revenue hedging. At the direction of the advisory committee and using funds in an oil and gas tax revenue hedging fund at the Bank of North Dakota, the Bank shall enter swap agreements or any other hedging strategies with designated counterparts approved by the advisory committee. The execution of hedging strategies must be designed to offset reduced state general fund oil and gas tax revenues due to oil and gas prices falling below selected levels included in the legislative revenue forecast at the conclusion of the most recently adjourned legislative assembly. The members of the advisory committee are entitled to receive reimbursement for reasonable and necessary expenses incurred while performing duties for the advisory committee at the same level as state officials. The advisory committee shall report the results of the pilot project and any recommendations regarding oil and gas tax revenue hedging to the legislative management before August 1, 2020. The advisory committee is composed of:

1. Two members chosen by the North Dakota petroleum council;
2. The director of the office of management and budget;
3. One member of the legislative assembly appointed by the majority leader of the senate;
4. One member of the legislative assembly appointed by the majority leader of the house of representatives;
5. One representative of the Bank of North Dakota;
6. The executive director of the Indian affairs commission; and
7. The agriculture commissioner.

**SECTION 2. APPROPRIATION.** There is appropriated out of any moneys in the general fund in the state treasury, not otherwise appropriated, the sum of $100,000, or so much of the sum as may be necessary, to the Bank of North Dakota for the purpose of conducting the pilot project regarding oil and gas tax revenue hedging, for the biennium beginning July 1, 2019, and ending June 30, 2021."

Renumber accordingly

**2019 TESTIMONY**

**HB 1379**

APPENDIX E

# Oil Prices, Volatility and Risk for Government Budget Revenues: *North Dakota Focus*

*ND Legislative Council, June 7 2018.*

Dr. William W Wilson, Norifumi Kimura and Bruce Dahl


Dr. William W. Wilson
CHS Chair in Risk Management and Trading
*University Distinguished Professor*
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701 231 7472

Dept of Agribusiness & Applied Economics
North Dakota State University
Fargo, USA

# Related studies

This presentation is based on current work of the co-authors and is available in the following publications:

- Norifumi Kimura, Dr. William W Wilson and Bruce Dahl. ***GOVERNMENT HEDGING OF OIL REVENUE*, forthcoming research report, Department of Agribusiness and Applied Economics, NDSU and under review at _____**
- Indranil SenGupta, William W. Wilson, et al ***Barndorff-Nielsen and Shephard Model-Oil Commodity Hedging with Variance Swap and Options*, available from the authors and under review at ....** Mathematics and Financial Economics. Here is the link: https://link.springer.com/journal/11579
- William Wilson, William Nganje, Indranil SenGupta, Semere Habtemicael, ***BN-S Model of Hedging Energy with Quantity Risk***, near completion and to be submitted to ……
- Bullock, D. Background and Description of ND Bakken Crude Oil Production Model, working paper, NDSU

# Topics

- Importance of problem
- Experiences of other sovereign entities
- North Dakota's Problem
- Previous studies
- Data
  - Prices
  - production
- Alternatives for risk management
- Issues impacting hedging decisions by sovereign entities in energy
- Empirical Model
- Results
- Interpretation
- Policy alternatives and issues
- Extensions
- Appendix
  - Model details
  - Solution methodology
- References

# Scope

- ND's budget is partly dependent on oil prices, production and revenue to the state. These are risky, which, makes government revenue risky.
- This document provides an analysis of alternatives for managing risks of adverse price changes in oil prices

Below is a summary of experiences and practices of varying sovereign entities in oil price risk management; followed by a detailed analytical model of strategy

## Recent News clips on governments and hedging energy

- **Government Oil Hedging**
  - ***Oil price hedging by governments can be a smart bet or a bad gamble***
    - **Every big drop in oil prices raises the question of why provinces don't hedge when they have the chance**
    - By Paul Haavardsrud, CBC News Posted: Apr 13, 2016 5:00 AM ET Last U

- **Published studies**
  - *The Use of Crude Oil Futures by the Governments of Oil-Producing States*, **Journal of Futures Markets**
  - *Hedging Government Oil Price Risk,* IMF
    - Promotes that governments
      - exposed to risk of oil price changes;
      - should be involved in risk mitigation strategies

## *Mexico Enters $76.40 Oil Price Hedge for 2015: Program Allowed Country to Avoid Major Budget Crisis When Crude Prices Sank in 2009 Hedging Government Oil Price Risk*

- Many governments are heavily exposed to oil price risk, especially those dependent on revenue derived from oil production.
- For these governments, dealing with large price movements is difficult and costly.
- Traditional approaches, such as stabilization funds, are inherently flawed. Oil risk markets could be a solution.
- These markets have matured greatly in the last decade, and their range and depth could allow even substantial producers, and consumers, to hedge their oil price risk.
- Yet governments have held back from using these markets, mainly for fear of the political cost and lack of know how.
- This suggests that the IMF, together with other development agencies, should consider encouraging governments to explore the scope for hedging their oil price risk.

# Mexico's oil hedges for 2016

Energy Insights

October 2015 | Leo Drollas

On June 9th of this year, according to Argus Media, Mexico started hedging some of its 2016 oil output, ending the operation on August 14th. The hedging program was undertaken by the Ministry of Finance in order to safeguard the oil revenues that accrue to the government. Mexico's hedge is said to have taken place through purchases of options to sell its Maya crude and Brent, the global crude oil benchmark, at a strike price of $49/bbl and at a cost of $1.09 billion in options premiums.

Bloomberg reported on July 29th this year that some large options deals being executed in the market in the previous ten days were probably related to the Mexican program, which suggests that Mexico's hedging would have started earlier than its usual months of August and September.
Bloomberg said that last year Mexico paid $773 million to lock in prices of $76.4/bbl for 2015, which represents a very good deal, given that Maya crude had averaged $49.78/bbl by the time Bloomberg's report was published in late July. Significantly, Bloomberg also pointed out that Mexico had received $5 billion from its hedges for 2009, due to the market's collapse, which suggests that hedging can be extremely useful in the right circumstances and using the right hedging instruments.

# Oil Deal of the Year: Mexico Set for $6 Billion Windfall (Bloomberg, Nov 15)

- Mexico is set to get a record payout of at least $6 billion from its oil hedges this year, according to data compiled by Bloomberg.
- The Latin American country locks in oil sales as a shield against price declines through a series of financial deals with banks including Goldman Sachs Group Inc., JPMorgan Chase & Co. and Citigroup Inc. For 2015, Mexico guaranteed sales at almost $30 a barrel higher than average prices over the past year.
- The 2015 payment, due next month, is set to surpass the record from 2009, when the Mexican government said it received $5.1 billion after prices plunged with the global financial crisis. The country's crude has fallen by almost half over the hedging period so far this year. Crude sales historically cover about a third of the government budget.
- "The windfall is huge," said Amrita Sen, chief oil analyst at Energy Aspects Ltd., a London-based consulting company. "This gives Mexico breathing space."
- The hedge, which runs from Dec. 1 to Nov. 30, covered 228 million barrels at $76.40 each for the Mexican oil basket, according to government documents and statements. With less than two weeks to the end of the program, the basket has averaged $46.61 a barrel over the period.

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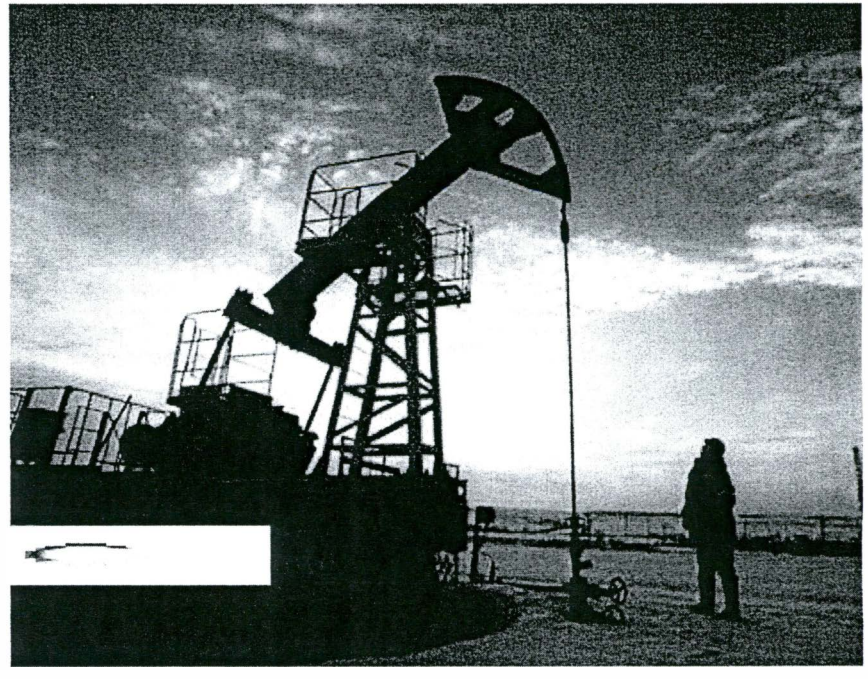
# Russia considers hedging part of oil its revenues - FT.com Financial Times, Jan 2016

- Jan 22, 2016 **...** Russia is looking at **hedging** a portion of its **oil** revenues in the future, ... Russia, which relies on **oil** and gas for about half its **government revenues** ...

# *Russia to Follow Mexico's Hedging Strategy*

- #FINANCIALS
- JUNE 27, 2017 / 5:17 AM / 7 MONTHS AGO
- Russia's Russneft looking to clinch oil hedging deal with VTB
- Reuters Staff
- 1 MIN READ
- MOSCOW, June 27 (Reuters) - Russneft, Russia's mid-sized oil producer, is looking to clinch an oil hedging deal with VTB, Russia's second biggest bank, Russneft Senior Vice President Olga Prozorovskaya said on Tuesday.
- https://www.reuters.com/article/russia-russneft-vtb/russias-russneft-looking-to-clinch-oil-hedging-deal-with-vtb-idUSR4N1JC02O





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# Alberta Government Hedging

**Hedging Alberta Government's Oil and Gas Revenue: Is Acting Like a Farmer a Viable Strategy?**

Joffre Hotz
Jim Unterschultz

Staff Paper #09-01

- 'Every big drop in oil prices raises questions as to why provinces don't hedge.
  - Alberta had been considering hedging for many years commencing from at least 2002.
  - An important point is political: "*just imagine how much hay the opposition could make if a provincial government spent a billion dollars on hedges that ultimately didn't pay off.*"
  - In many cases, stabilization funds would be less risky, and easier to explain than hedging programs.
- Bakx described Alberta's dilemma in 2016 and referred to it as "Inevitably…pegging an oil price is one of the most critical jobs facing budget markets in not just Alberta, but also Saskatchewan and Newfoundland and Labrador.
- And went on to indicate that "Alberta is expected to table a budget with at least a $10 billion shortfall, largely because of the oil price crash in the last two years. Royalty revenues fell from $8.9 billion in 2014-15 to only $2.5 billion this fiscal year."

# Texas Hedging or Oil Revenue

- Royalty revenues fell from $8.9 billion in 2014-15 to only $2.5 billion this fiscal year."

- Option hedging strategies were evaluated for hedging energy prices (Swidler, Butimer, and Shaw).
  - They simulated oil revenue risk for Texas and evaluated option strategies.
  - Option strategies manage extreme downside risk effectively, and stops large budget deficits from occurring
- Texas hedged oil revenues using collars (Daniels) in the early 1990s.

# Numerous other examples of sovereign entities approach to price risk management in Oil

- Russia was said to be exploring hedging a portion of its oil revenues (*Financial Times* 2016).
  - Importantly about one-half of the government's revenues are from oil and gas.
- Ghana: The Institute of Fiscal Studies (IFS) urged to consider hedging oil exports against price volatilities.
- Ecuador was active in hedging for several years in the early 1990s and the oil hedges cost the country millions. Ultimately a committee was appointed to investigate allegations and potential for corruption (Haavardsrud).
- Other countries have explored similar strategies including Ecuador, Colombia, Morocco, Uruguay and Algeria (as suggested by Blas and Martin).

- Governments that are short of oil, and increases in oil prices adversely impacts their economy.
  - To protect against that, they may buy futures, or calls.
  - The Government of Jamaica has been hedging since 2015 using call options (Hill 2017). Costs of those hedges were about $30 million for about 15 months. These were conducted by the Bank of Jamaica and an oversight committee.
  - However, instead of prices increasing, as expected to $67/barrel, they fell to $30/barrel and some projections were for them to fall further. This had the impact of accruing losses in the option positions, but of course, the Government apparently would have benefitted from the lower spot cash prices.
- Malta: Caruana advocated that Malta should be hedging oil, but, should fully understand the reason behind the hedge.
  - He indicates however that if the hedge is out-of-the-money, there would be complaints because the cost of fuel would be higher than otherwise; but, if the hedge is in-the-money, society would probably not recognize it.

# Hedging at Ryanair (similar to Delta)

- Ryan Air (comparable to Delta hedging):
- 2015 " **Carrier pre-bought fuel at nearly twice current price leaving profits squeezed as rivals cut fares to fill planes, says budget airline"**
- 2018, Ryanair indicated that profits would fall in part due to not having in place for 2020, despite that hedging was effective in 2018.
- References


  - Matthews, C. and. B. Olson, 2018. " Oil Is Above $70, but Frackers Still Struggle to Make Money," *Wall Street Journal*, May 17, 2018
  - The Guardian, 2015. "Ryanair warns plunging oil price will hurt profits" February 2, 2015. Available at https://www.theguardian.com/business/2015/feb/02/ryanair-warns-plunging-oil-price-hurt-profits
  - Percival, G. 2018. " Ryanair surges but profits set to fall this year," *Irish Examiner,* May 22, 2018 available at http://aws2.irishexaminer.com/breakingnews/business/ryanair-surges-but-profits-set-to-fall-this-year-844273.html


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# *And, hedging oil is not a slam-dunk*

- Going in to 2018,
  - Oil was $50-55 and many drillers hedged anticipated 2018 output (Jan 2018)

- Results reported May 18 (WSJ)
  - 'Hedging' Losses occurred at many companies
    - At $69million for WPX, and others

  - Whereas Continental Oil chose not to hedge, instead looking to profits of $258 million


References:

- Oil Is Above $70, but Frackers Still Struggle to Make Money https://www.wsj.com/articles/oils-at-70-but-frackers-still-struggling-to-make-money-1526549401
- Many companies performance was not so good in 2017/2018. "largely due to bad bets hedging crude prices..."
- "Hedging played a big role in companies; underwhelming cash generation.."
- Many companies sold forward in 2017 to price 2018 production at the 50-55 range; prices then increased to 70.....which is creating problems for many of the hedges
- Financial results are highly variable across firms, ranging from some incurring larges losses, while others (e.g., Continental Resources" "didn't hedge its oil production for 2017. ...and It raked in almost $258 million in cash....best among its peers."
- Matthews, C. and. B. Olson, 2018. " Oil Is Above $70, but Frackers Still Struggle to Make Money," *Wall Street Journal*, May 17, 2018

# North Dakotas Challenge in Oil Revenue Risk (from 2016)

- ***Issues Confronting North Dakota Oil and Royalty Revenues***
  - North Dakota is the second largest producing state, following Texas.
  - Oil production has benefitted from shale technology and has increased substantially during the past decade.
  - Data on oil production (shown below) is volatile, which ultimately means any hedging strategy must confront quantity uncertainty.
  - A complex royalty structure exists including two taxes:
    - Oil Gross Production tax of 5%
    - Oil Extraction Tax of 5%.
    - The price for crude oil received in North Datkoa is based on *First Purchaser Prices* which are typically at a discount to NYMEX or WTI prices.
  - The royalty has important impacts on the State budget. These are distributed in a complex structure for disposition. In addition, a share of these were used to fund a stabilization fund, called the Legacy Fund.

- Volatile production and prices impacts government revenue
  - Concurrent with the decline in oil prices, proceeds to the government fell sharply.
  - Recent forecasts (from 2016) reduced the budget by $4 billion for the 2015/2017 biennium. This was based on oil prices of $42/barrel
    - Ausick 2016, Brooks 2015, Isidore 2016; Scheyder 2015
  - 2016, the budget was reduced to $4.2 billion instead of $8.3 billion in oil and tax revenue (Brooks 2015).
  - The previous budget (2015-2017) was based on a price of $72-82/barrel, which has since been reduced to $42/barrel. (and now increase)
  - Most recent projections (fall 2016) assumed prices at $47.52 and production projected at 925,000 to 950,000 bpd and taken together would reduce projected revenue by an additional $46 million (Sharp 2017).

# North Dakotas Challenge in Oil Revenue Risk

- ***Issues Confronting North Dakota Oil and Royalty Revenues***

- Beitsch (2015) indicated that among the top 10 oil producing states, oil taxes have declined from 45 to 75 percent.
- Hageman (2017) indicated that importance of volatile oil prices in North Dakota during the 2017 legislative session.
- Covenant Group compared the oil tax structure across a number of states.
  - The rate changes based on a price trigger.
  - In addition, due to exemptions, the effective rate of the two taxes is less than 10% .

- ***Key features***

- Problems and issues of oil price volatility on government revenues are important.
  - Declines were greatest for Texas, North Dakota and Oklahoma. The oil tax revenue projection fell from $8.3 billion and by March it was $3.4 billion. Similar comparisons were presented by the EIA.
- Volatility results in risks, and has been increasing over time.
- Many firms and organizations view that it is futile to try to out-forecast oil prices (i.e., Nixon and Smith 202).
- Taken together, mechanisms for commercial firms exist for managing these risks and they are relatively effective and routine way of doing business.
- These are not as apparent for sovereign entities

# Recent oil related press

- **North Dakota's Pipeline Payoff**
  - https://www.wsj.com/articles/north-dakotas-pipeline-payoff-1514591716
- http://www.inforum.com/news/4381512-oil-production-booms-new-year-begins
- http://www.inforum.com/news/4381512-oil-production-booms-new-year-begins
- **Oil Expected to Rally but Face a Rocky Ride**
  - https://www.wsj.com/articles/oil-prices-expected-to-keep-rising-in-2018-but-it-could-be-a-rocky-ride-1514635200
- http://www.inforum.com/news/4384427-900-mile-natural-gas-liquids-pipeline-proposed-bakken

- These are several recent press stories illustrating the nature of changes in the oil market, specifically
  - Factors giving rise to recent oil prices
  - The dynamics of the Bakken
  - Impacts of the oil pipeline and market values

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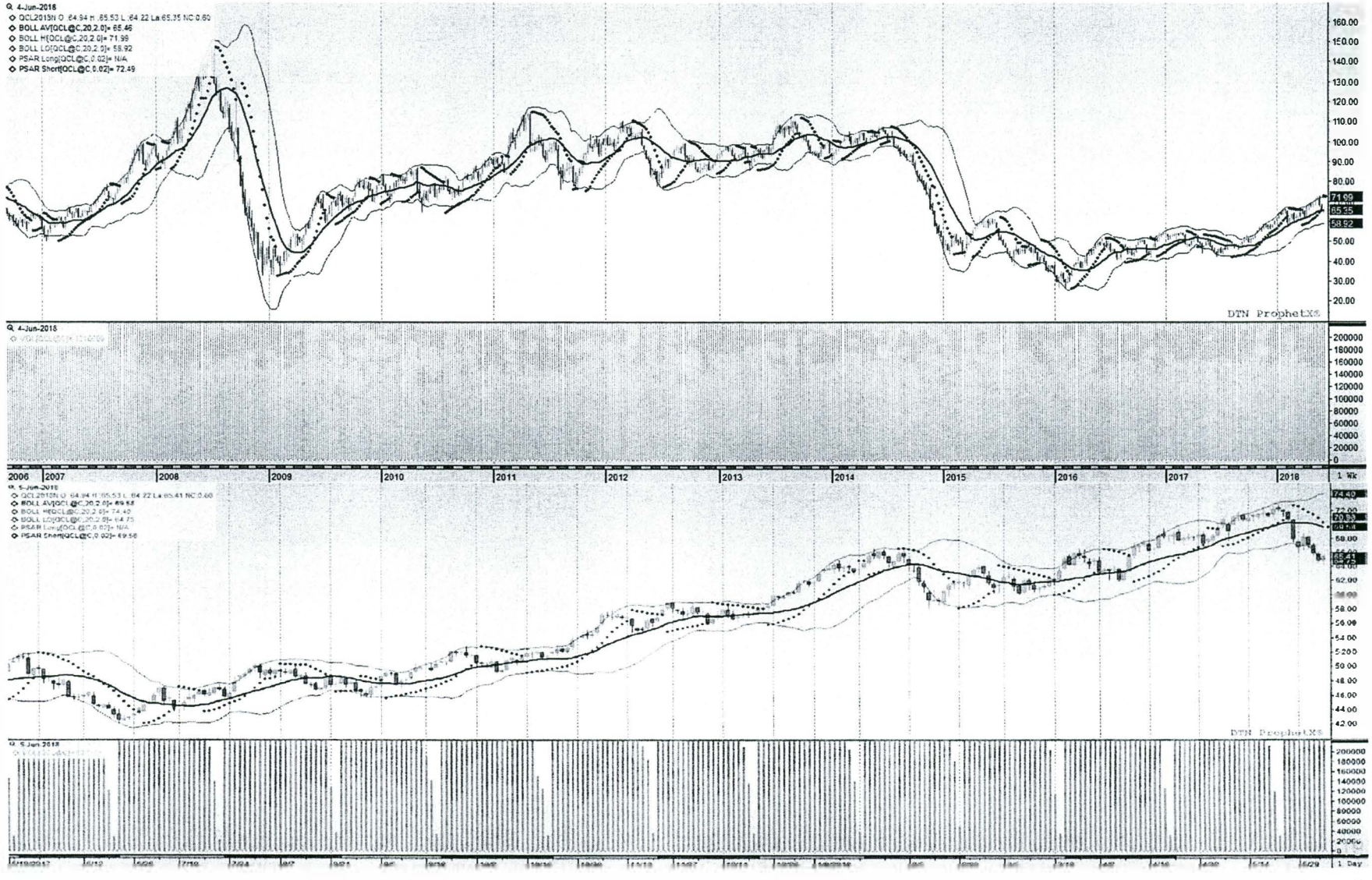
**WTI Weekly Price:**
***2006-Current***
***Daily to current***

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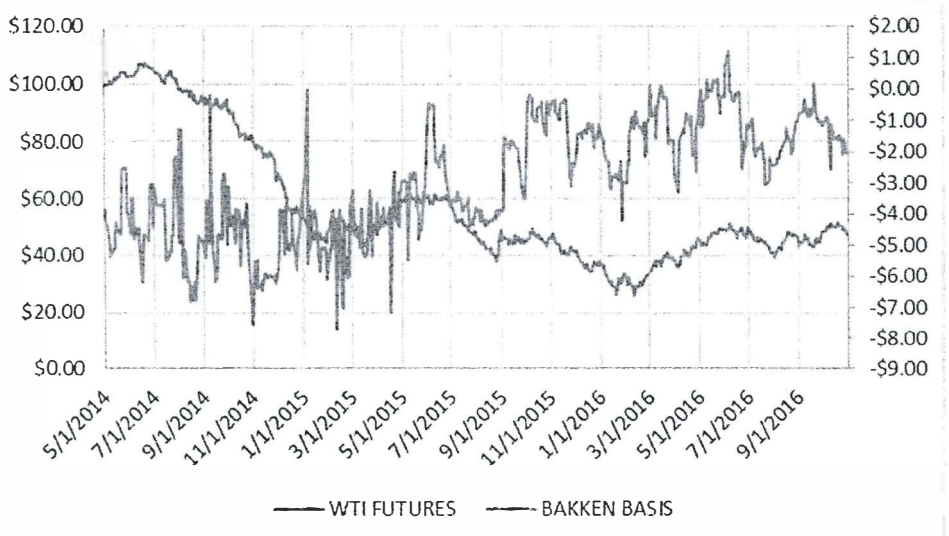
# Oil Price Volatility

- **WTI Futures and Bakken Basis Prices**




- **Two elements of price: futures and basis**
  - Local prices are comprised of futures (WTI) and the basis (spread between cash and futures)
  - Futures declined from 100$ in 2014 to what appears to be a low in early 2016; and have since increased
  - Basis values are volatile, and has generally been increasing



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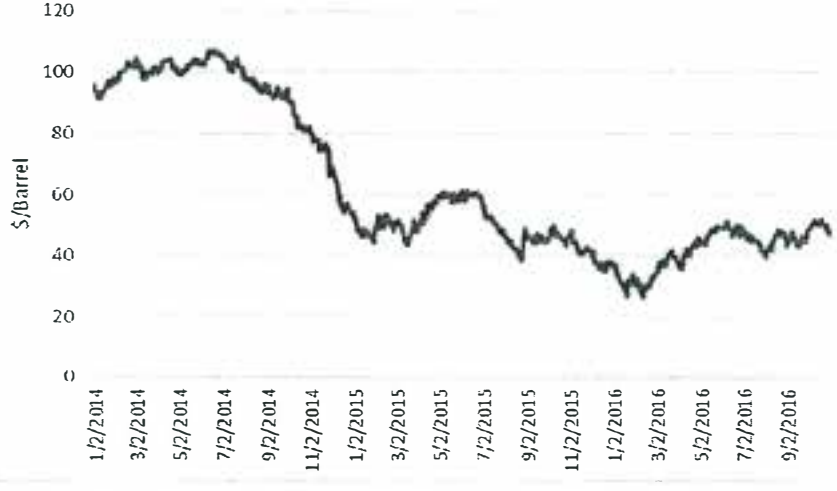
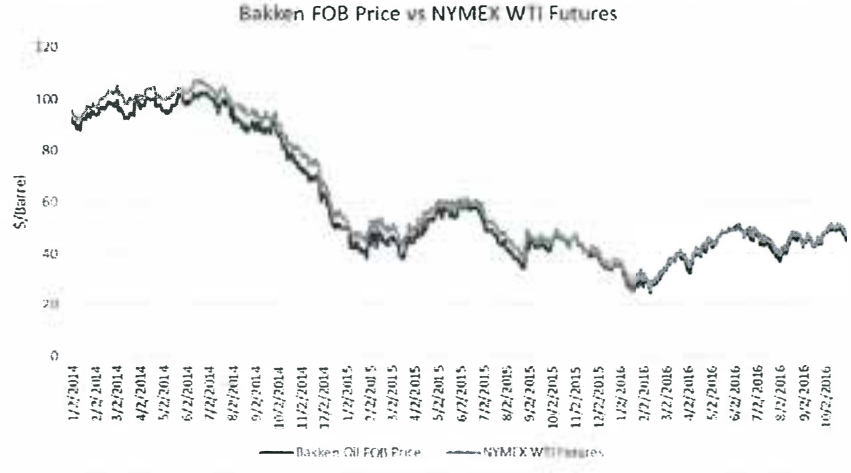
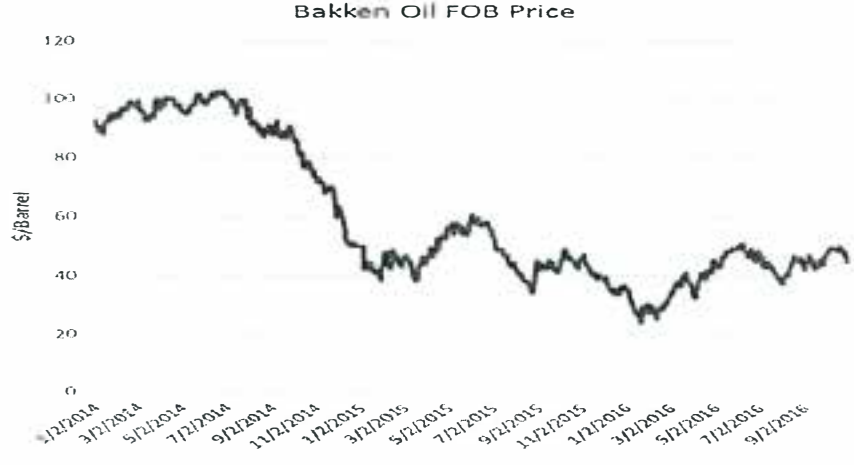
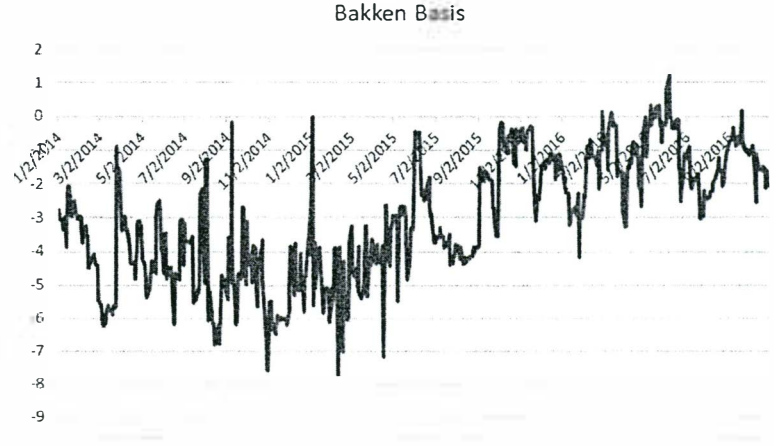
# Elements of Bakken Oil Price

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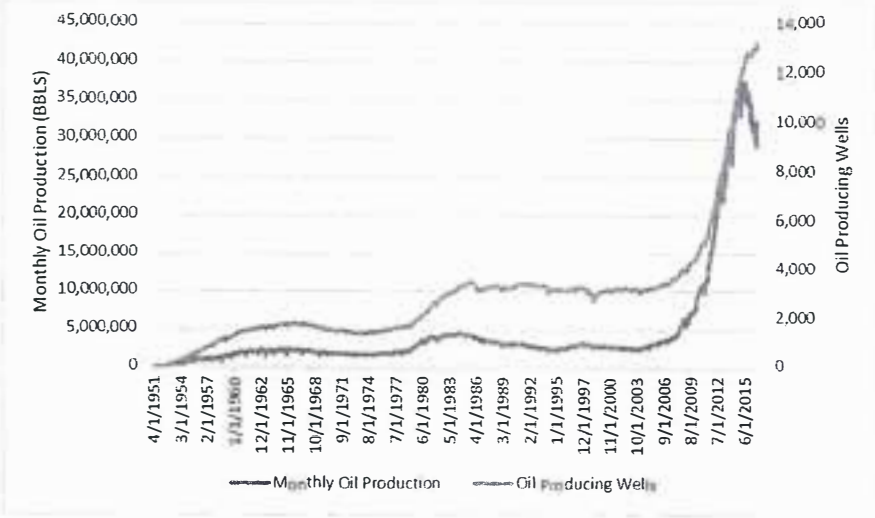
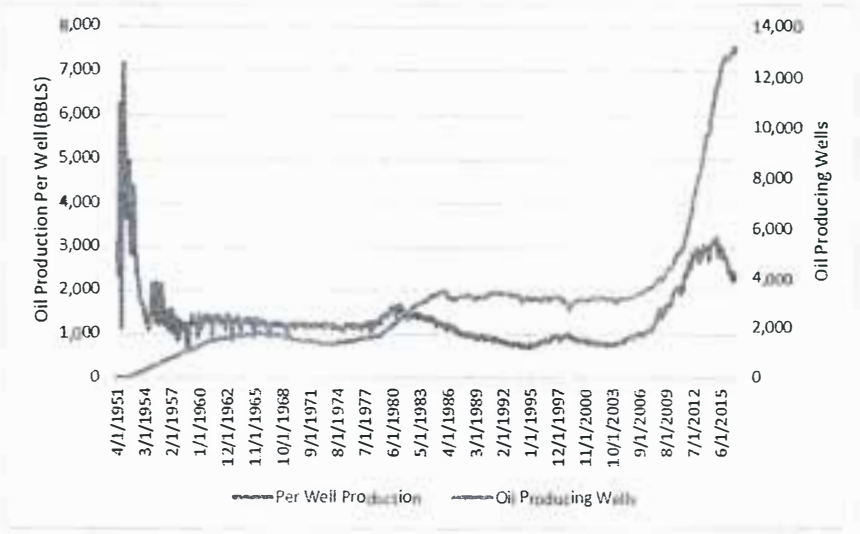
# North Dakota Oil Production Volatility

- Oil Production and Oil Producing Wells




- Per Well Production and Oil Producing Wells



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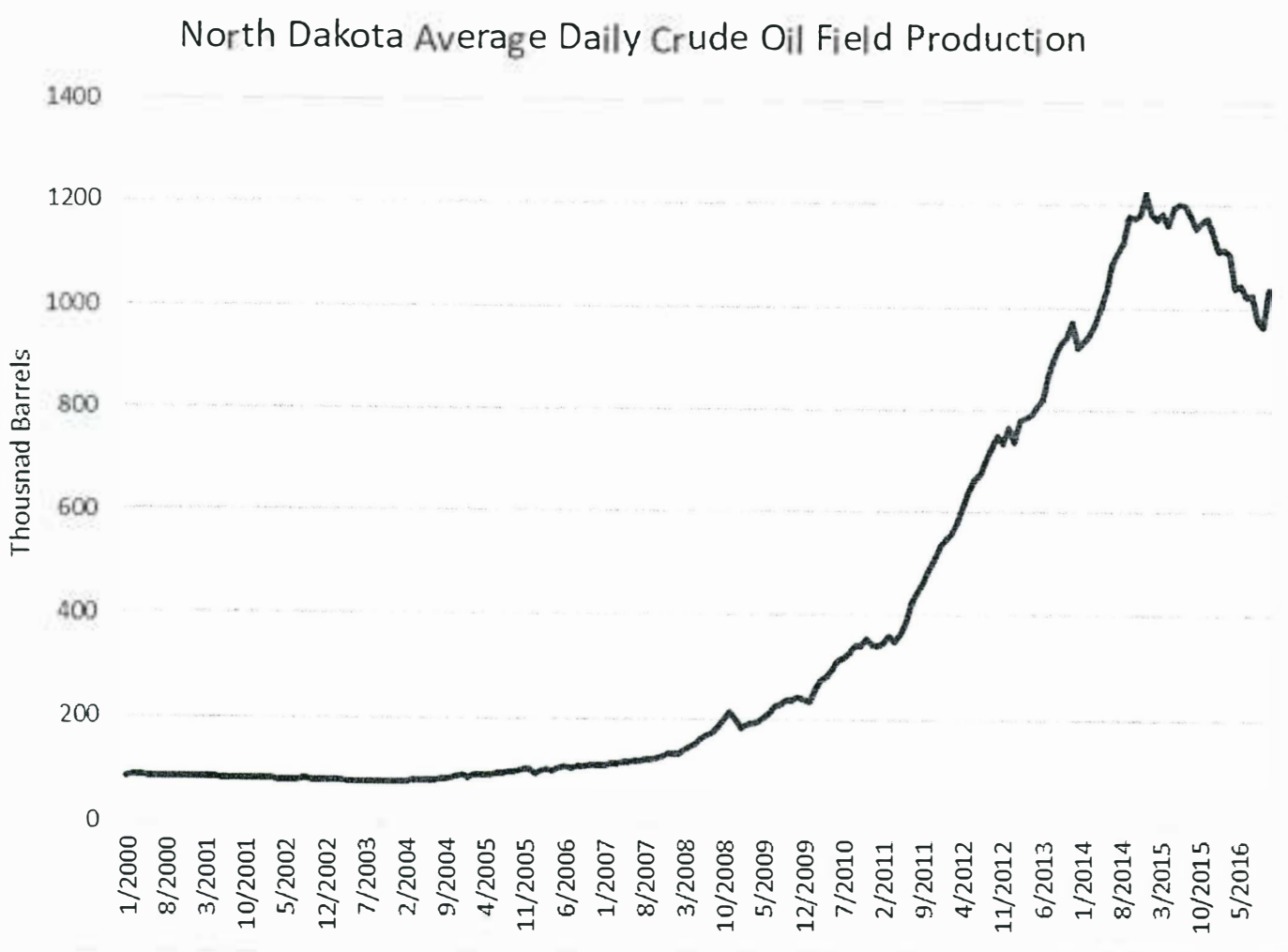
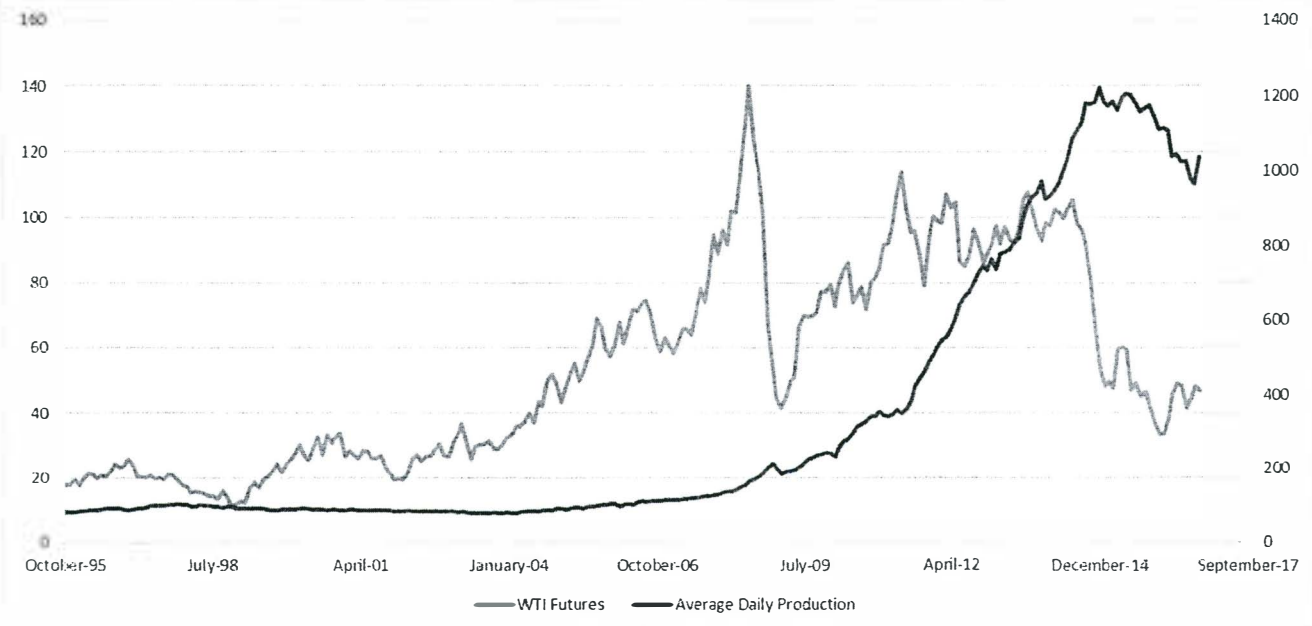
# North Dakota Crude Oil Production (Daily)



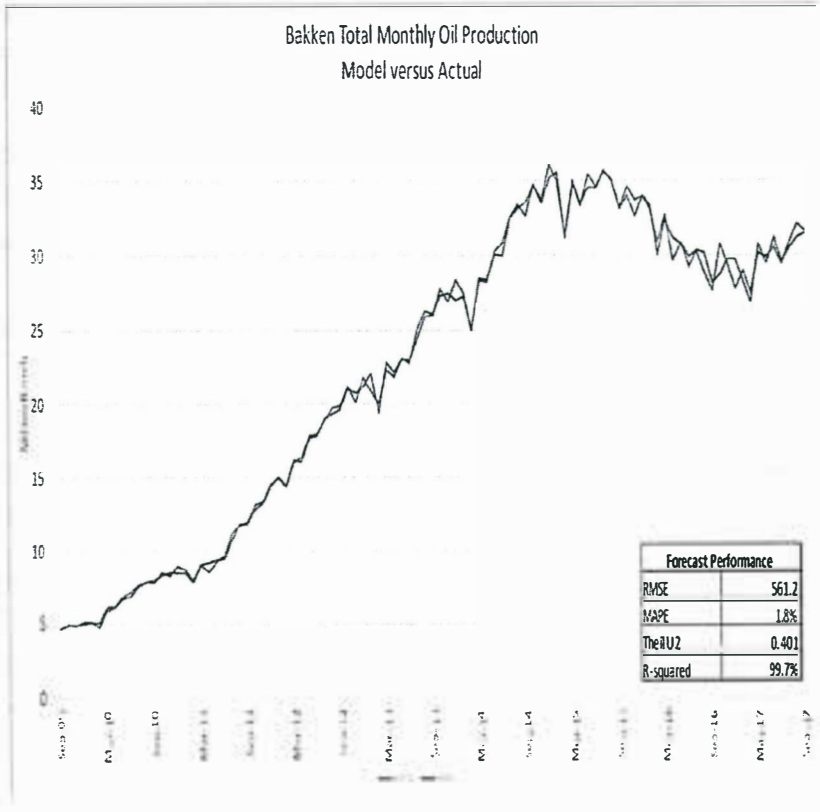
# ND Oil Production vs futures prices (contemporaneous)




- There is a poor relation between oil production and futures values
- Bullock (see below) has developed a more elaborate model to project oil production based on lagged and nonlinear modeling

# Improved model for projecting Bakken oil production (Bullock)

- Empirical models below treat output of oil as a risky or random variable, which, ultimately impacts the size and type of positions that can be taken.
- Since the development of the hedging and risk management Dr. Bullock (NDSU) has develop very sophisticated econometric models of oil production in the Bakken (predicted vs actual values are shown)
- These should be revisited and could be adopted in budget planning. It can also be integrated in a systematic way with the price risk models and strategies below. In so doing the results would be enhanced.



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# Challenges in developing and implementing an oil price risk management strategy

- Price risk management is much more complicated for government and sovereign entities versus commercial firms
- As a result, there is volatility in revenues for governments, which affects their ability to fund sovereign programs.
- Though some international agencies have strongly urged that governments become more active in managing these risks, it is still not common for governments to actively manage these risks.
- There are a number of major issues as states and governments look to being more proactive in managing risks from oil prices.
- 1) Margins: Though futures are obvious, and most effective, any hedging strategy in futures requires that ability to fund margins and margin calls. There is a chance that margin calls would be accrued. While commercial firms routinely manage this, they do so in part that gains or losses in one market are offset by gains or losses of the other market. This is not true for governments and in practice would be cumbersome to administer in practice.

2) Cost: While options, specifically puts, are attractive, it necessitates a cost which is not inconsequential.

3) Managing risks results in visible losses from futures, or losses (or costs) due to option premiums; and, it is difficult to *ex-post* explain these politically, and to bureaucracies and/or constituents.

4) Quantity Risk: Oil production has quantity risk, which would affect and complicate any hedging or risk management strategy.

5) Other strategies such as stabilization funds, are said to be potentially more effective at reducing risks. This may or may not be true but in either case would be highly stylized and preclude a general conclusion.

6) Risk Policy: While it is common that most commercial firms manage risk using a risk policy, it should be similarly valid though not identical for governments for develop and manage using a risk policy.

# Oil Prices: *Price levels, changes in prices, and outlook*

- ***Price changes*** (see attached figures that illustrate the dynamics of changes in oil prices (WTI)
  - ND Prices trade at a discount to WTI
  - Prices were at abnormally high values (i.e. relative to cost of production and history) from at least 2012 through August 2014
  - Prices fell from a high of $90 in August 2014, to a low of $32 in January 2016 (-64%)
  - It was very clear that prices commenced their decline in August 2014
- ***Price Risk*** Escalated substantially in the period following August 2014, to levels comparable to those in the grain markets of 2008. This resulted in a substantial increase in risk to any firm or government entity dependent on oil derived revenues
- ***Price outlook:*** An alternative forecast is the 'forward curve' generated by the commodity markets. This reflects the effects of the current best set of available public and private information.
  - These values suggest the most likely values, at this moment, for WTI in 2020. However, the increase to about $56/brl. Current 2020 at $60
  - The market and forward curve is quite efficient at reflecting this information; few studies (or individuals) have been capable of effectively 'out-predicting' the market (as reflected in this forward curve).

# Oil Prices: *Hedging risks of adverse price changes*

- ***Price and Revenue Risk:*** There are substantial risks to all entities in the supply chain for oil and energy. For firms this is related to their profitability of energy operations. For governments, these risks related to government revenue, and the ability to plan expenditures.
- ***Hedging as a common practice to risk management:*** These risks are common in most commodity markets, from grains and oilseeds, to energy. As a result a number of highly commercial mechanisms have emerged in the past 100 years to allow firms to manage these risks.
  - These are commonly used in virtually all functions in agriculture (producers, handlers, processors and end-users)
  - These are similarly widely used in the energy sector. They are commonly used by oil firms, by land-owners (lease holders) in addition to intermediaries throughout the industry
  - These are also commonly used by governments in varying ways to manage their risk exposure to adverse price changes. Specifically, oil price declines adversely affect government revenues, and it is this risk that is crucial to governments ability to plan expenditures.
    - In governments, these could be responsibility of varying agencies; but, should not be avoided!
    - Indeed, not hedging oil price risk would be equivalent to a grower planting soybean at 15$, then doing nothing about managing the risk, making expenditures based on the robust prices (buying land, machinery, and life-style) then, watching soybean prices fall to $8; and then, with agony having to retroactively adjust his/her spending!
    - This is no different with oil prices, government tax revenue, and expenditures.

# Oil Prices: *Hedging risks of adverse price changes*

- ***Mechanisms*** There are numerous mechanisms to manage this risk, including
  - Selling futures; or buying puts, and many more complicated combinations.
  - Indeed, Mexico has very effectively managed their risks using put option strategies and collars
- ***Issues*** There are issues in managing and administering these mechanisms, albeit minor. Most important are:
  - Determining the risk exposure to oil price changes
  - Quantitatively determining how quantity risks affect optimal hedge ratios.
  - Each of these are common in other sectors and methodologies exist to capture these impacts.

## North Dakota Century Code: *ND already has provisions to facilitate risk management using put options*

- 54-44-16. Oil and gas tax revenue put options.
- *Upon request of the director of the office of management and budget and upon approval by the industrial commission, the state investment board may purchase oil put options for the office of management and budget.*

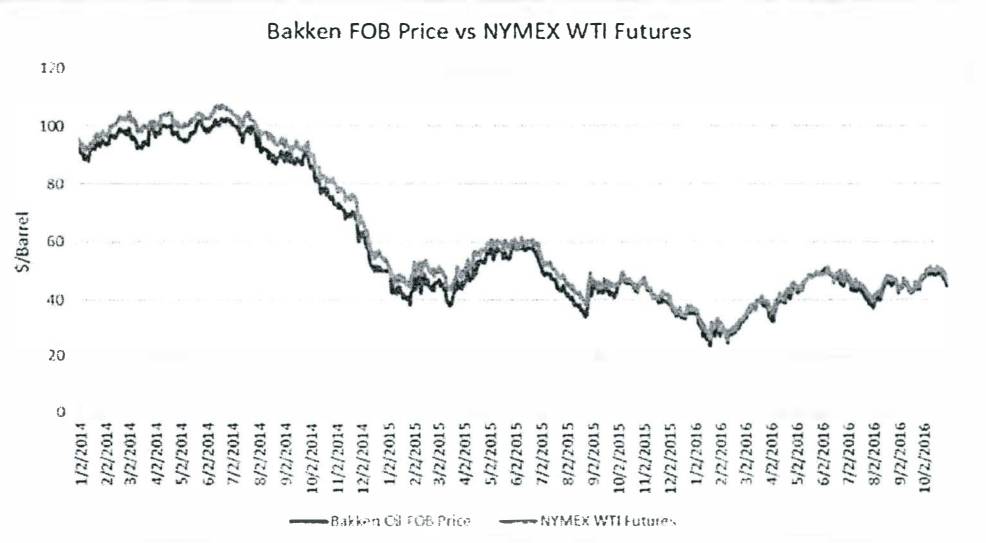
*The purchase of put options must be designed to offset reduced state general fund oil and gas tax revenues due to oil and gas prices falling below selected levels. Put options may be purchased only at such times that the purchase assures that oil tax revenues plus the revenues from the sale of put options will be in excess of the oil tax revenues estimated for that level of production by the most recently adjourned legislative assembly. The office of management and budget shall report any purchases of put options to the budget section of the legislative management.*

- **ND Century Code** addresses the prospect of using put options to mange price risk
- It ***does not*** facilitate other strategies including
  - Use of futures
  - Use of collars (long puts/short calls)

# Price Relations are important

- **Implications**
  - Prices are highly correlated
    - Use of futures and options can be appropriate
  - Correlation between basis and futures prices makes hedging more complex
  - Use of options is more complex
    - Premiums are costly
    - Short options can offset these costs
    - Option values depend on volatility, time, etc. in a very complex way

- **WTI vs Bakken and Bakken Basis**




| Correlation | | | |
|---|---|---|---|
| | *Bakken Oil FOB Price* | *NYMEX WTI Futures* | *BAKKEN BASIS* |
| Bakken Oil FOB Price | 1.00 | | |
| NYMEX WTI Futures | 0.96 | 1.00 | |
| BAKKEN BASIS | 0.57 | 0.33 | 1 |

# Alternatives for risk management

## Issues

- Defining the timing and size of the long position in oil is less obvious than traditional hedging (i.e. as compared to a grain farmer)
  - Ultimately the State becomes at risk once budget commitments are made based on anticipated oil tax revenues
- Size of position: there is quantity risk due to uncertainty in future oil production, thereby complicating the size of the position to take to mitigate risks
- Upside vs downside risk: Prices may increase or decrease. Increases are favorable and decreases are not
- Selling futures precludes advantages of price increases
- Option related strategies have a cost, but, these can be partially mitigates price risk

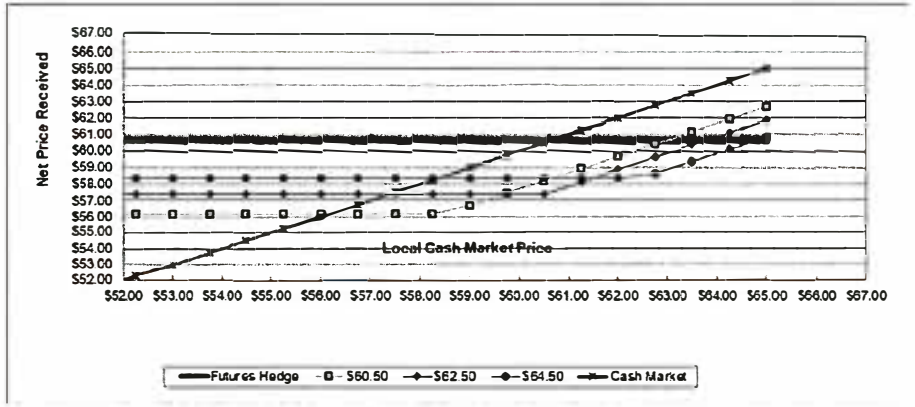
## Alternatives Strategies: Selected

| Instrument/ Mechanisms | Implication |
|---|---|
| Do Nothing | Risky |
| Sell futures | Margin calls; preclude advantages of price increases |
| Buy Puts | Protect from price decreases; but, costly due to put premiums |
| Collar: buy puts/sell calls | Costs are reduced from the proceeds of the call premium, but, there is potential for margin calls |
| Portfolio (combination) of the able | Optimally, but, more difficult analytically |

## Payoffs to fundamental strategies

- Prices for Jan 18 for July 2018 positions
- Comparison of strategies
  - Do nothing (cash market)
    - Most risky
  - Selling futures: Price levels are fixed at the futures price (plus basis), irrespective of subsequent increases or decreases
    - $62.66-2
  - Long Put: a premium is paid which lowers the return if prices stay low; the effect of that protects against declines in prices.
    - If prices increase, returns increase
    - Higher (lower) strike results in greater floor, but, lesser (greater) gain if prices increase

## Payoffs: do nothing, short futures, long puts Jan 2018 in July positions




| | Jul-18 | | |
|---|---|---|---|
| Futures | 62.66 | | |
| Strike | Calls | Puts | |
| 60.5 | 4.65 | 2.31 | |
| 61 | 4.33 | 2.49 | |
| 61.5 | 4.03 | 2.69 | |
| 62 | 3.74 | 2.9 | |
| 62.5 | 3.46 | 3.12 | |
| 63 | 3.2 | 3.35 | |
| 63.5 | 2.95 | 3.59 | |
| 64 | 2.71 | 3.86 | |
| 64.5 | 2.49 | 4.13 | |
| 65 | 2.28 | 4.42 | |

# Payoffs for individual positions

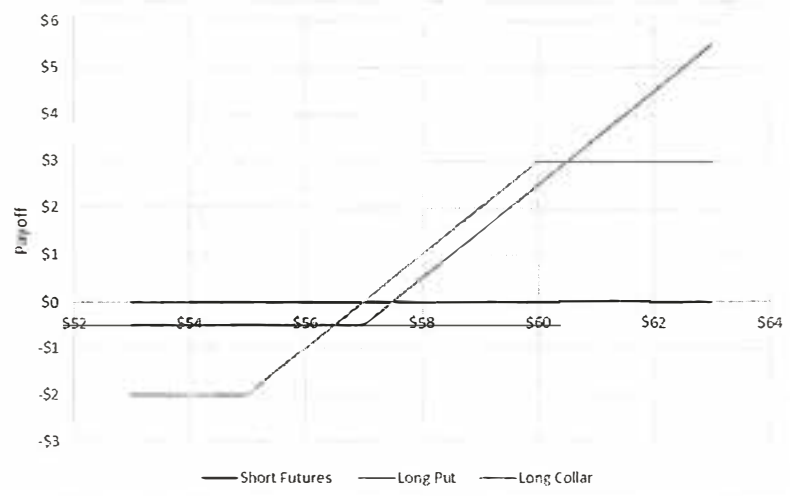
# Payoffs from Collar: *Long Put/Short Call*

Payoffs from short futures, long put and long collar

Based on Futures=$57,

put 55 @.7 and call 60@.7

Net cost of put: Put-Call, or .7-.7=0




## Interpretation

- Collar (long put, short call): cost of the put are offset partly by the sale of a call.
  - E.g., *Buy a 55 put at $.70*
  - *and selling a 60 call at $.70*
- Effects of strategy are:
  - Lessen the cost of put insurance
    - $0 vs $.70
  - There is risk if futures prices increase.
  - As a result, there is a margin requirement and potential for margin calls (on the call if prices increase too much)

Soybean Grower Risk Mgmt.

- Timing: sometime between buying inputs and selling production, grower seeks protection against price declines
- Quantity: Due to yield uncertainty, initial hedges may be for a portion of production and adjusted as yield uncertainty declines
- Alternatives:
  - sell futures to lock in price levels,
  - buy puts establish a price floor
  - buy collars and/or
  - some portfolio of above.

State of ND as Risk Manger

- Timing: Either prior to budget decisions to guide budget decisions; or, following budget decisions to assure against losses
- Quantity: Based on estimated oil production, prices and expected tax revenue
- Alternatives
  - sell futures to lock in price levels
  - buys puts to establish price floor
  - Buy collar to lower cost of put coverage
  - Some portfolio of above

# Comparison: *Soybean grower as a hedger vs State of ND as risk mgmt.*

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1-28-19

# Probability of a margin call

- Any futures hedge, or short option would result in a non-nil probability of a margin call (payment of a margin to the commodity broker)
- To illustrate, we developed a model based on
  1. $4,000 initial margin and $2,900 maintenance margin
  2. Derived margin call threshold price defined as the price at which a short hedger incurs a margin call if price goes above it.
  3. This simulation assumes the hedger replenishes, margin to the initial margin after incurring margin call.

- Based on this, the results indicate the probability of a margin call would be: .34
- Derivation used stochastic simulation using the parameters below

| Current Futures | SD Futures | Futures Distribution |
|---|---|---|
| $46.86 | $2.76 | $46.86 |
| **Current Basis** | **SD Basis** | **Basis Distribution** |
| -$2.05 | $0.91 | -$2.05 |

| Correlation matrix | *Futures* | *Basis* |
|---|---|---|
| Futures | 1.00 | 0.33 |
| Basis | 0.33 | 1.00 |
| | Period 1 Futures | $46.86 |
| | Margin Call Thresho | $47.96 |
| **Probability of Margin call** | | 34% |

## Empirical Model (Empirical equations are in the appendix)

### Description/Logic

- Empirical model is based on modern portfolio theory, commonly referred as the mean-variance (E-V) model
- It determines efficient portfolios for a risk-averse investor using the mean and variance of portfolio's return. production or inventory.
- An important challenge in hedging is determination of the quantity to be hedged. For governments, this random quantity is an important feature of risk management strategies.
- To do so, we used a triangular distribution (as inferred from the data) to capture production risks which ultimately impacts hedge ratios (HR's).
  - This is specified as [0.964, 1.011, 1.044] where the values are respectively the minimum, most likely and maximum and represent barrels of production per day.

### Empirical Procedures

- The empirical model determines the optimal hedging strategy for North Dakota oil using WTI futures and/or options.
- It uses RISKOptimizer (Palisade Corporation) to determine E-V utility maximizing optimal futures and put option hedge ratios
- Five strategies are specified to simulate implicit cash positions related to long oil. These include,
  - no hedge
  - futures hedge only (i.e. selling futures)
  - put options hedge (long puts)
  - collar hedging (long put and short a call)
  - Unrestricted hedging with futures and put options whereby the model determines the optimal combinations of each.

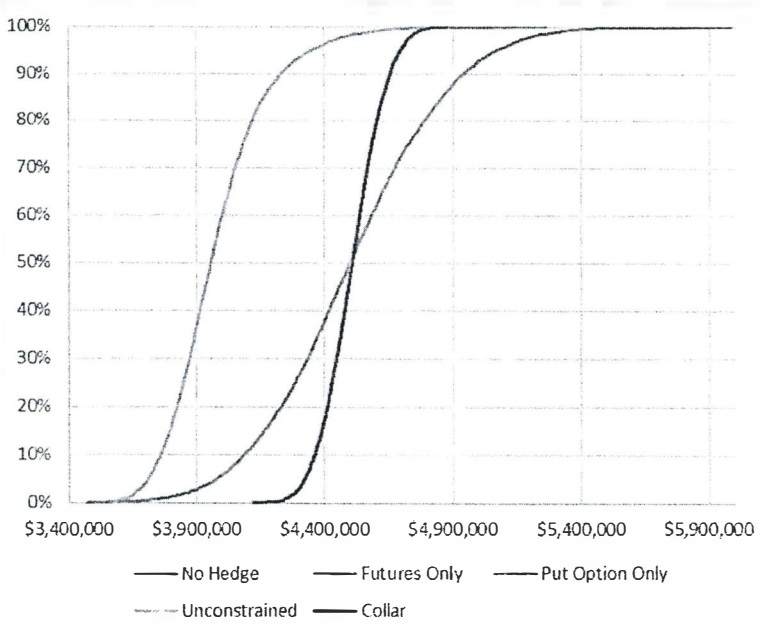
# Results: *Optimization Results for Alternative Hedging Strategies (values are in $/day)*

- Important is the mean and st. deviation
  - Position size is optimal hedge ratio for each instrument
    - E.g., $HR_f$ = -10% means a short futures of 10% of average daily production
  - Each strategy has the impact of reducing risk (st. deviation)
- Best strategy: *Collar, followed by Optimal futures and puts, and then futures only*
  - COLLAR is a strategy of long put and short call at 11.09% of average daily production.
  - Collar strategy has highest mean $4,510,503 and standard deviation $111,585

| | *Position Size % (Hedge Ratio)* | | | |
|---|---|---|---|---|
| | Futures | Put Option | Mean | Standard Deviation |
| No Hedge | 0.00% | 0.00% | $4,510,404 | $328,337 |
| Futures Only | -11.02% | 0.00% | $4,510,473 | $113,818 |
| Put Option Only | 0.00% | 16.14% | $3,988,559 | $194,694 |
| Unrestricted Future & Puts | -10.94% | 0.05% | $4,508,562 | $113,365 |
| Collar | 11.09% | | $4,510,503 | $111,585 |

# CDF for Alternative Strategies

**Probability Distributions for Each Strategy (cdf is cumulative prob distribution)**




## Interpretation

- cdf for each strategy illustrates the range of potential outcomes and compares the size of that range across strategies
- Results illustrate
  - No hedge has the greatest range (widest range, or dispersion) of outcomes
  - Futures hedge has the least range, but, no upside potential
  - Put only has a lower value due to the cost of the put, but, its range is lesser
  - Collar has a higher outcome, and a lower dispersion than a put only strategy
- Probability vs $/day

# Interpretation

- Best strategy: Collar (buy put/sell call)
- Alternatives:
  - Portfolio of futures, and puts
  - Long puts: While options have appeal, they are costly vs a collar strategy
  - Futures hedge
- Margin Calls:
  - Very important!
  - Both futures and collar (long put/short call) have the potential for margin calls.
  - Prob of margin call=.34 (by varies substantially)
  - Requires cash outlay from a trading or other budget
- Any of these strategies reduces risk relative to doing nothing (no hedge)
  - By about 2/3's
  - Without adversely impacting mean revenue
- There are many alternative combinations of the above instruments which can (have been) analyzed further, but, the general conclusions remain the same

# Estimates of Costs of Risk Mgmt.

**Estimated Cost of Option Coverage**

Jan 19 2018 using July 2018 options

| | | Option Premium | |
|---|---|---|---|
| Futures | $62.66 | *Put Cost* | *Call Offset* |
| Put Strike | 61 | -2.49 | |
| Call Strike | 65 | | 2.28 |
| | | | |
| Producdtion per month (1000/d) | 30,000,000 | | |
| Share of Prod | 0.10 | | |
| | | | |
| Monthly oil production at risk | 3,000,000 | | |

**Estimated Oil Tax Revenue $**

| | Per Month | Annual |
|---|---|---|
| | 181,980,000 | 2,183,760,000 |

**Net Cost of Risk Mgmt $**

| | | |
|---|---|---|
| Put Strategy | -7,470,000 | -89,640,000 |
| Collar strategy | -630,000 | -7,560,000 |

- Above are estimated elements of cost for 2018 oil prices/production, for illustration
- Results are dependent on choice of put and call strike prices, and coverage
- Results assume risk management for 10% of production @1000 brl/day; and at market level (ATM) strikes for puts and offset by a call.
- Cost of put strategy: 4%
- Cost of collar strategy: <1%

# Policy alternatives and issues

- Do nothing
- Risk management strategy
  - Results in lower risk of oil tax revenue without substantially impacting mean

- Optimal results require use of a collar:
  - meaning both long puts and short calls
  - Spread in strike prices for puts and calls can vary
- Legislation should be revised to
  - Allow for use of collars, in addition to puts which currently exists
  - Reflect the organization, intent and structure of the oil price risk management initiative
- Determine department and organizational responsibility
- Managerial guidelines

# Extensions beyond work-to-date

- Several important extensions should be pursued in some format:
  - Continual updating of data and refining the model
  - Critical evaluation of use of hedging mechanisms vs. some type of reserve fund
  - Improved model for projecting Bakken oil production (Bullock)
  - Timing of risk management positioning
  - Expand to include natural gas, if/as appropriate
  - Development of a Risk Policy for the State of North Dakota (or any sovereign entity) to guide decisions related to managing revenue risk

# Continual updating of data and refining the model

- Results above are based on data from October 2016 (comparable to June 2018)
- From this statistical distributions were derived, as well as correlations
- The value of these impact the results
- These statistical distributions and correlations change through time, thereby affecting the results
- For these reasons, it would be prudent to establish a mechanism to routinely
  - Update the data
  - Re-evaluate the distributions and correlations
  - Derive revise optimal positions (hedge ratios)
- With the opening of the Dakota Access Pipeline, Bakken and WTI the basis has changed significantly. In addition to being higher, it is likely less volatile. This will be captured by continually updating the models.

# Evaluation of use of hedging mechanisms vs. some type of reserve fund

- Hedging has the impact of reducing risk or volatility of revenues from oil taxes
- It will not eliminate the risk, but, will reduce the risk
  - i.e., risk in the variability of oil revenues,
  - By, about 2/3's
- An alternative to hedging is to use some form of revenue fund.
- This was a preferred choice by the Government of Alberta
- The parameters by which this fund would operate would have to be developed, and could be done analytically
- Which of these mechanisms is preferred is subject to further study

## Tactical Details: *Timing of risk management positioning, strikes, etc*

- This is in reference as to when hedging positions are taken. While there are many alternatives, the discrete ones include:
  - Initiate positions in anticipation of budget decisions
    - This provides anticipatory revenues for budgeting
  - Take position following budget decisions
    - Once budget decisions are taken, based on projected revenues, positions are initiated for duration of budget period
  - Routine hedging throughout the *ex-ante* and *ex-post* budgeting process
    - Requires analysis
- An assessment should be made of the practicality of these differences
- Which strikes?
  - This is an important tactical issue and guidance should be provided

# Development of a Risk Policy for the State of North Dakota (or any sovereign entity) to guide decisions related to managing revenue risk

- Problem:
  - Ultimately, decisions related to implementing risk mitigation are challenging and the outcomes can be severe
  - There are numerous examples of firms that have had individual manage risk, that accrue unexpected losses, many times due to inappropriate and unintended trading
  - There are prospective costs that could be large associated with these strategies
  - Unexpected losses will be subject to public criticism

- For these reasons, it is prudent that prior to adopting and implementing a strategy as prescribed here, that a Risk Policy be developed as suggested

- Most all companies with successful risk management strategies manage this through a thoroughly developed risk policy (e.g., ND Mill)

- Risk policy should include detailed development and specification of the below:
  - Description of market risks
  - Acceptable trading strategies/mechanisms
  - Risk measurement tools
  - Acceptable risk limits (based on above)
  - Specify how both the floor and net premium constraint are set via their Risk Policy.
  - Organizational structure for managing price risk, including
    - Designated agency responsible for administering the strategy
    - Risk and price reporting structure (procedures for risk reporting
    - Etc.
  - Document should be formally approved by some organization

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# Appendix/Figures

# Empirical equations

- The model was specified using a payoff functions for ND state oil revenue defined in eq 3 and 4
- Equation (3) represents a strategy inclusive of cash, future and put options equation (4) differs and is specified to include payoffs from a collar strategy.
- Tilde indicates a random variable. $\tilde{\pi}_3$ and $\tilde{\pi}_4$ are payoffs for equation (3) and (4), respectively.
- At period i, $B_i$ and $F_i$ are basis and futures prices respectively. $Q_i$ is average daily production, and it is important that this variable is random. $R$ is royalty rate imposed on the gross value of the oil production. $HR_f$ and $HR_o$ are optimal futures and put option HR respectively. $HR_{collar}$ is the optimal HR for collar hedging strategy and $HR_{collar} \geq 0$. $\bar{X}$ is not random variable, and it is an average of average daily production for ND oil production for historical month.
- $Prem_f$ and $K$ are put option premium and strike price of put option, respectively. The first part of the right-hand side of equation (3) is oil revenue, the second part is return from futures, and the third part is return from put option.
- Current maximum tax rates in North Dakota are 10 to 11% are imposed to the gross value of oil, which are comprised of 5.0 percent production tax and 5.0 to 6.0 percent extraction tax depending on the price (North Dakota Petroleum Council 2015). Hence, we assumed royalty rate, $R$ = 10%.
- Put option's value is derived from the intrinsic value because the option's payoff is easy to derive.
- The average daily oil production was not statistically related to basis and futures prices. This is supported by the data (Figure 1 and 2).

  These results indicate that production is random, but not related to the price of oil, at least over the study period. For this reason, the North Dakota oil tax revenue reduction mostly comes from the oil price drop. The WTI futures price dropped approximately -68.6% ($107.07 to $33.62 per barrel using close price) from highest to lowest prices during August 2013 to October 2016. During the same period, the difference of highest and lowest average daily production is only -21.0% (1.22 million to 0.964 million barrels a day). While WTI futures price and production decreased, the number of wells producing oil has been increasing, and this suggests that ND oil production is consistent.

- To keep the model simple, no attempt here is made to annualize the results. There are detailed procedures and processes for capturing and disseminating the proceeds of these royalties in North Dakota, as in other states or countries.
- If average oil price is above $90 for any three consecutive months, the extraction tax rate increases to 6.0 percent.

$$\tilde{\pi}_3 = R\tilde{Q}_2\left(\tilde{B}_2 + \tilde{F}_2\right) + HR_f\bar{X}\left(\tilde{F}_2 - F_1\right) + HR_o\bar{X}(Prem_{p,K} + Max(K - F_2, 0)) \quad (3)$$

$$\begin{aligned}\tilde{\pi}_4 = {} & R\tilde{Q}_2\left(\tilde{B}_2 + \tilde{F}_2\right) \\ & + \left[-HR_{collar}\bar{X}\left(Prem_{c,K} + Max(F_2 - K, 0)\right)\right. \\ & \left. + HR_{collar}\bar{X}\left(Prem_{p,K} + Max(K - F_2, 0)\right)\right]\end{aligned} \quad (4)$$

# Additionally:

- These strategies are each simulated and compared.
- We also explored impact of the best-fit copula and empirical copula to the optimal HRs.
- Finally, we ran simulations across different strategies and compared them using E-V utility. In addition, to expand the results, we used stochastic efficiency with respect to function (SERF) to estimate certainty equivalents for each of the five strategies across a range of risk attitudes.

#2
HB 1186
1-28-19
p.1

CME Group

# Crude Oil 2 Year MidCurve Options Quotes
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| Underlying Future | Charts | Last | Change | Prior Settle | High | Low | Volume | Hi / Low Limit | Updated |
|---|---|---|---|---|---|---|---|---|---|
| Jun 2021 | | - | - | 54.28 | - | - | 325 | 60.28 / 48.28 | 11:01:55 CT 28 Jan 2019 |

Type: 2 Year Mid-Curve Options

Expiration: Jun 2019

Strike Range: At The Money

| Calls | | | | | | | | | Puts | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Updated | Hi / Low Limit | Volume | High | Low | Prior Settle | Change | Last | Strike Price | Last | Change | Prior Settle | Low | High | Volume | Hi / Low Limit | Updated |
| 16:00:00 CT | No Limit | | | | | | | | | | | | | | No Limit | 16:00:00 CT |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 Jan 2019 | / No Limit | 0 | - | - | 12.91 | - | - | 5200.0 | - | - | 1.57 | - | - | 0 | / No Limit | 27 Jan 2019 |
| 16:00:00 CT 27 Jan 2019 | No Limit / No Limit | 0 | - | - | 12.52 | - | - | 5250.0 | - | - | 1.68 | - | - | 0 | No Limit / No Limit | 16:00:0( CT 27 Jan 2019 |
| 16:00:00 CT 27 Jan 2019 | No Limit / No Limit | 0 | - | - | 12.12 | - | - | 5300.0 | - | - | 1.78 | - | - | 0 | No Limit / No Limit | 16:00:0( CT 27 Jan 2019 |
| 16:00:00 CT 27 Jan 2019 | No Limit / No Limit | 0 | - | - | 11.73 | - | - | 5350.0 | - | - | 1.89 | - | - | 0 | No Limit / No Limit | 16:00:0( CT 27 Jan 2019 |
| 16:00:00 CT 27 Jan 2019 | No Limit / No Limit | 0 | - | - | 11.35 | - | - | 5400.0 | - | - | 2.01 | - | - | 0 | No Limit / No Limit | 16:00:0( CT 27 Jan 2019 |
| 16:00:00 CT 27 Jan 2019 | No Limit / No Limit | 0 | - | - | 10.97 | - | - | 5450.0 | - | - | 2.13 | - | - | 0 | No Limit / No Limit | 16:00:0( CT 27 Jan 2019 |
| 16:00:00 CT 27 Jan 2019 | No Limit / No Limit | 0 | - | - | 10.60 | - | - | 5500.0 | - | - | 2.26 | - | - | 0 | No Limit / No Limit | 16:00:0( CT 27 Jan 2019 |
| 16:00:00 CT 27 Jan 2019 | No Limit / No Limit | 0 | - | - | 10.24 | - | - | 5550.0 | - | - | 2.40 | - | - | 0 | No Limit / No Limit | 16:00:0( CT 27 Jan 2019 |
| 16:00:00 CT 27 Jan 2019 | No Limit / No Limit | 0 | - | - | 9.87 | - | - | 5600.0 | - | - | 2.53 | - | - | 0 | No Limit / No Limit | 16:00:0( CT 27 Jan 2019 |
| 16:00:00 CT 27 Jan 2019 | No Limit / No Limit | 0 | - | - | 9.52 | - | - | 5650.0 | - | - | 2.68 | - | - | 0 | No Limit / No Limit | 16:00:0( CT 27 Jan 2019 |

? About This Repor

#3
HB1186
1-28-19

19.0580.01001
Title.

Prepared by the Legislative Council staff for
Representative Kempenich
January 22, 2019

PROPOSED AMENDMENTS TO HOUSE BILL NO. 1186

Page 1, line 1, after "A BILL" replace the remainder of the bill with "for an Act for a pilot project regarding oil and gas tax revenue hedging; to provide for a report to the legislative management; and to provide an appropriation.

**BE IT ENACTED BY THE LEGISLATIVE ASSEMBLY OF NORTH DAKOTA:**

**SECTION 1. OIL AND GAS TAX REVENUE HEDGING PILOT PROJECT - ADVISORY COMMITTEE - REPORT TO LEGISLATIVE MANAGEMENT.** During the 2019-20 interim, an advisory committee shall oversee a pilot project regarding oil and gas tax revenue hedging. At the direction of the advisory committee and using funds in an oil and gas tax revenue hedging fund at the Bank of North Dakota, the Bank shall enter swap agreements or any other hedging strategies with designated counterparts approved by the advisory committee. The execution of hedging strategies must be designed to offset reduced state general fund oil and gas tax revenues due to oil and gas prices falling below selected levels included in the legislative revenue forecast at the conclusion of the most recently adjourned legislative assembly. The members of the advisory committee are entitled to receive reimbursement for reasonable and necessary expenses incurred while performing duties for the advisory committee at the same level as state officials. The advisory committee shall report the results of the pilot project and any recommendations regarding oil and gas tax revenue hedging to the legislative management before August 1, 2020. The advisory committee is comprised of:

1. Two members chosen by the North Dakota petroleum council;
2. The director of the office of management and budget;
3. One member of the legislative assembly chosen by the majority leader of the senate;
4. One member of the legislative assembly chosen by the majority leader of the house of representatives;
5. One representative of the Bank of North Dakota; and
6. The executive director of the Indian affairs commission.

**SECTION 2. APPROPRIATION.** There is appropriated out of any moneys in the general fund in the state treasury, not otherwise appropriated, the sum of $100,000, or so much of the sum as may be necessary, to the Bank of North Dakota for the purpose of conducting the pilot project regarding oil and gas tax revenue hedging, for the biennium beginning July 1, 2019, and ending June 30, 2021."

Renumber accordingly

#1
HB 1186
2-5-19

19.0580.01002
Title.

Prepared by the Legislative Council staff for
Representative Kempenich
January 30, 2019

PROPOSED AMENDMENTS TO HOUSE BILL NO. 1186

Page 1, line 1, after "A BILL" replace the remainder of the bill with "for an Act to provide for a pilot project regarding oil and gas tax revenue hedging; to provide for a report to the legislative management; and to provide an appropriation.

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4. One member of the legislative assembly appointed by the majority leader of the house of representatives;
5. One representative of the Bank of North Dakota;
6. The executive director of the Indian affairs commission; and
7. The agriculture commissioner.

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Renumber accordingly