

A new transaction evidence timber appraisal model for Montana



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Bureau of Business and Economic Research



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SCAN ME

Montana DNRC Timber Appraisal

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Outline

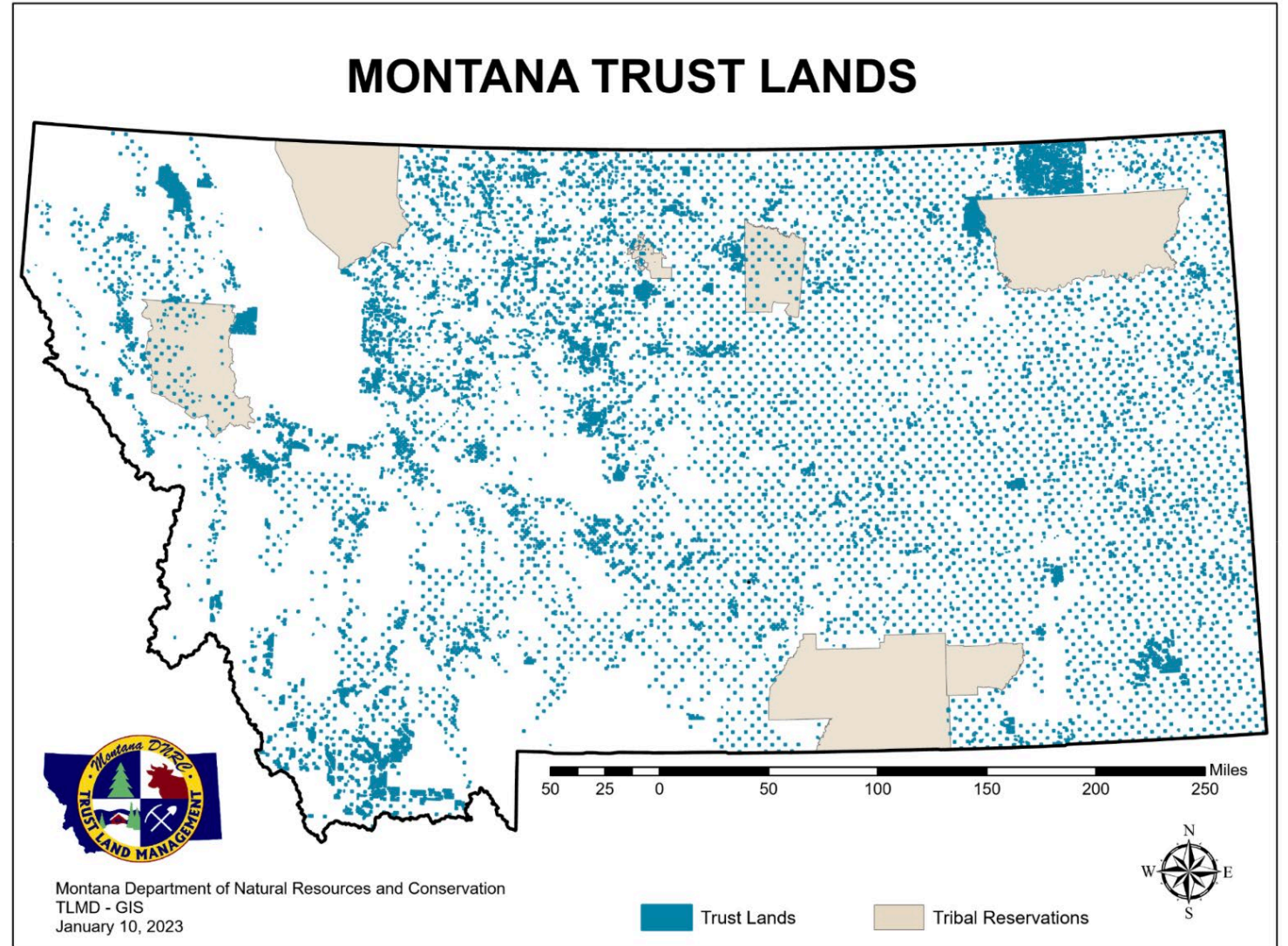
- **Background**
- **Data**
- **Methods**
- **Results**
- **Discussion**



Background

DNRC Trust Lands

- Two sections/township
- State forests
- Multi-use
- Working lands
- Receipts to schools
- 5.2 million acres
- 55 MMBF target
- 25-30 sales per year



Background

Public timber appraisal



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Background

Public timber appraisal

- Mandatory



Background

Public timber appraisal

- Mandatory
- Accountability
- Publicly-owned resource for sale
- Appropriate return for perpetual investment
- Procedural, defensible, repeatable



Background

Public timber appraisal

- Mandatory
- Accountability
- Auction starting value
- Open market auctions
- Limited competition
- Sealed-bid



Background

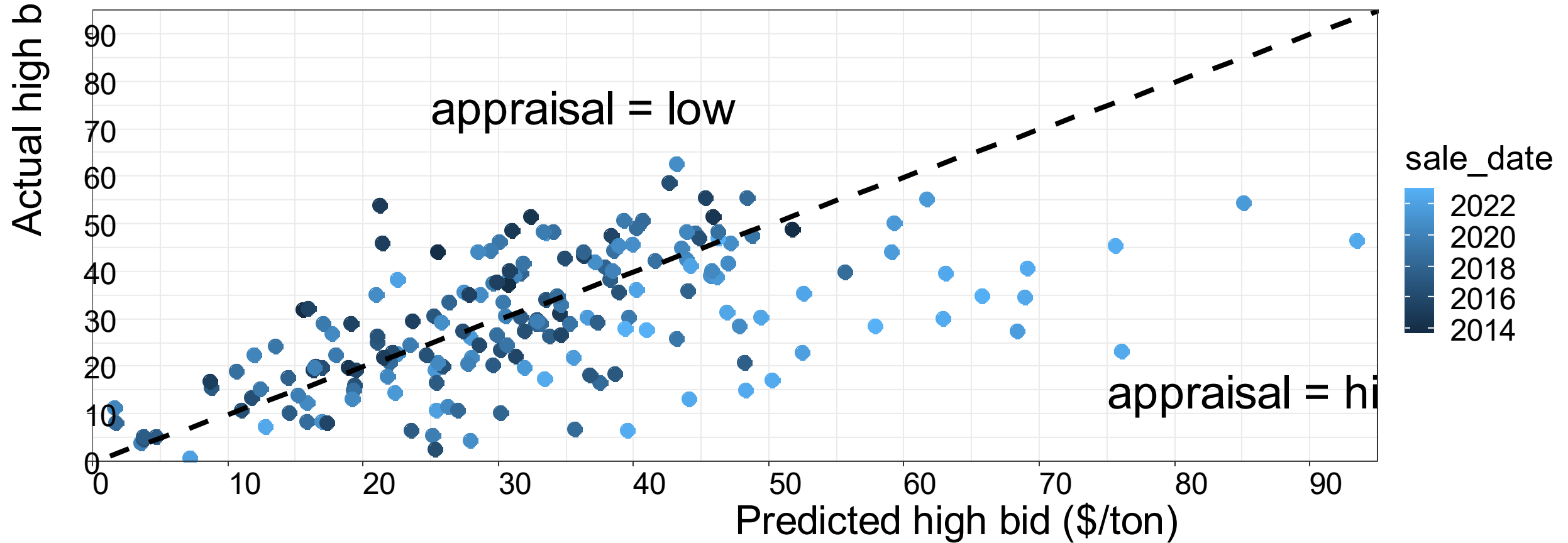
Public timber appraisal

- Mandatory
- Accountability
- Auction starting value
- Tool for managers
- Sale feasibility?
- Timber offering quality?
- Appropriate contract costs?



Background

Old (2014) model performance



Background

Old model performance

What do we hear?



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Background

Old model performance

What do we hear?

Model overpredicts!



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Background

Old model performance

What do we hear?

Model overpredicts!

But why?

- Land base change?
- Timber condition change?
- Market changes?



Background

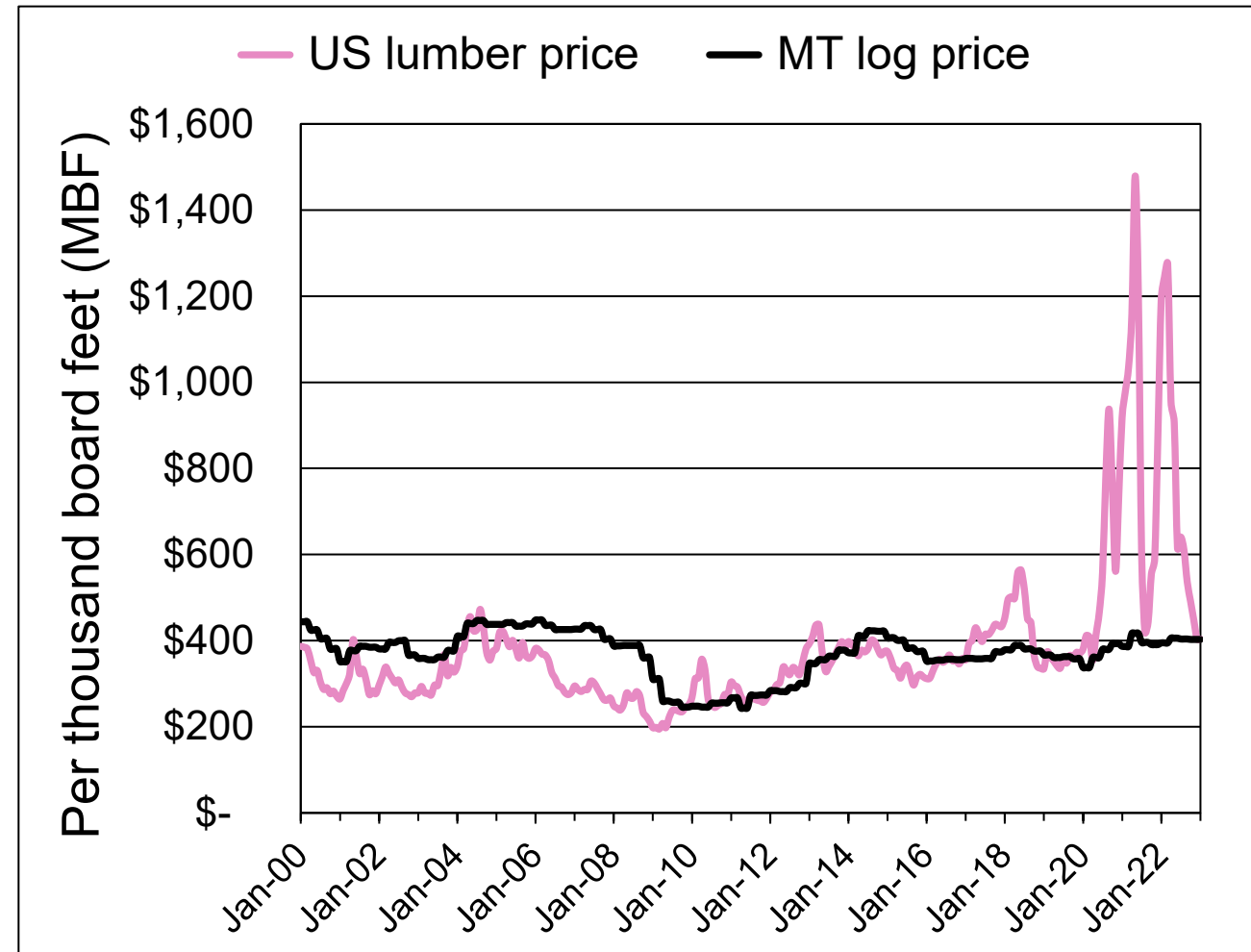
Old model performance

What do we hear?

Model overpredicts!

But why?

- Land base change?
- Timber condition change?
- Market changes?



Data

Three sources:



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Data

Three sources:

- **DNRC**
- **BBER**
- **External**



Data

Three sources:

- **DNRC**
 - **BBER**
 - **External**
- 2014 – 2022
 - 245 timber sales
 - Sale characteristics
 - Location
 - Volume
 - Species breakdown
 - Systems breakdown
 - Timber condition
 - Associated costs
 - Etc....



Data

Three sources:

- **DNRC**
 - **BBER**
 - **External**
- Delivered log prices
 - Published quarterly
 - Survey-based
 - Logging costs
 - Published in odd years
 - Survey & expert opinion
 - Haul costs
 - Published in even years
 - Survey-based



Data

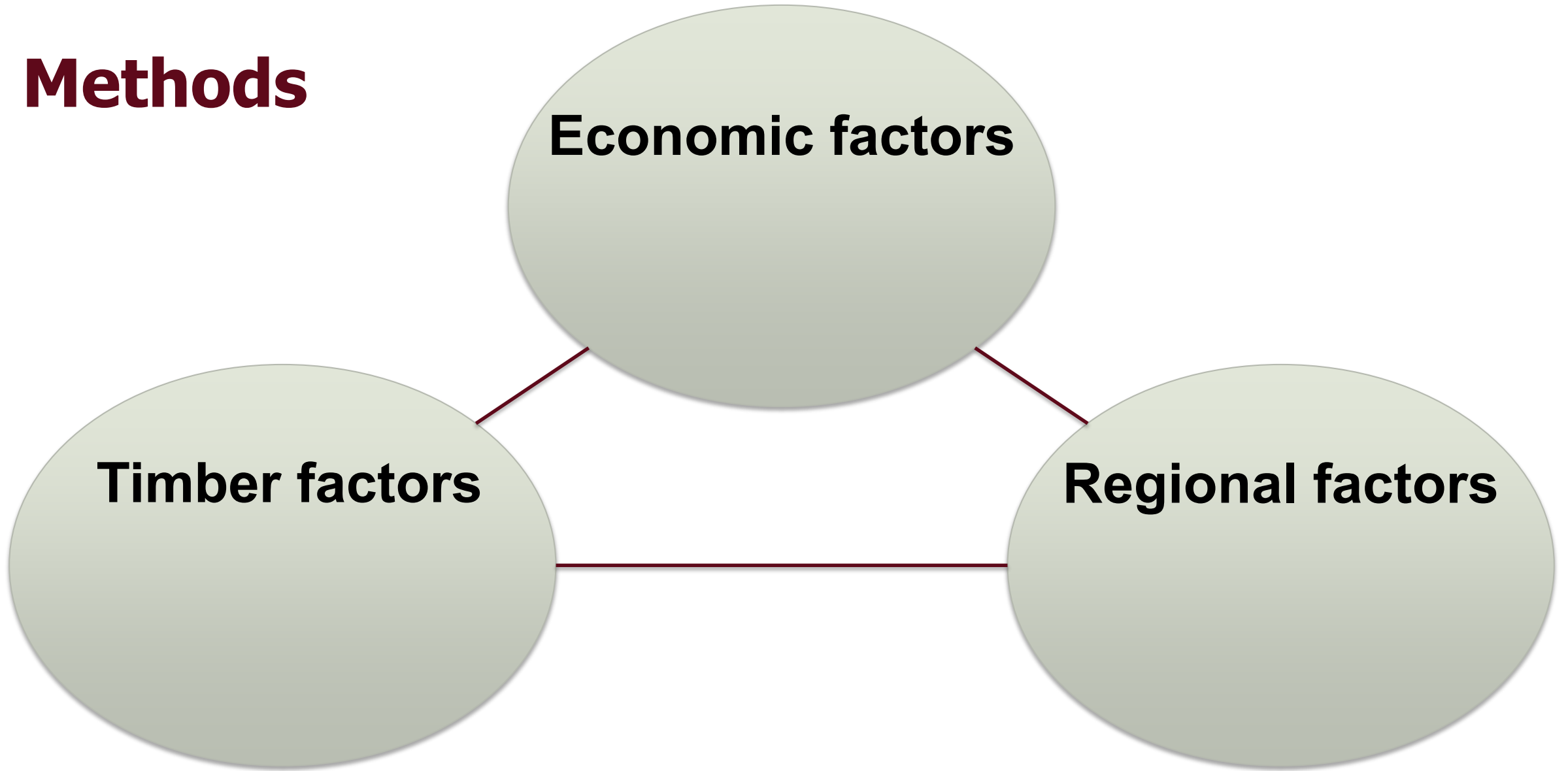
Three sources:

- **DNRC**
- **BBER**
- **External**

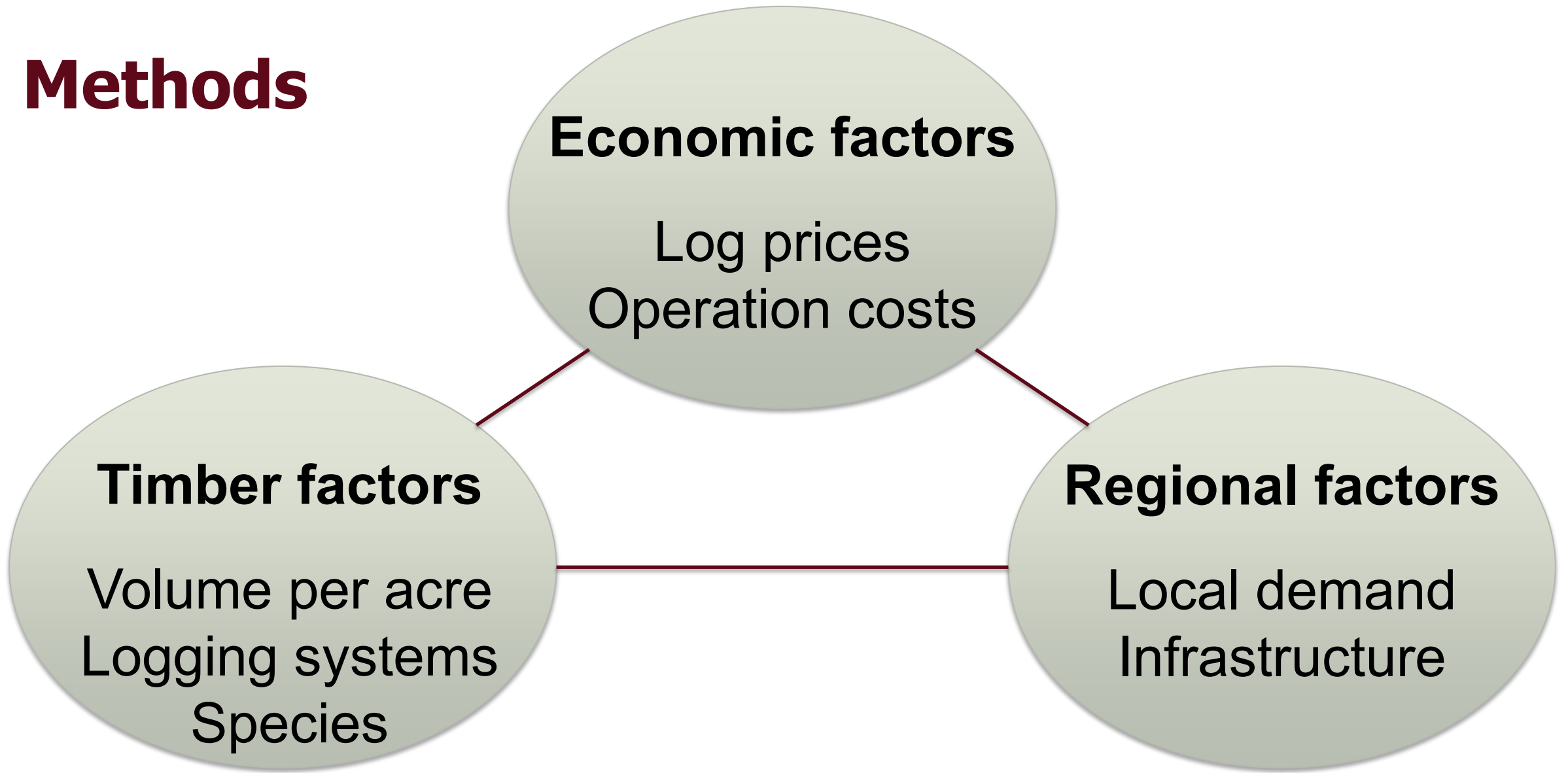
- Lumber prices
 - WWPA
 - Random Lengths
- Log prices
 - RISI Fastmarkets
- Market areas
- Economic indicators
 - GDP, PCE, CPI, etc.
 - PPI



Methods



Methods



Methods

model.group	model.name	model.description	data.set	filter.1	filter.2	filter.3	left.1	left.2	right.1	right.2	right.3	right.4	right.5	right.6	right.7	right.8	right.9
dnrc.simulation	Im.1	DNRC coefficients, no regression															
dnrc.simulation	Im.2	DNRC simulation	base_real				winning_bid_real		contract_mbf_real	haul_dnrc	log_dnrc	NWLO_dummy	wwpa_avg_real	total_acres			
dnrc.simulation	Im.3	DNRC simulation w/ delivered log prices	base_real				winning_bid_real		contract_mbf_real	haul_dnrc	log_dnrc	NWLO_dummy	bber_avg_real	total_acres			
dnrc.simulation	Im.4	DNRC w/ log prices and BBER (1) haul cost	base_real				winning_bid_real		contract_mbf_real	haul_bber_mbf	log_dnrc	NWLO_dummy	bber_avg_real	total_acres			
dnrc.simulation	Im.5	DNRC w/ log prices and BBER (2) haul cost	base_real				winning_bid_real		contract_mbf_real	haul_bber2_mbf	log_dnrc	NWLO_dummy	bber_avg_real	total_acres			
dnrc.simulation	Im.6	DNRC w/ log prices, BBER haul (1) and log cost	base_real				winning_bid_real		contract_mbf_real	haul_bber_mbf	log_bber_mbf	NWLO_dummy	bber_avg_real	total_acres			
dnrc.simulation	Im.7	DNRC w/ log prices, BBER haul (2) and log cost	base_real				winning_bid_real		contract_mbf_real	haul_bber2_mbf	log_bber_mbf	NWLO_dummy	bber_avg_real	total_acres			
price.tests	Im.14	Starting point	base_real				winning_bid_real		number_bids	bber_avg_real	log_bber_mbf	haul_bber_mbf	road_mbf_real	other_mbf_real	avg_diameter		
price.tests	Im.15	WWPA weighted test	base_real				winning_bid_real		number_bids	wwpa_avg_real	log_bber_mbf	haul_bber_mbf	road_mbf_real	other_mbf_real	avg_diameter		
price.tests	Im.17	BBER total average test	base_real				winning_bid_real		number_bids	bber_total_avg	log_bber_mbf	haul_bber_mbf	road_mbf_real	other_mbf_real	avg_diameter		
price.tests	Im.18	RL index test 1	base_real				winning_bid_real		number_bids	rl_index_real	log_bber_mbf	haul_bber_mbf	road_mbf_real	other_mbf_real	avg_diameter		
logging.tests	Im.20	DNRC logging index test	base_real				winning_bid_real		number_bids	bber_avg_real	log_dnrc	haul_bber_mbf	road_mbf_real	other_mbf_real	avg_diameter		
logging.tests	Im.21	New logging index test	base_real				winning_bid_real		number_bids	wwpa_total_avg	log_index	haul_bber_mbf	road_mbf_real	other_mbf_real	avg_diameter		
logging.tests	Im.22	Disag logging 1 (volume * distance)	base_real				winning_bid_real		number_bids	bber_avg_real	haul_bber_mbf	road_mbf_real	other_mbf_real	avg_diameter	ground_disag	cable_disag	other_disag
logging.tests	Im.23	Disag logging 2 (volume + distance)	base_real				winning_bid_real		number_bids	bber_avg_real	haul_bber_mbf	road_mbf_real	other_mbf_real	avg_diameter	ground_mbf	cable_mbf	excavation_mbf
logging.tests	Im.24	Volume by system test	base_real				winning_bid_real		number_bids	bber_avg_real	haul_bber_mbf	road_mbf_real	other_mbf_real	avg_diameter	ground_mbf	cable_mbf	excavation_mbf
haul.tests	Im.25	DNRC haul index	base_real				winning_bid_real		number_bids	bber_avg_real	log_bber_mbf	haul_dnrc	road_mbf_real	other_mbf	avg_diameter		
haul.tests	Im.26	New haul index	base_real				winning_bid_real		number_bids	bber_avg_real	log_bber_mbf	haul_index	road_mbf_real	other_mbf	avg_diameter		
haul.tests	Im.27	BBER haul w/ pup	base_real				winning_bid_real		number_bids	bber_avg_real	log_bber_mbf	haul_bber2_mbf	road_mbf_real	other_mbf	avg_diameter		
haul.tests	Im.28	Disag haul 1 (total distance)	base_real				winning_bid_real		number_bids	bber_avg_real	log_bber_mbf	road_mbf_real	other_mbf_real	avg_diameter	total_distance		
haul.tests	Im.29	Disag haul 2 (paved distance + unpaved distance)	base_real				winning_bid_real		number_bids	bber_avg_real	log_bber_mbf	road_mbf_real	other_mbf_real	avg_diameter	paved_distance	unpaved_distance	
other.cost.tests	Im.30	No road costs	base_real				winning_bid_real		number_bids	bber_avg_real	log_bber_mbf	haul_bber_mbf	other_mbf_real	avg_diameter			
other.cost.tests	Im.31	No other costs	base_real				winning_bid_real		number_bids	bber_avg_real	log_bber_mbf	haul_bber_mbf	road_mbf_real	avg_diameter			
other.cost.tests	Im.32	No road or other costs	base_real				winning_bid_real		number_bids	bber_avg_real	log_bber_mbf	haul_bber_mbf	avg_diameter	FI_mbf_real			
other.cost.tests	Im.32b	Combine costs	base_real				winning_bid_real		number_bids	bber_avg_real	log_bber_mbf	haul_bber_mbf	contract_mbf_real	avg_diameter			
other.cost.tests	Im.33	FI fee	base_real				winning_bid_real		number_bids	bber_avg_real	log_bber_mbf	haul_bber_mbf	road_mbf_real	other_mbf_real	avg_diameter		



Results



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Results

- Predicted:
 - Winning bid
- Explanatory:
 - Delivered log price
 - Logging cost
 - Haul cost
 - Contract costs
 - Geographic adjustment
 - Bids



Results

- Predicted:
 - Winning bid
- Explanatory:
 - Delivered log price
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 - Bids

	lm.74 (Option 1)		lm.75 (Option 2)		lm.76 (Option 3)	
(Intercept)	7.68	(9.80)	-34.09 ***	(8.52)	60.66 ***	(7.98)
number_bids	2.04 ***	(0.34)	2.51 ***	(0.34)	2.48 ***	(0.39)
bber_avg_real	0.13 ***	(0.02)	0.13 ***	(0.02)		
haul_bber2_ton	-0.46 **	(0.15)			-0.46 **	(0.17)
log_bber_ton	-1.17 ***	(0.17)			-1.12 ***	(0.19)
contract_ton_real	-0.86 ***	(0.18)	-0.90 ***	(0.19)	-0.73 ***	(0.20)
NWLO_dummy	20.59 ***	(2.33)	18.56 ***	(2.55)	21.04 ***	(2.67)
SWLO_dummy	13.98 ***	(2.49)	11.18 ***	(2.70)	14.62 ***	(2.84)
haul_index			-0.05 **	(0.02)		
log_index			-0.01 ***	(0.00)		
wwpa_avg_real					0.00	(0.00)
N	201		201		201	
DF	193.00		193.00		193.00	
R2	0.73		0.70		0.64	
adj.R2	0.72		0.69		0.63	
SE	9.00		9.46		10.25	
f_stat	73.29		63.63		50.08	

*** p < 0.001; ** p < 0.01; * p < 0.05.

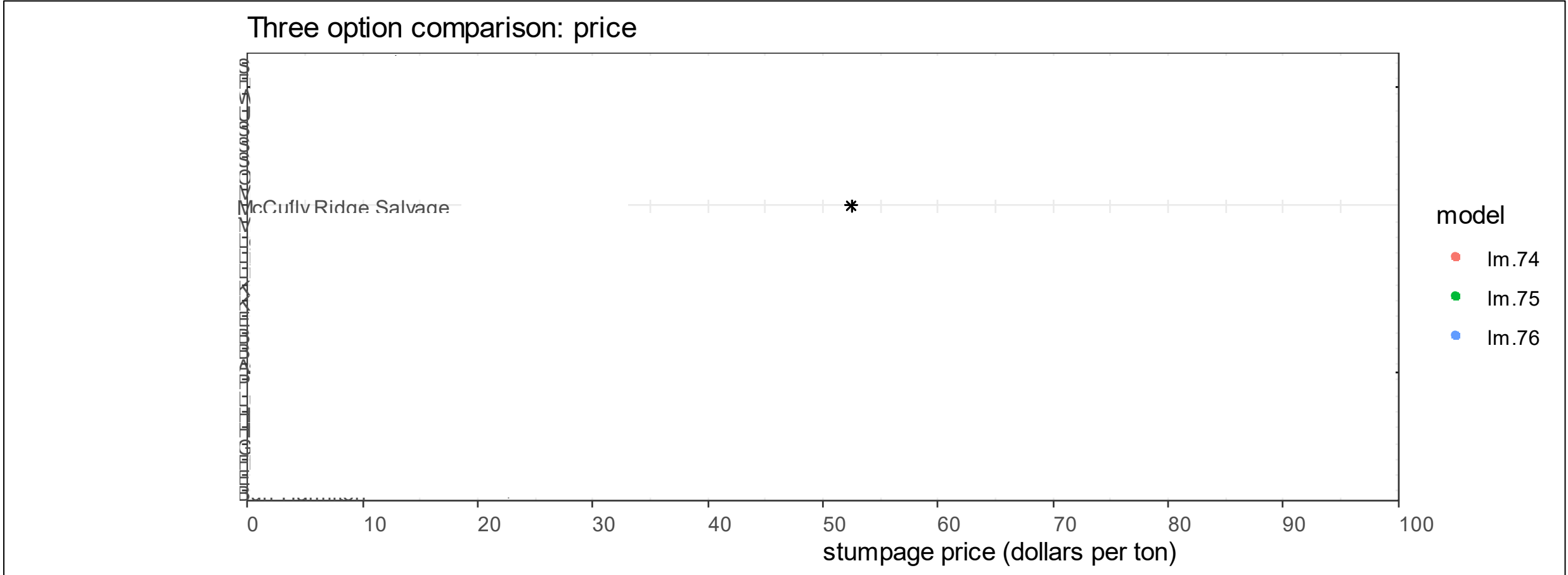


Results

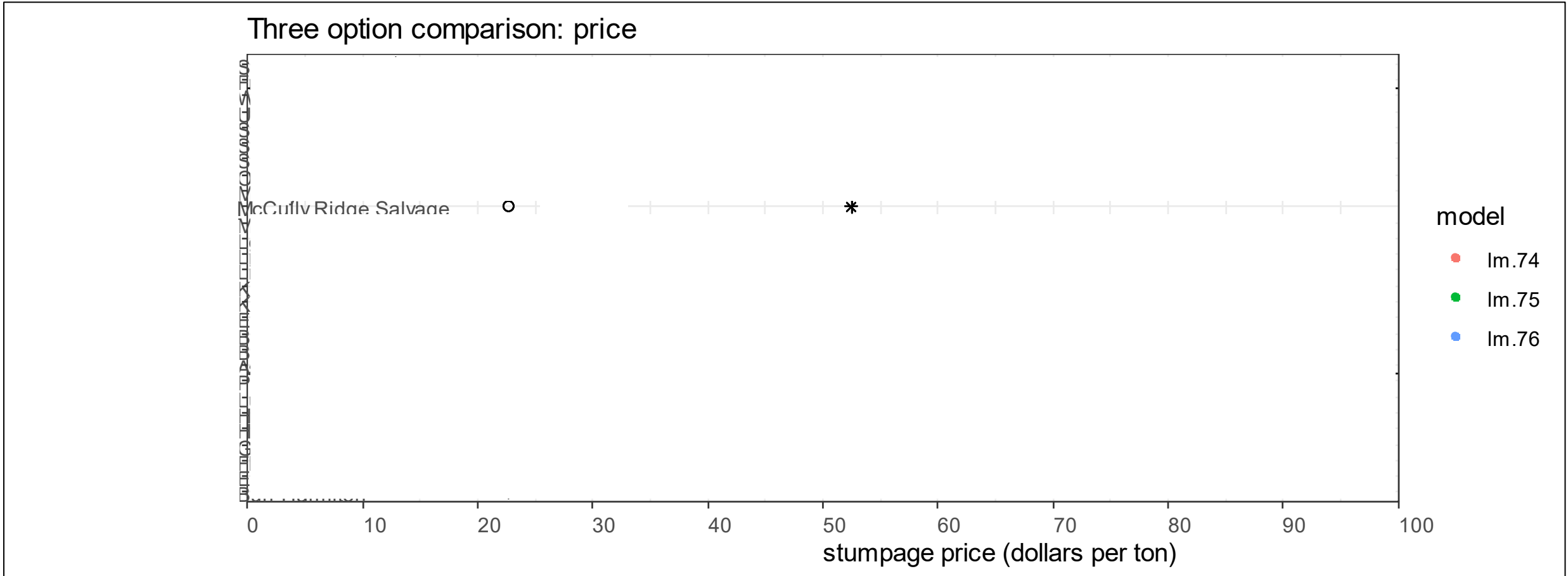
Model	U-DNRC	Option 1	Option 2	Option 3
Exogenous variables	WWPA price ! Haul index (c) ^{***} Logging index (c) ^{***} Contract costs ^{***} NWLO adj ^{***} Total acres ^{**}	Bids ^{***} BBER log price ^{***} BBER haul cost ^{**} BBER log cost ^{***} Contract costs ^{***} NWLO adj ^{***} SWLO adj ^{***}	Bids ^{***} BBER log price ^{***} <i>Haul index</i> ^{**} <i>Logging index</i> ^{***} Contract costs ^{***} NWLO adj ^{***} SWLO adj ^{***}	Bids ^{***} <i>WWPA price !</i> BBER haul cost ^{**} BBER log cost ^{***} Contract costs ^{***} NWLO adj ^{***} SWLO adj ^{***}
Adj. R²	0.44	0.72	0.69	0.63
Advantages	Same variables and appraisal sheet	Best fit Easy interpretation	Similar to current method	Keeps WWPA lumber prices



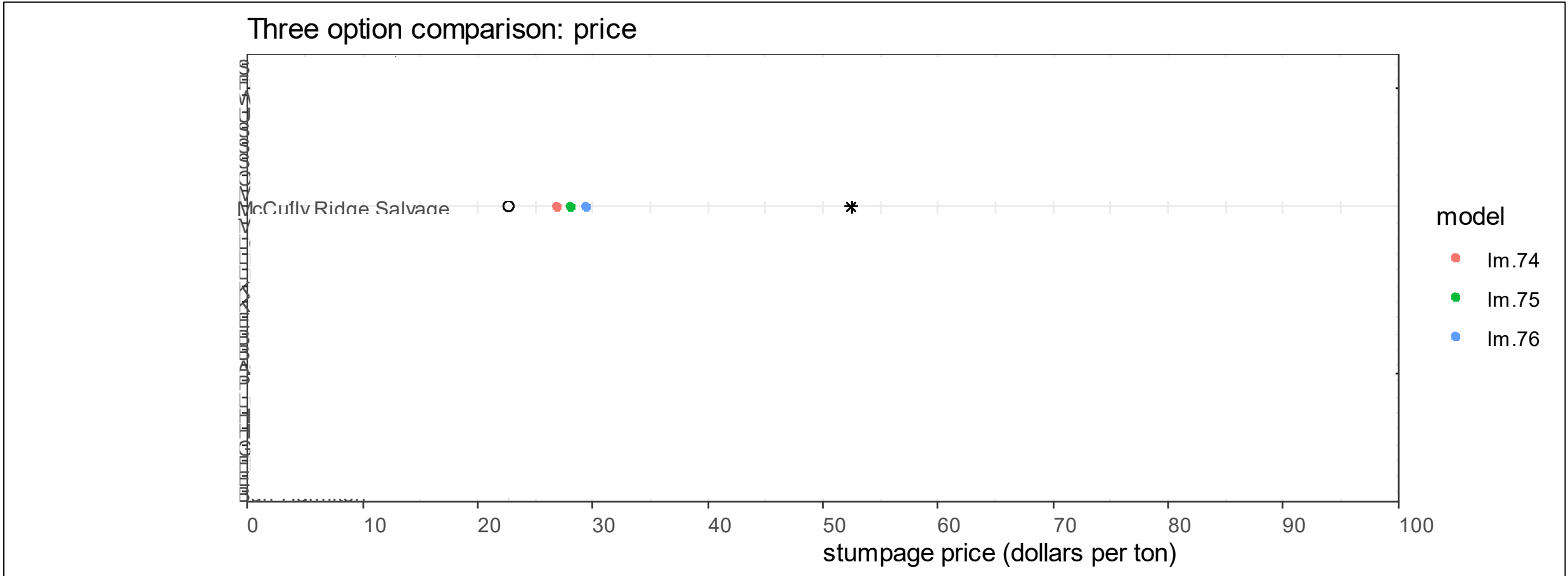
Results



Results

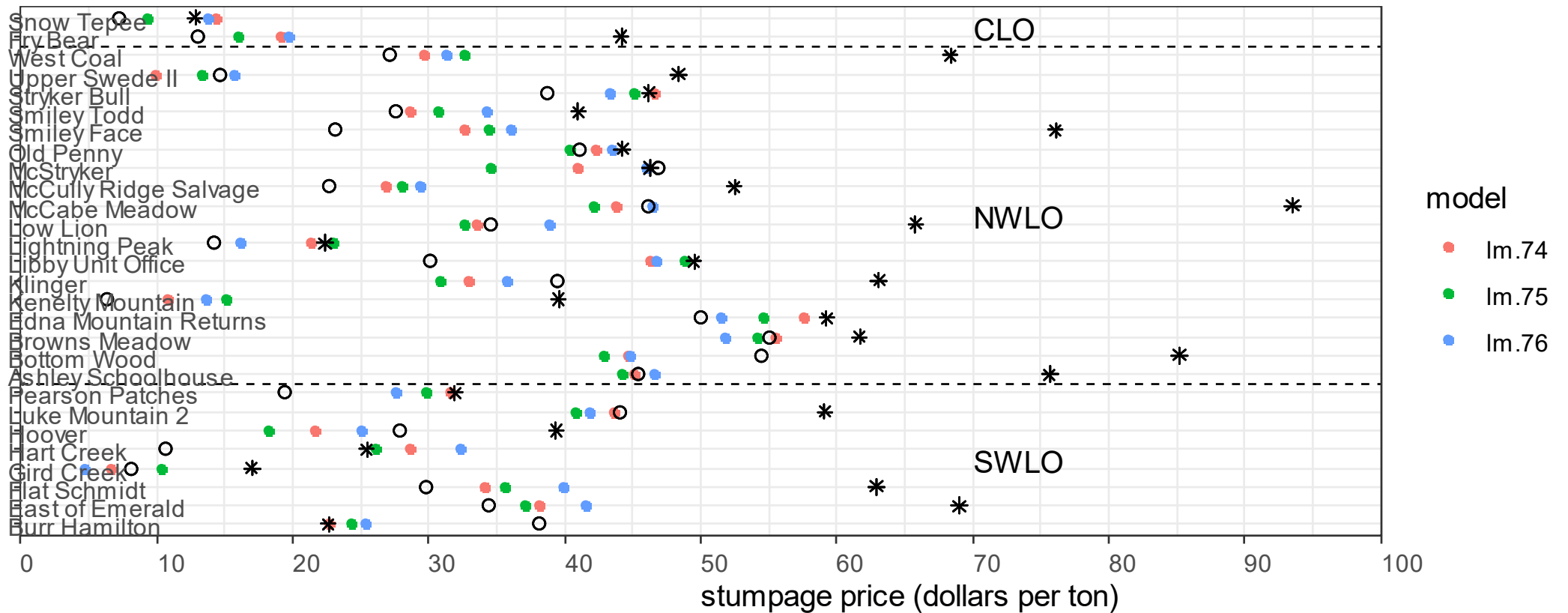


Results

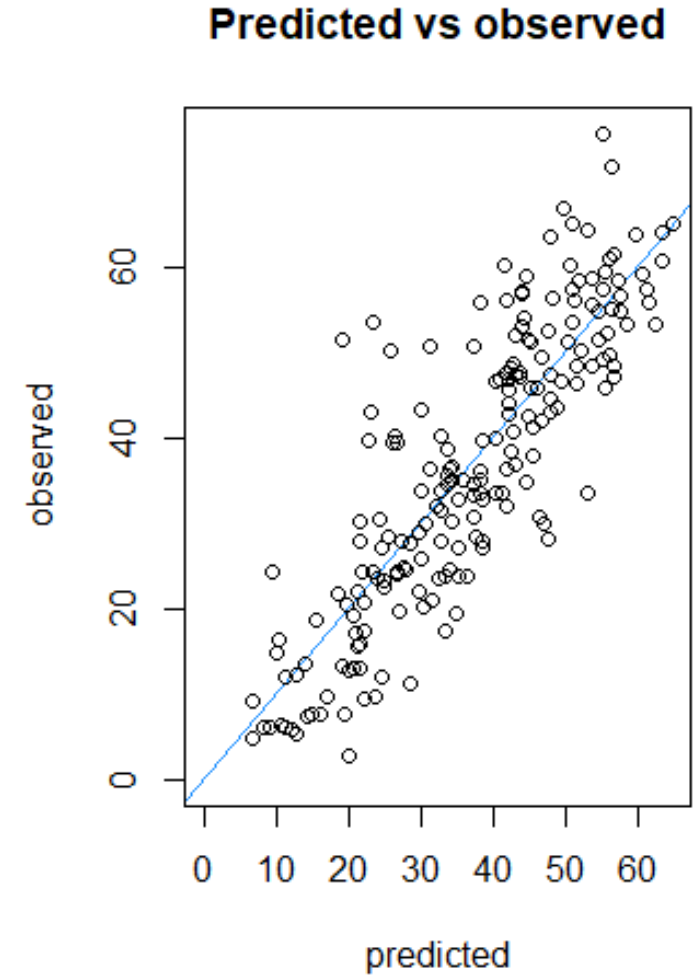
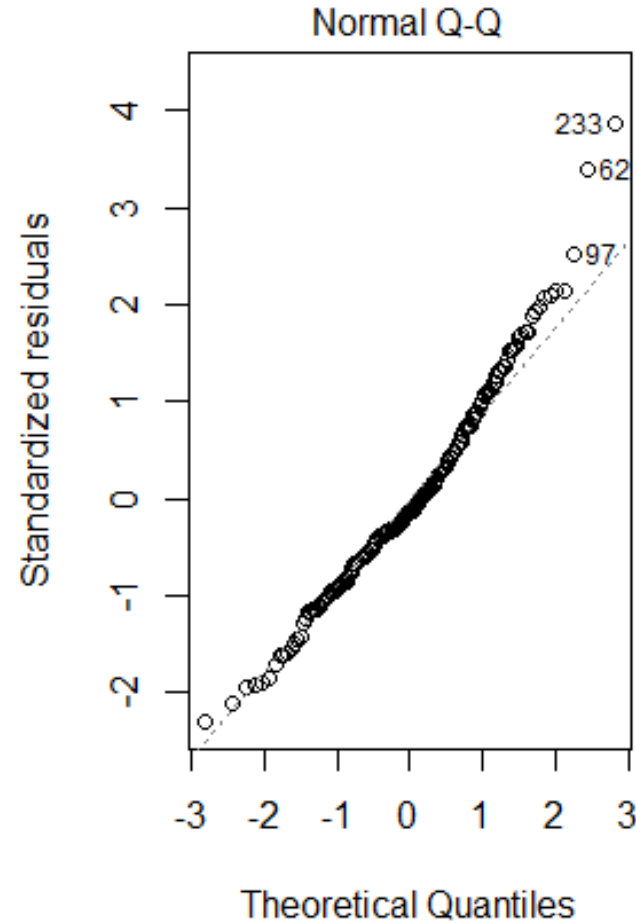
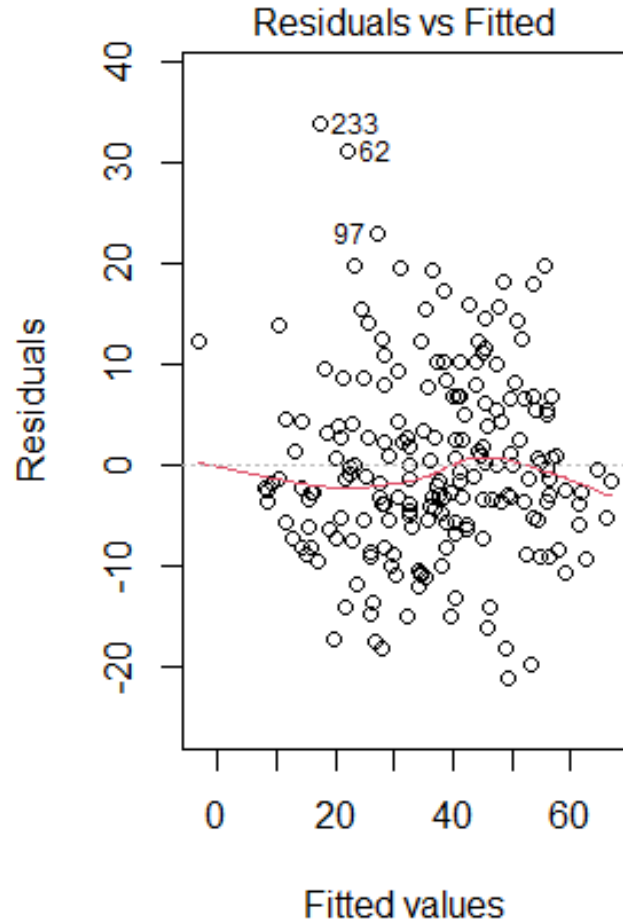


Results

Three option comparison: price



Results



The short of it...

- DNRC timber appraisal needed updating
- New transaction evidence equation was developed
- New model has been well-received
 - $N = 201$
 - $DF = 193$
 - $Adj. R^2 = 0.72$
 - $SE = 9.00$
 - All independent variables: $p < 0.01$



Thank you!



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Methods

Method	Output	Calculation	Data	Tradeoffs
Transaction Evidence	Predicted high bid	Multiple regression	Previous timber sales	<p>Requires large(r) sample</p> <p>Requires less precise data</p> <p>Estimates FMV</p>
Residual Value	Estimated minimum value	Price minus cost	Constructed costs	<p>Requires small(er) sample</p> <p>Requires more precise data</p> <p>Estimates value to average buyer</p>



Methods

Transaction evidence			
Variable	Value	Coefficient	Impact (\$/ton)
Log price index	441	+0.13	+57.33
Logging index	500	-0.01	-5.00
Hauling index	23	-0.05	-1.15
Contract index	2	-0.90	-1.80
Bids	3	+2.51	+7.53
Geographic adjustment	1	+18.56	+18.56
Intercept	1	-34.09	-34.09
Predicted high bid			41.38

Residual value	
Item	\$/ton
Log price	+70.67
Logging cost	-33.28
Hauling cost	-12.17
Contract costs	-2.17
Est. min. value	23.05

