

# A Model of Canadian Oil and Gas Price Fluctuations 2012 Update

October 31, 2012  
Calgary, AB

Mike Morgan, P. Eng.

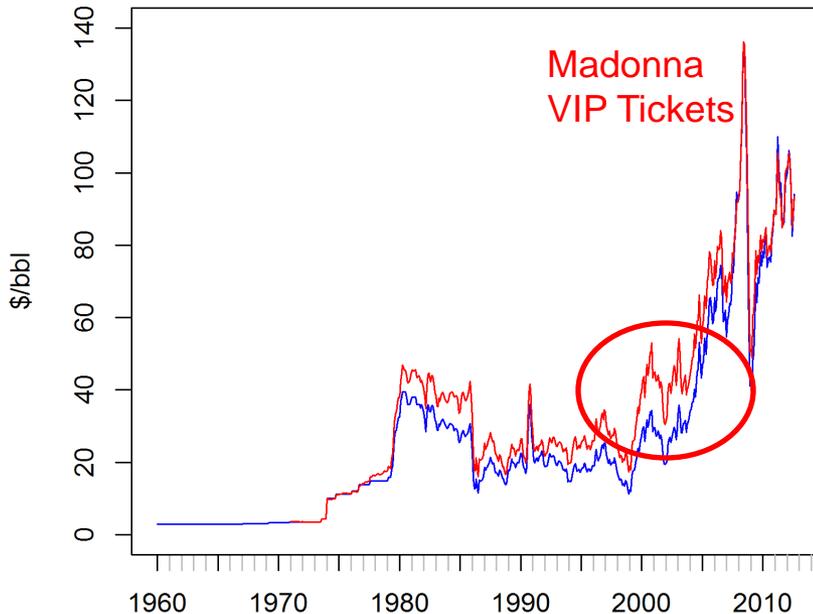
# What to Expect

- Inflation matters, as does your choice of inflation adjustment.
- Extreme prices don't last long.
- US prices are not the same as Canadian prices.
- Each hydrocarbon and sales point has its own set of price statistics. Simple offsets or ratios to benchmark prices capture only a portion of this price behaviour.
- For brevity, this presentation concentrates on the most widely quoted prices (WTI and HH).
- Real prices are normalized to Dec 31, 2010
- US \$ are in blue, Canadian \$ are in red

# Nominal Oil Prices

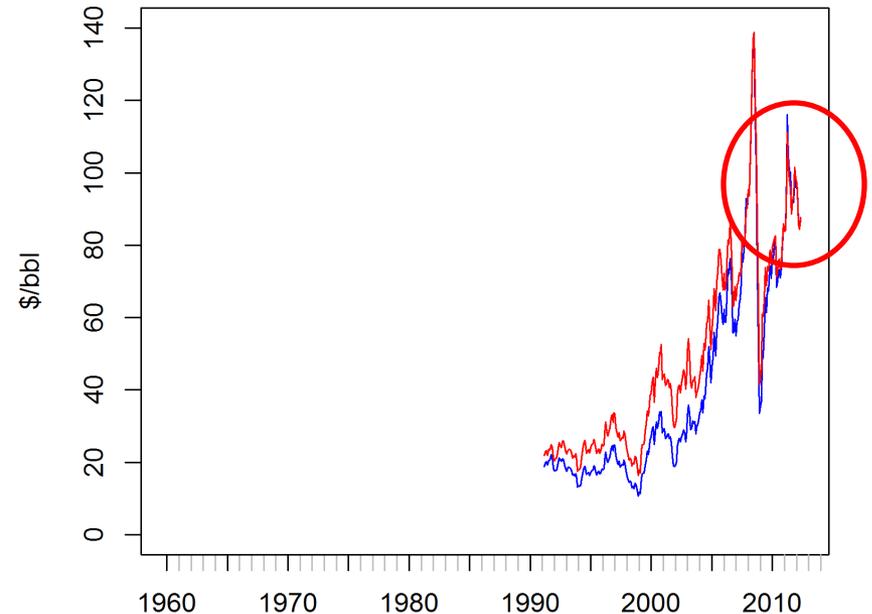
WTI Oil Prices

\$US/bbl (blue) and \$CDN/bbl (red)



Edmonton Light Oil Prices

\$US/bbl (blue) and \$CDN/bbl (red)

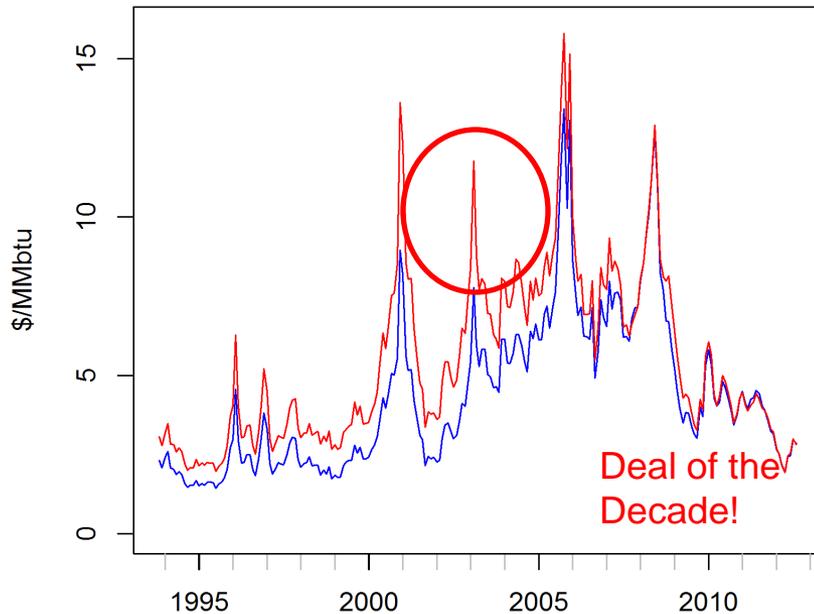


No surprise here... sometimes sticker prices are different and sometimes the offsets are larger. You might think oil gets less affordable over time.

# Nominal Gas Prices

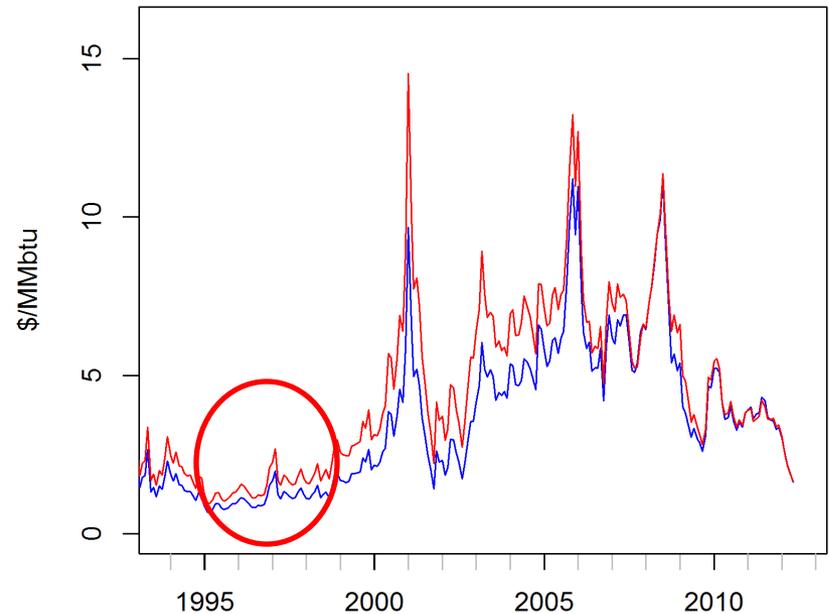
## Henry Hub Gas Prices

\$US/MMbtu (blue) and \$CDN/MMbtu (red)



## AECO Gas Prices

\$US/MMbtu (blue) and \$CDN/MMbtu (red)

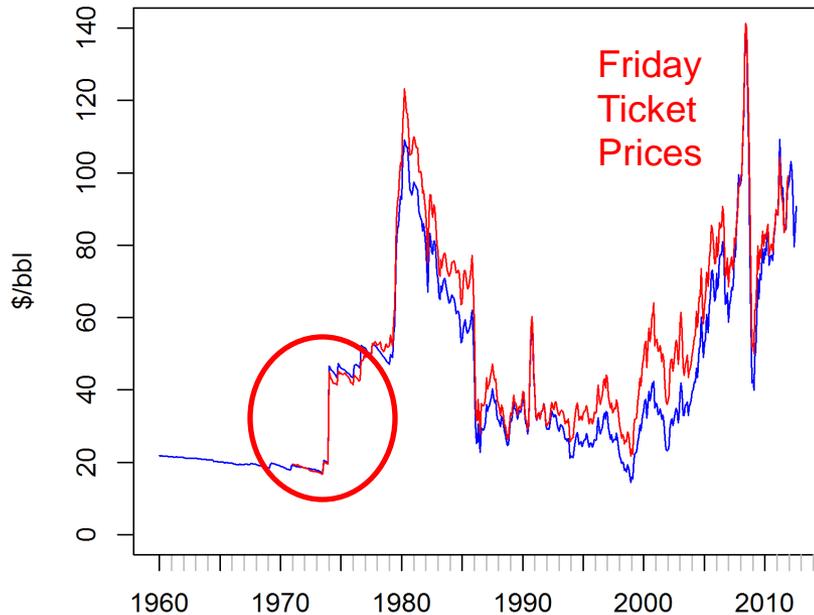


Again, no surprise... basis differentials can change

# Real Prices (CPI or Consumer Prices)

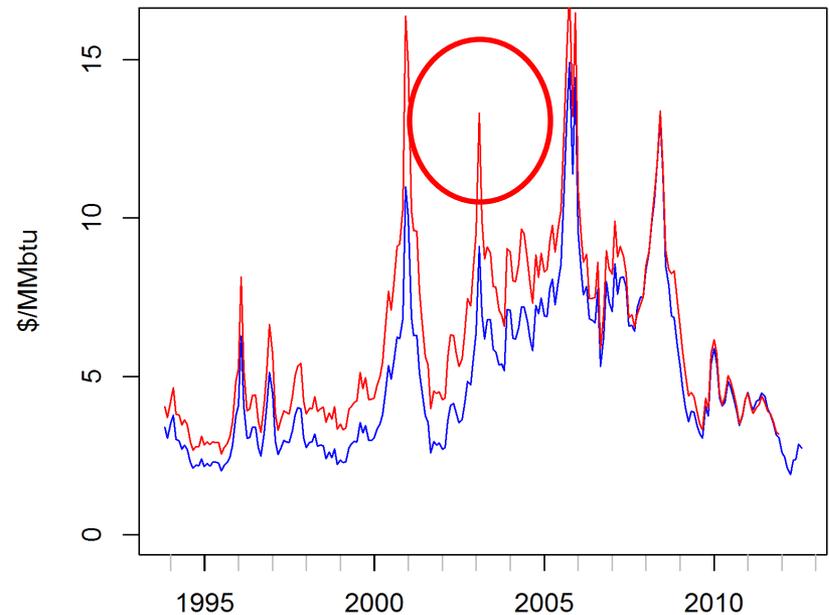
WTI Oil Prices

\$US/bbl (blue) and \$CDN/bbl (red)



Henry Hub Gas Prices

\$US/MMbtu (blue) and \$CDN/MMbtu (red)

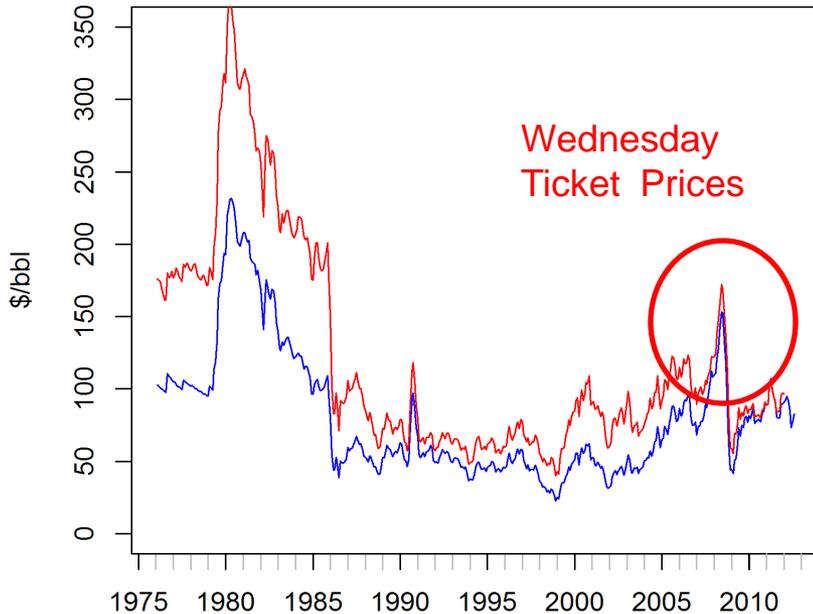


I guess everything did cost less back then.  
By this measure, oil is as affordable as in 1982.

# Real Prices (M2 or Supply of Money)

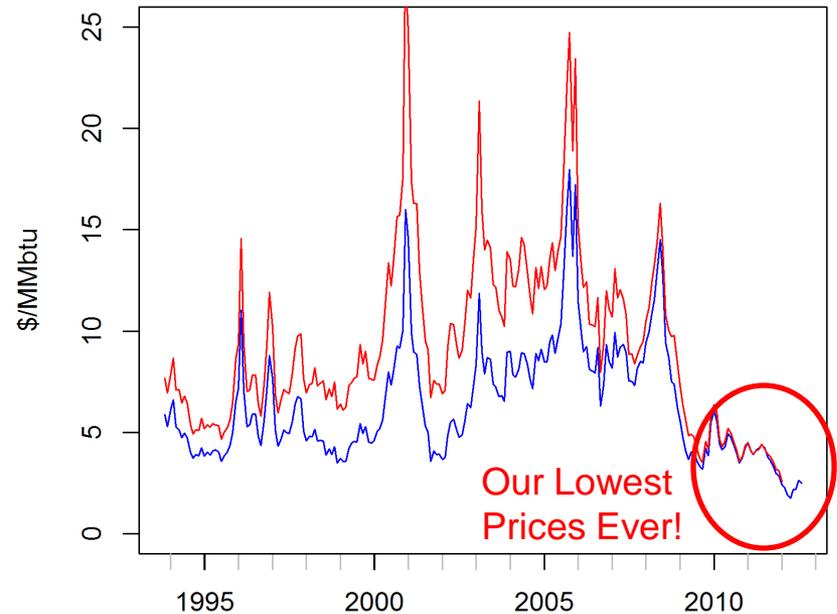
WTI Oil Prices

\$US/bbl (blue) and \$CDN/bbl (red)



Henry Hub Gas Prices

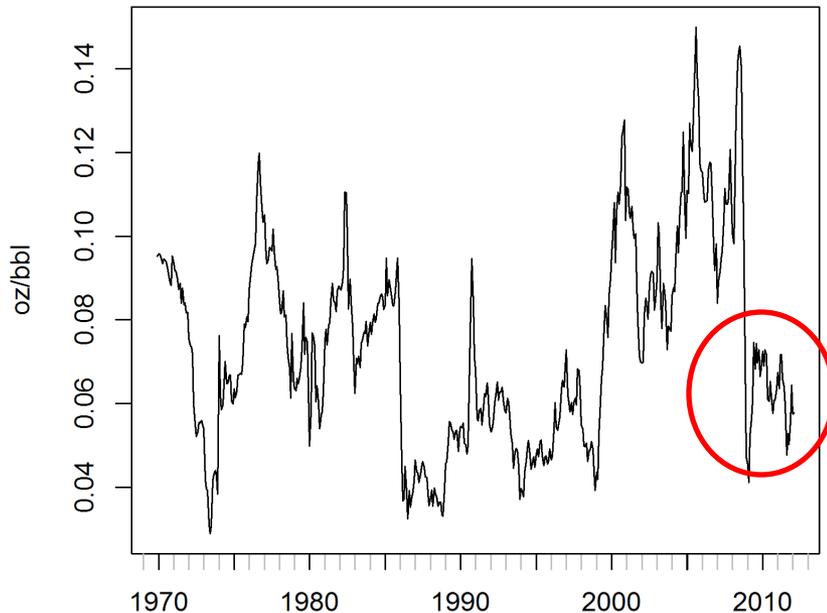
\$US/MMbtu (blue) and \$CDN/MMbtu (red)



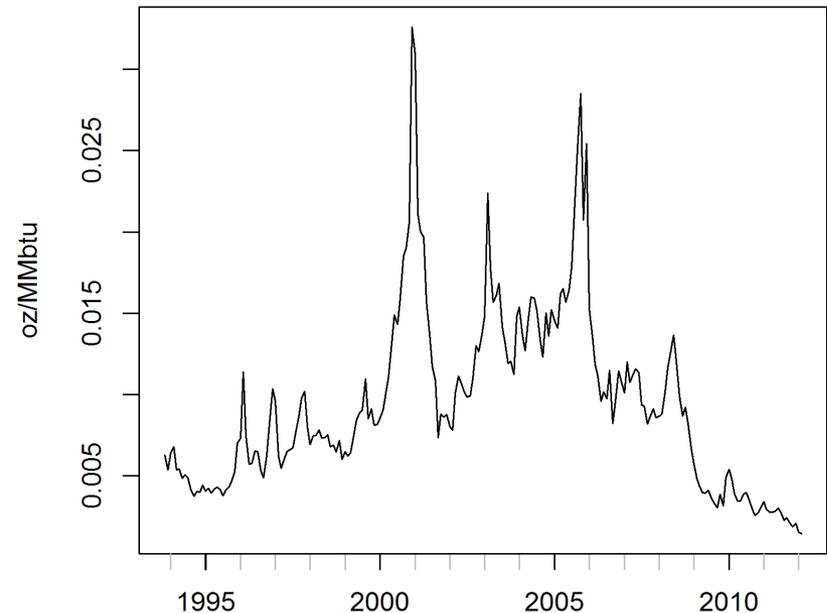
If you believe that “inflation is always and everywhere a monetary phenomenon” ...  
...oil is as affordable as in 1985.

# Real Prices (In Terms of Gold Price)

WTI Oil Prices  
oz/bbl



Henry Hub Gas Prices  
oz/MMbtu



If you believe that “Gold was an objective value, an equivalent of wealth produced. Paper is a mortgage on wealth that does not exist”... oil is cheap

# Let's Assume a Model

- Real prices don't increase without limit.
- Instead, they appear to drift back to normal after any dramatic change (up or down).
- An Ornstein–Uhlenbeck Model captures the basics of this behaviour.

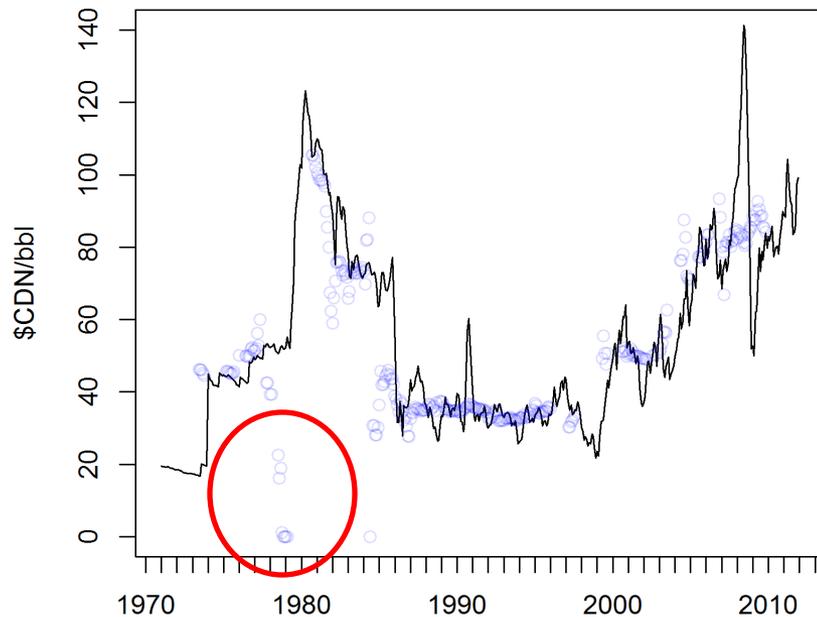
Change in Price      Difference from Average      Error

$$dP = \lambda(\mu - P)dt + \sigma dW$$

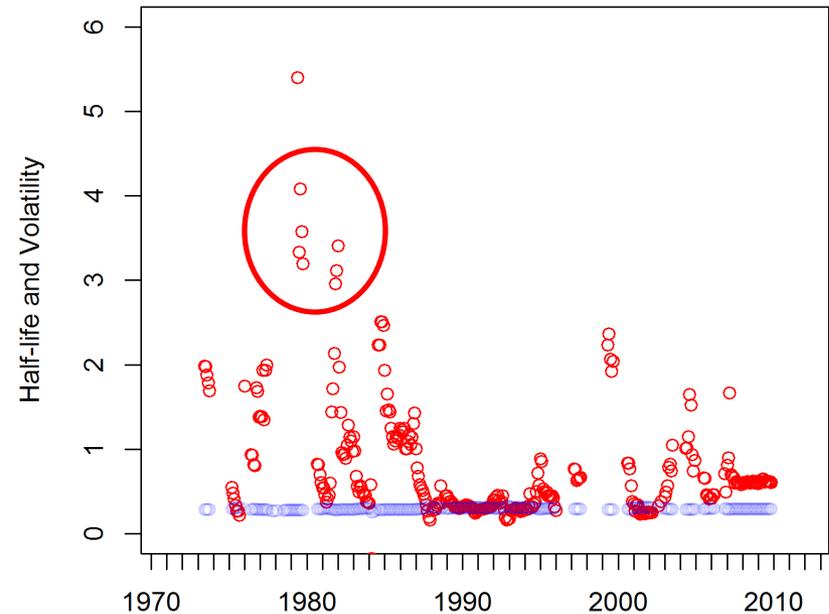
How Fast      How Variable

# Real Prices (CPI or Consumer Prices)

WTI Oil Prices (Actual and  $\mu$ )  
\$CDN/bbl



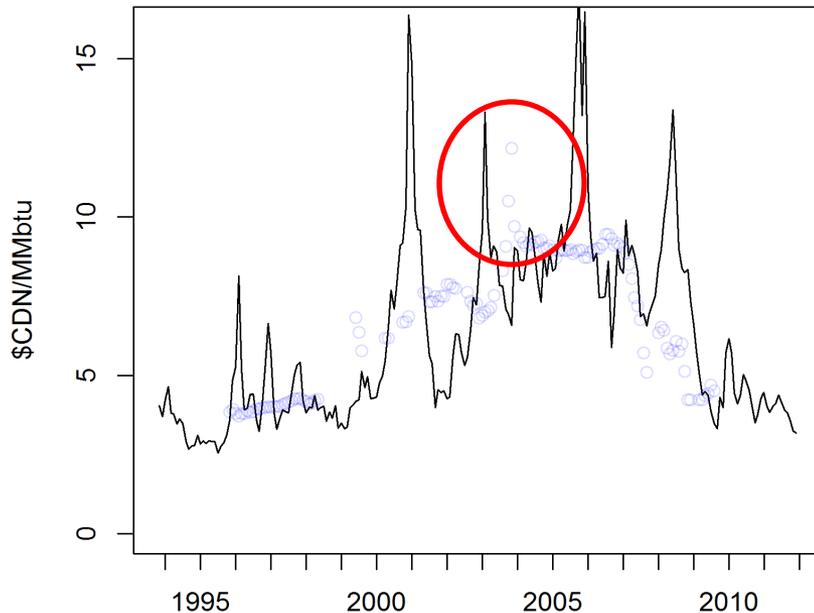
Half-life (years)  
Volatility (%)



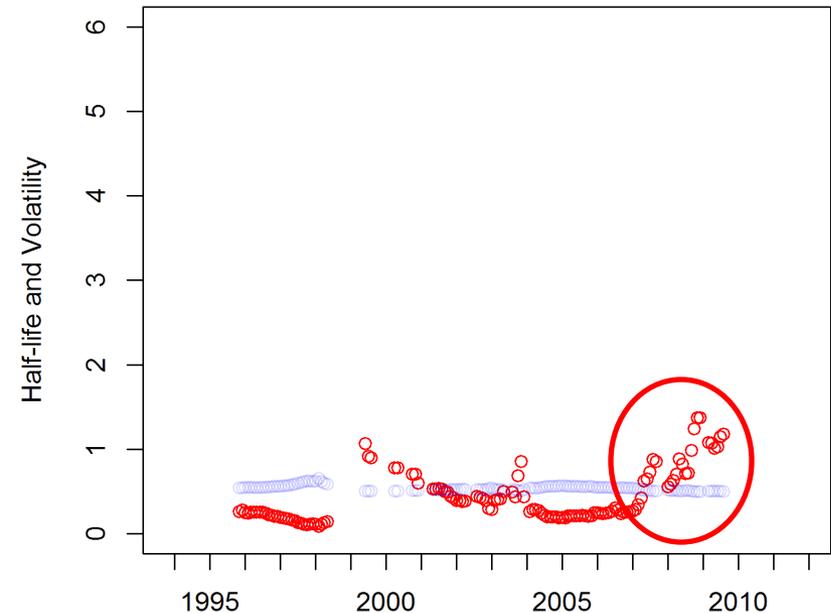
Using 4 year windows, the model gives estimated mean reversion prices ( $\mu$ ) that look like moving averages, constant volatilities and unstable half-lives.

# Real Prices (CPI or Consumer Prices)

Henry Hub Gas Prices (Actual and  $\mu$ )  
\$CDN/MMbtu



Half-life (years)  
Volatility (%)



Using 4 year windows, the model gives estimated mean reversion prices ( $\mu$ ) that look like moving averages, constant volatilities and unstable half-lives.

# Model Parameters (Real Prices \$CDN)

	<b>Average</b>	<b>Volatility</b>	<b>Half-Life</b>
WTI	87.04	29.91%	1.334
Brent	92.07	27.22%	1.029
Edmonton Light Sweet	85.13	35.09%	1.442
Edmonton Condensate	90.71	30.76%	1.140
Edmonton Mixed Sweet	84.58	35.17%	1.434
Cromer Light	80.49	37.46%	1.513
Hardisty Heavy	55.48	78.24%	2.654
Edmonton Butane	69.93	37.76%	2.043
Edmonton Propane	53.29	41.04%	2.353
Henry Hub	4.77	47.88%	0.425
AECO	4.78	47.43%	0.576
Alberta Plantgate	4.53	48.90%	0.567
Station 2	4.66	50.76%	0.644

Since 2005, the less you are like Brent or AECO/HH, the lower and the more volatile your price.

# Obvious Conclusions

- Prices for Canadian producers are related, but not the same as prices for US producers.
- Discussing the price of a commodity in terms of only one currency ignores changes in the relative value between currencies and basis differentials.
- Prices generally increase over time, but gas prices are currently very very low.

# Not-So Obvious Conclusions

- Short-term prices are unpredictable, but mean reversion should be included in any long-term model.
- Any discussion of oil and gas prices must consider inflation, though you can pick from several measures of inflation. Some measures show that current oil prices are slightly high others show that prices are slightly low.
- Real price changes of  $\pm 40\%$  are common, but real prices generally edge back to average within 5 years.
- Our paper lists fitted model coefficients for a number of benchmark Canadian hydrocarbons.

Prices have gone up, and they have gone down at times, but the predominant driver of higher prices appears to be general inflation.

The authors would also argue “increased scarcity causes the development of its own remedy”.

Prices, at least in real terms, are not forced to increase without limit due to scarcity of any single resource.

So long as the investment horizon is a couple decades or less, the data demonstrates that you must consider prices to be volatile but stationary.