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Research Institute of Economy, Trade & Industry, IAA

RIETI BBL Seminar Handout

"Energy Markets: What to do when forecasting is useless"

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ENERGY MARKETS: WHAT TO DO WHEN FORECASTING IS USELESS

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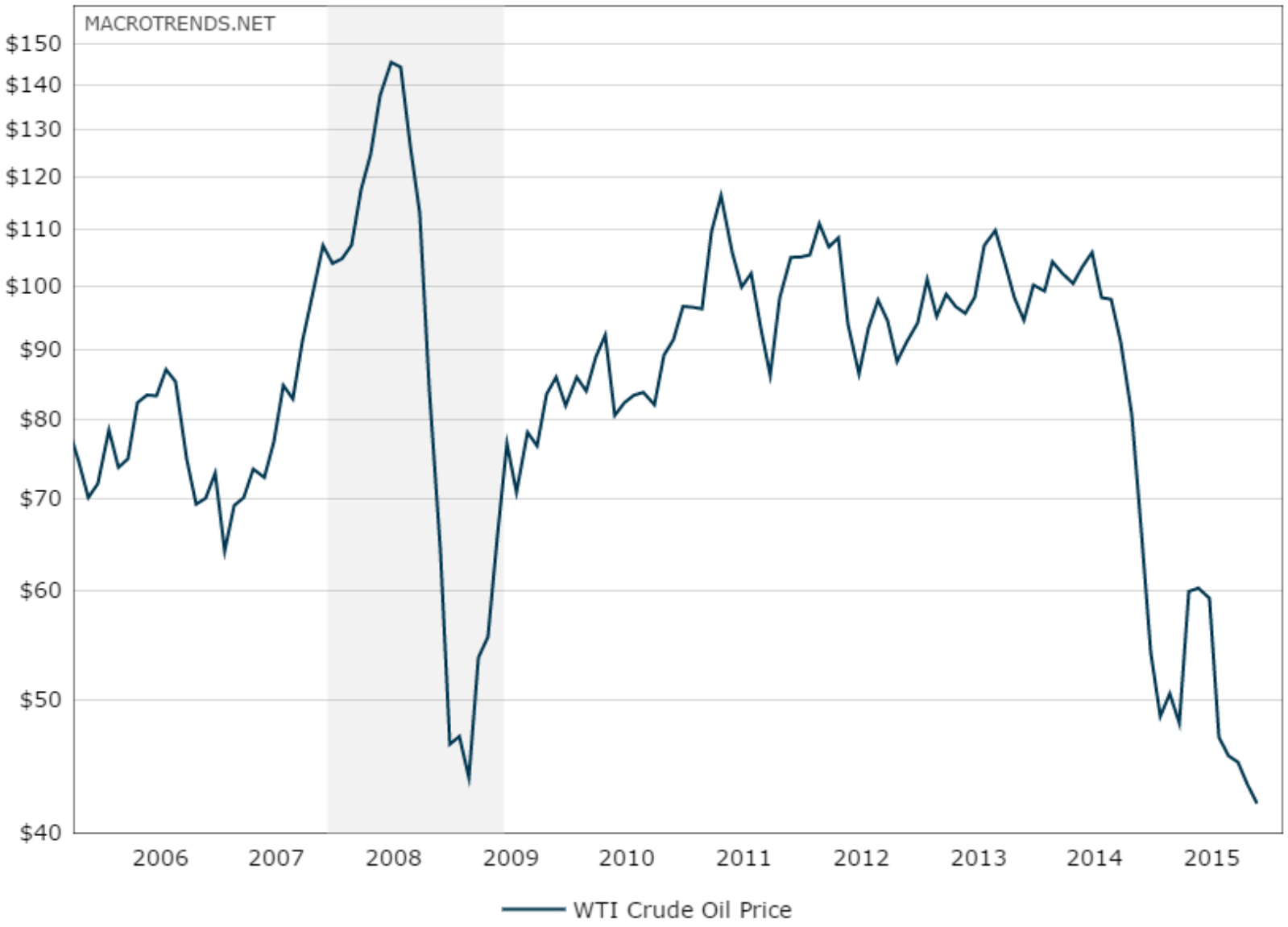
May 2017

OUTLINE

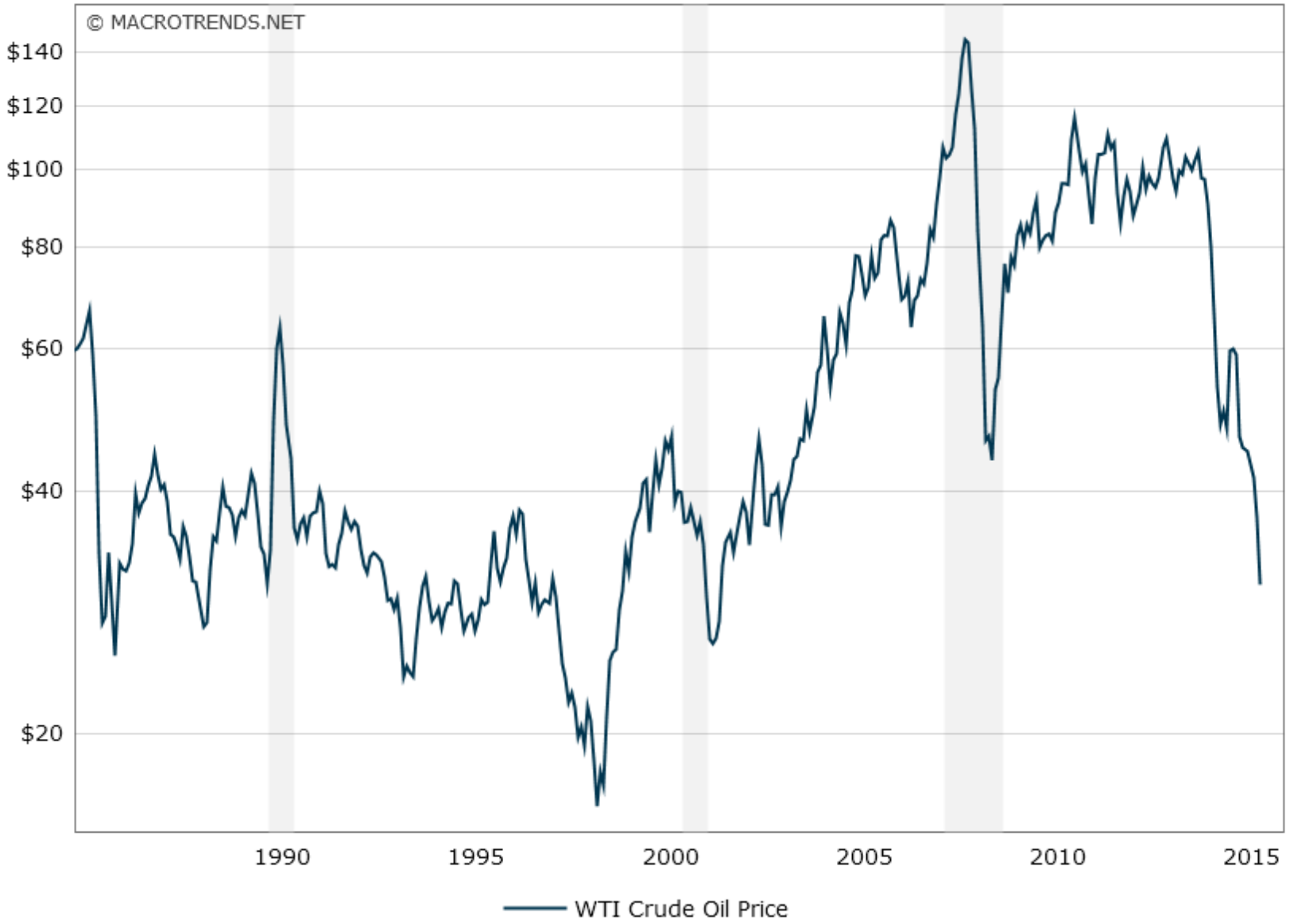
- Oil Prices:
  - In the past.
  - Today and in the future.
- Linkages to Natural Gas, Coal.
- What Drives Sharp Price Changes?
  - Short-run versus long-run elasticities.
  - Supply shocks, demand shocks.
- What Will Happen to the Price of Oil:
  - We don't know.
  - Don't believe anyone who claims to know.
  - Key is what might happen. How much uncertainty?
- What To Do: Assess uncertainty, option value.

THE DROP IN OIL PRICES

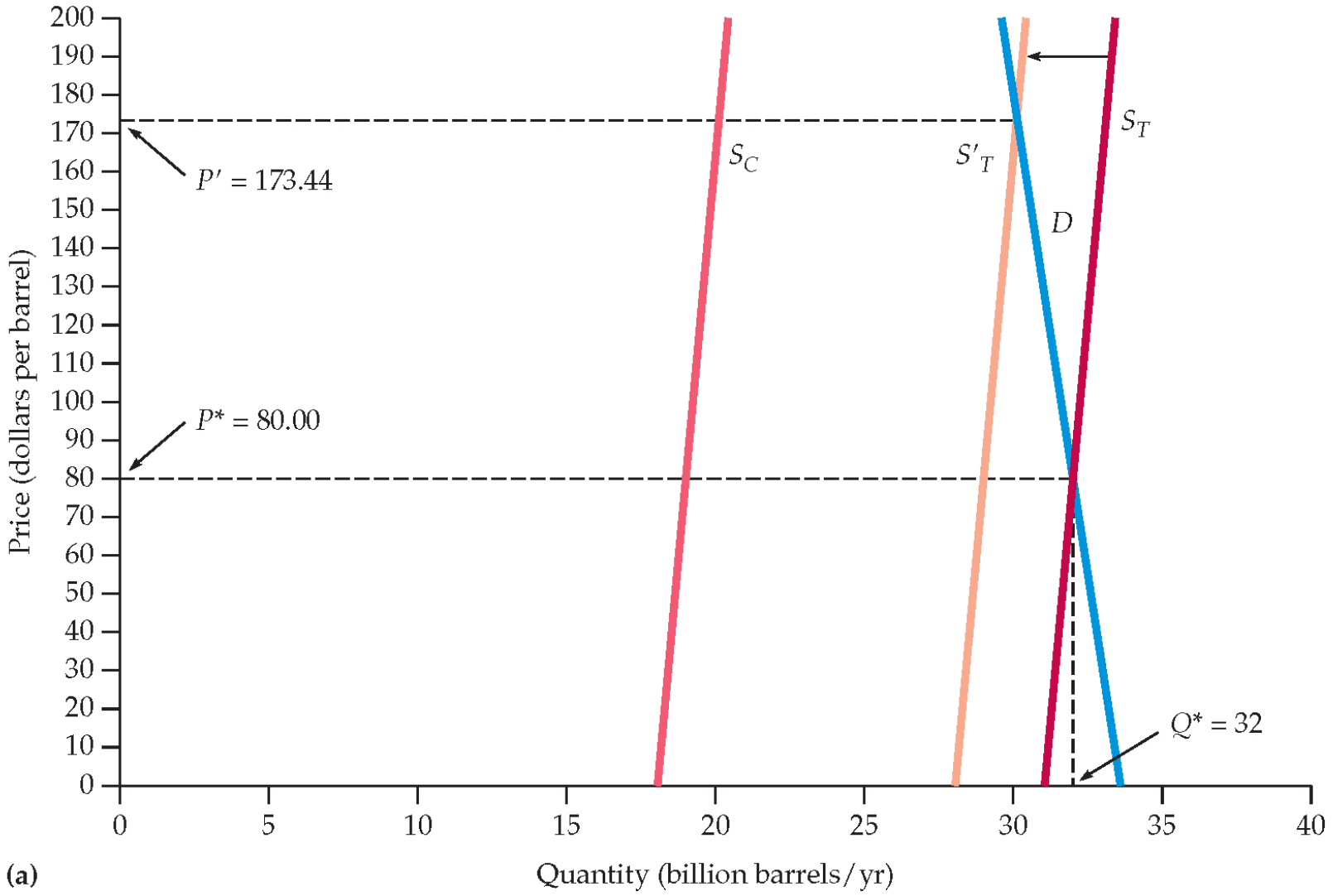
PRICE OF WTI CRUDE OIL



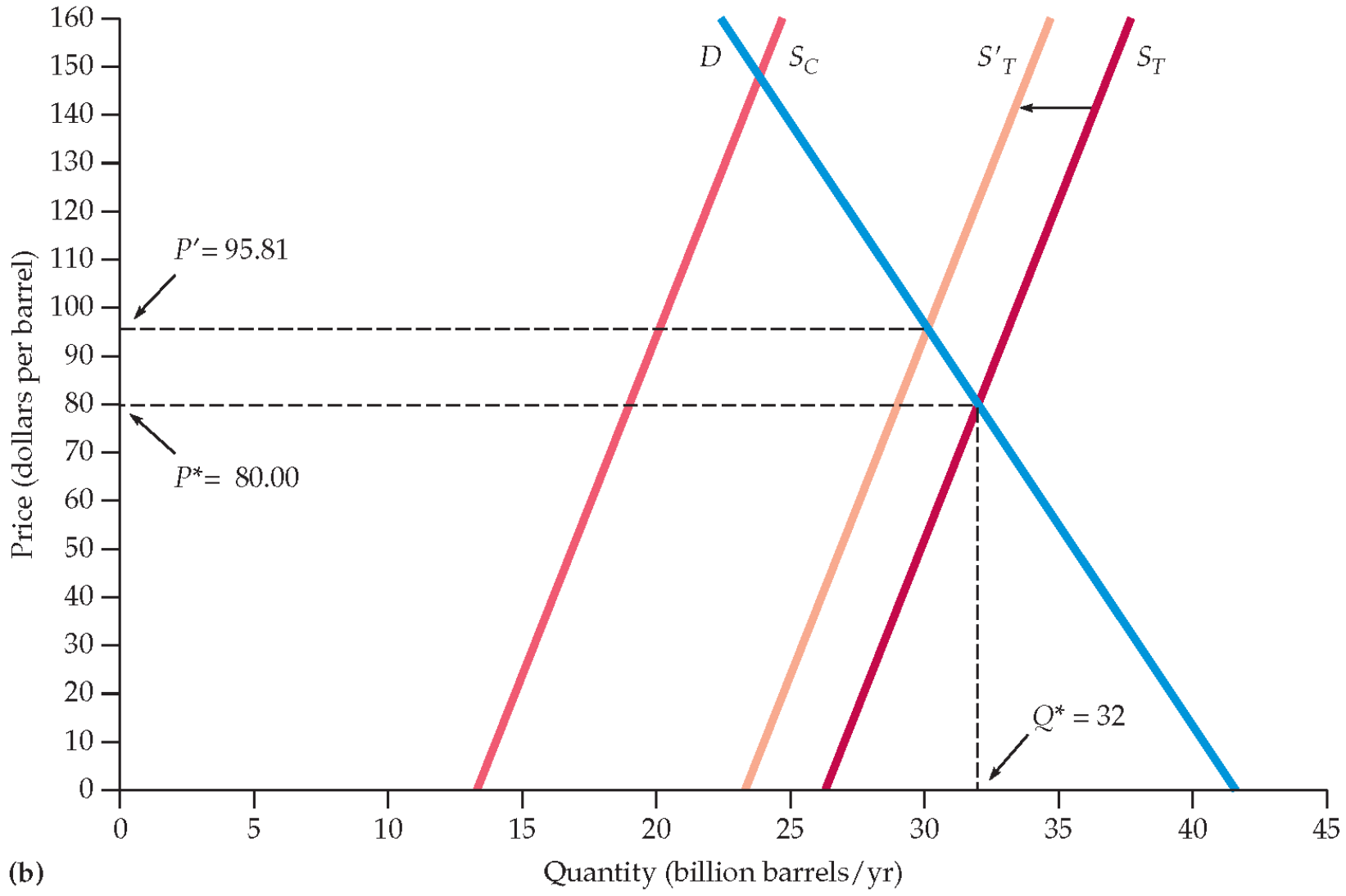
PRICE OF WTI CRUDE OIL



SUPPLY AND DEMAND – SHORT RUN



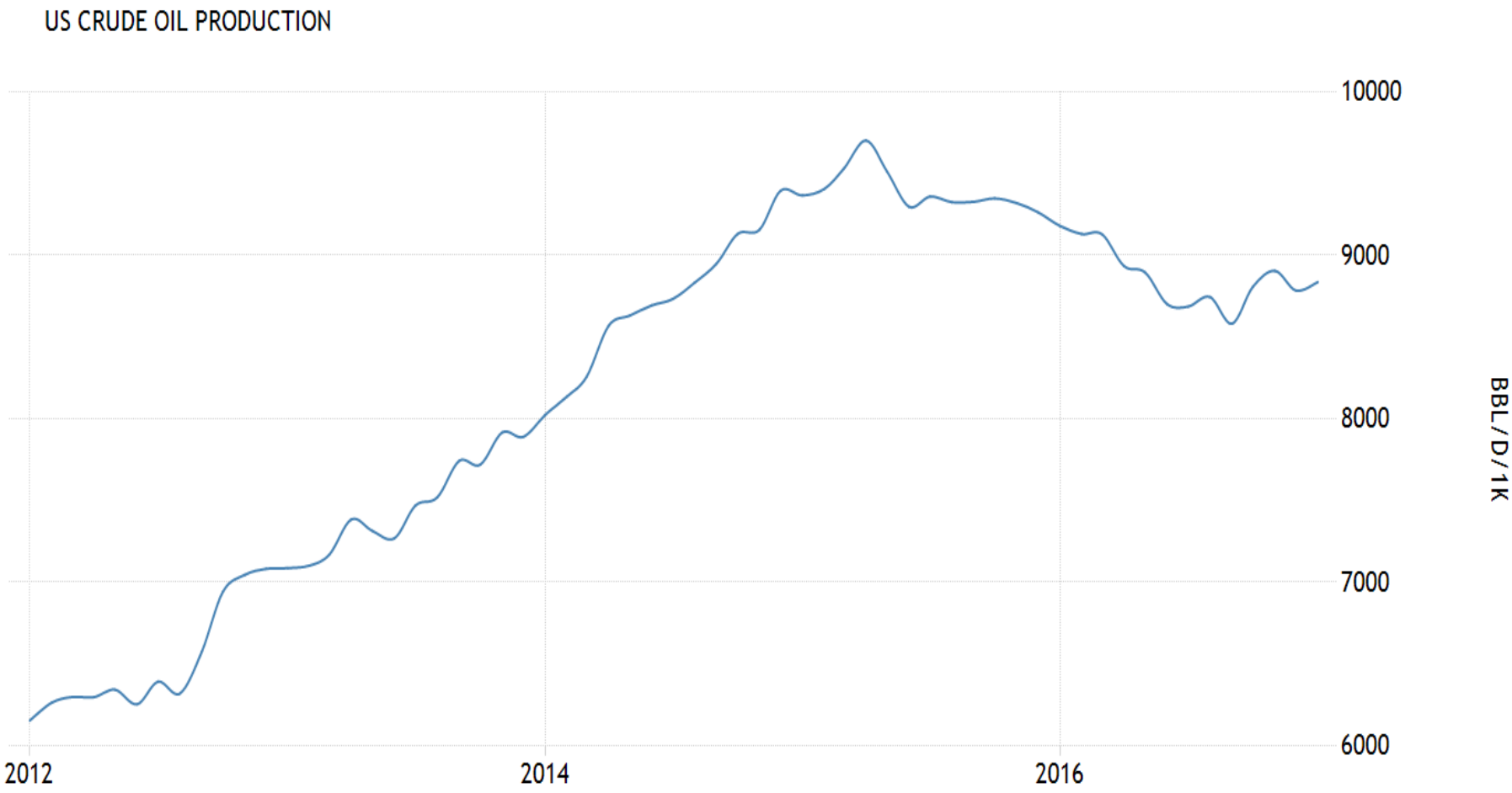
SUPPLY AND DEMAND – LONG RUN



SHOCKS TO OIL MARKET

- World oil consumption in 2016 = 97 mb/d.
- What changed from 2013 to 2016?
- Increase in production: 3 mb/d
  - United States: + 3 mb/d
  - Russia: + 0.5 mb/d
  - Brazil: + 0.5 mb/d
  - Iraq: + 1 mb/d
  - Libya: – 2 mb/d
- Increase in consumption: about 1 mb/d
- Result: Inventories must increase (a lot!) and/or price must fall.

INCREASE IN U.S. OIL PRODUCTION

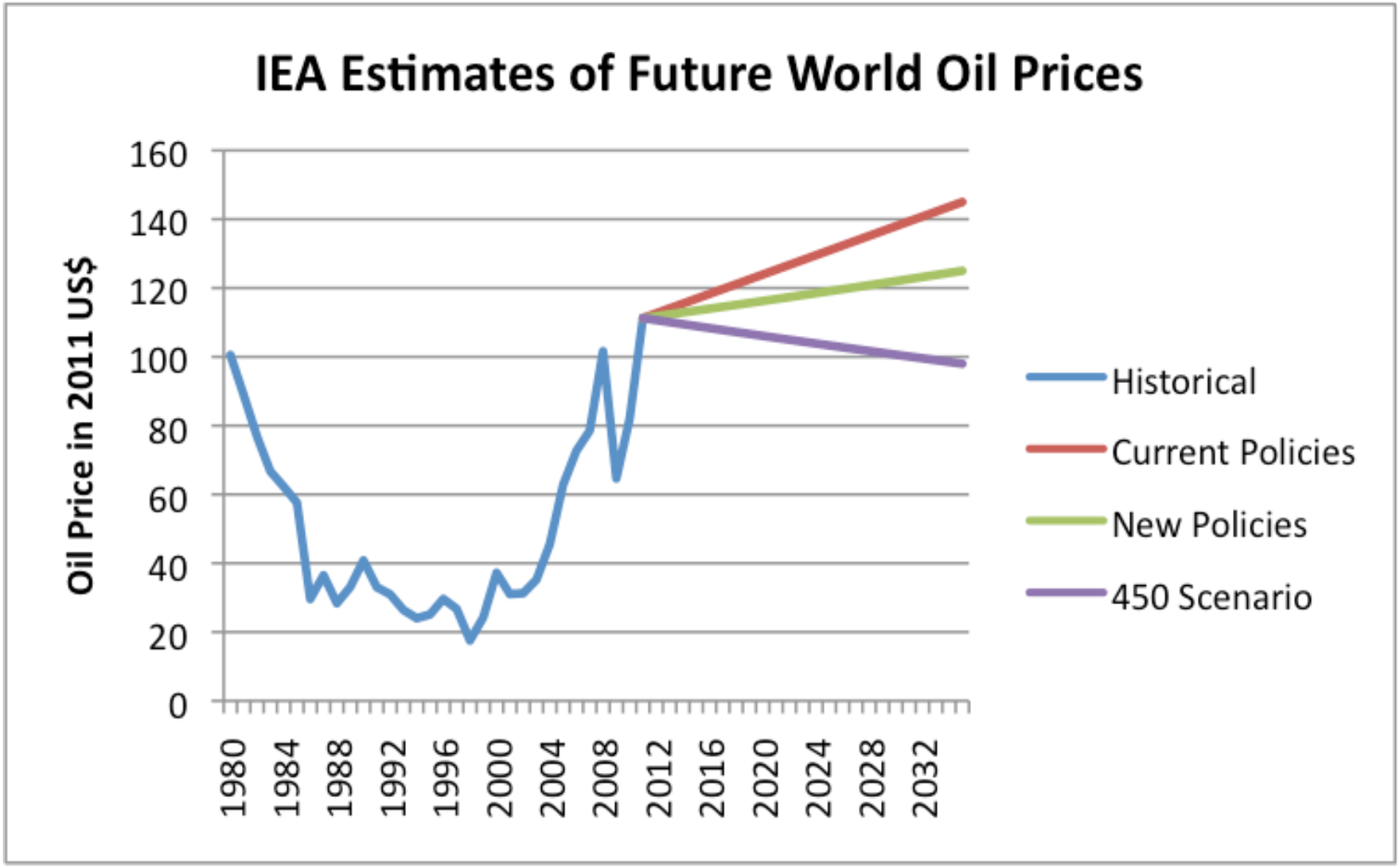


SOURCE: WWW.TRADINGECONOMICS.COM | U.S. ENERGY INFORMATION ADMINISTRATION

WHAT WILL HAPPEN IN NEXT FEW YEARS?

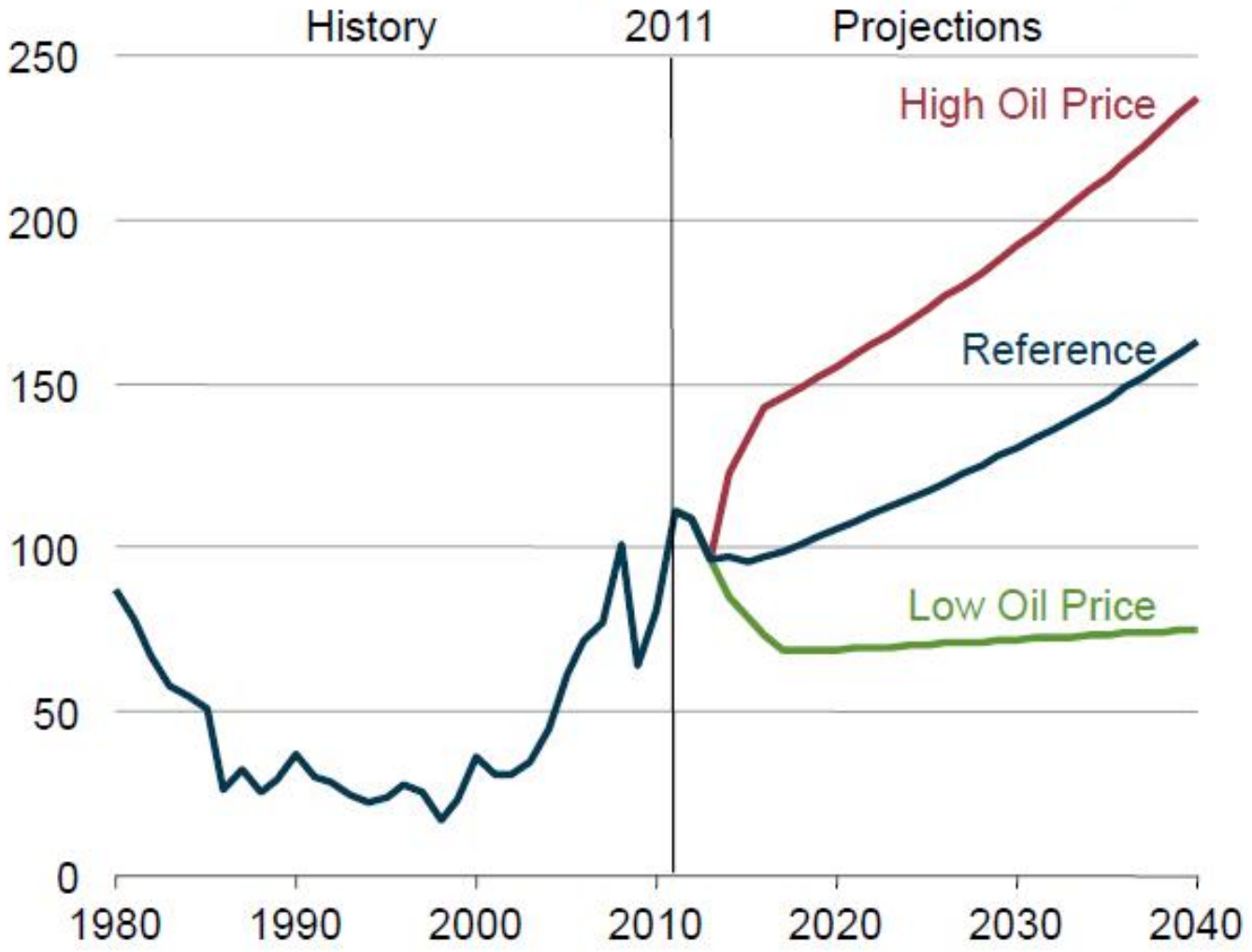
- Oil prices have fluctuated and will continue to fluctuate.
- But you are a consumer (or producer) of oil, so you ask: "What will the price of oil be three years from now? Five years from now?"
- Answer: Wrong question! Don't even ask that question.
  - Forecasts of oil prices are meaningless.
  - Don't believe anyone who claims to be able to forecast oil prices.
- The right question: What might happen to oil prices? What is the extent and nature of uncertainty?
- Why is this the right question? Option value.

FORECASTS

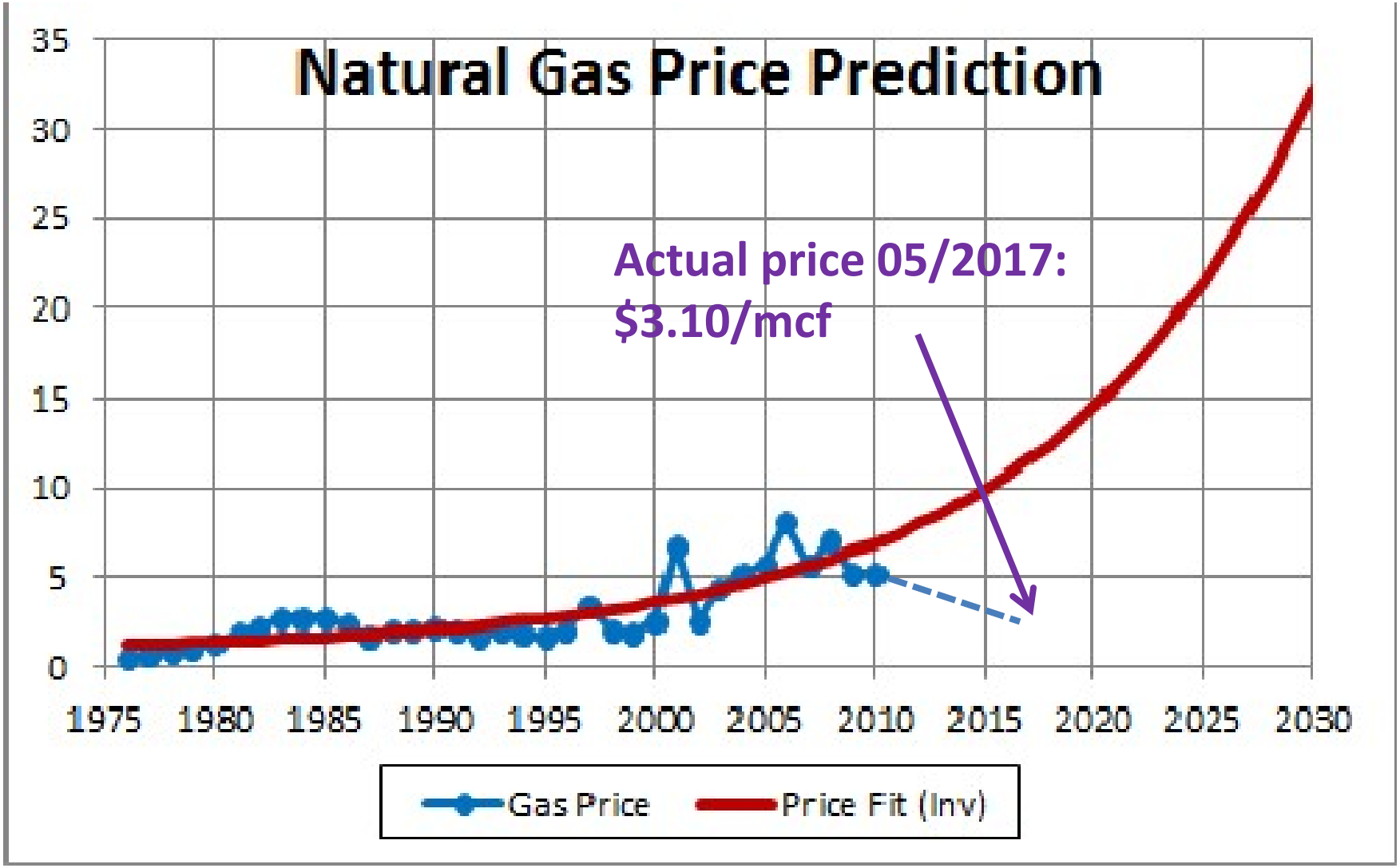

IEA Estimates of Future World Oil Prices
Oil Price in 2011 US$
160
140
120
100
80
60
40
20
0
1980
1984
1988
1992
1996
2000
2004
2008
2012
2016
2020
2024
2028
2032
Historical
Current Policies
New Policies
450 Scenario

MORE FORECASTS

Figure 5. Average annual Brent spot crude oil prices in three cases, 1980-2040 (2011 dollars per barrel)



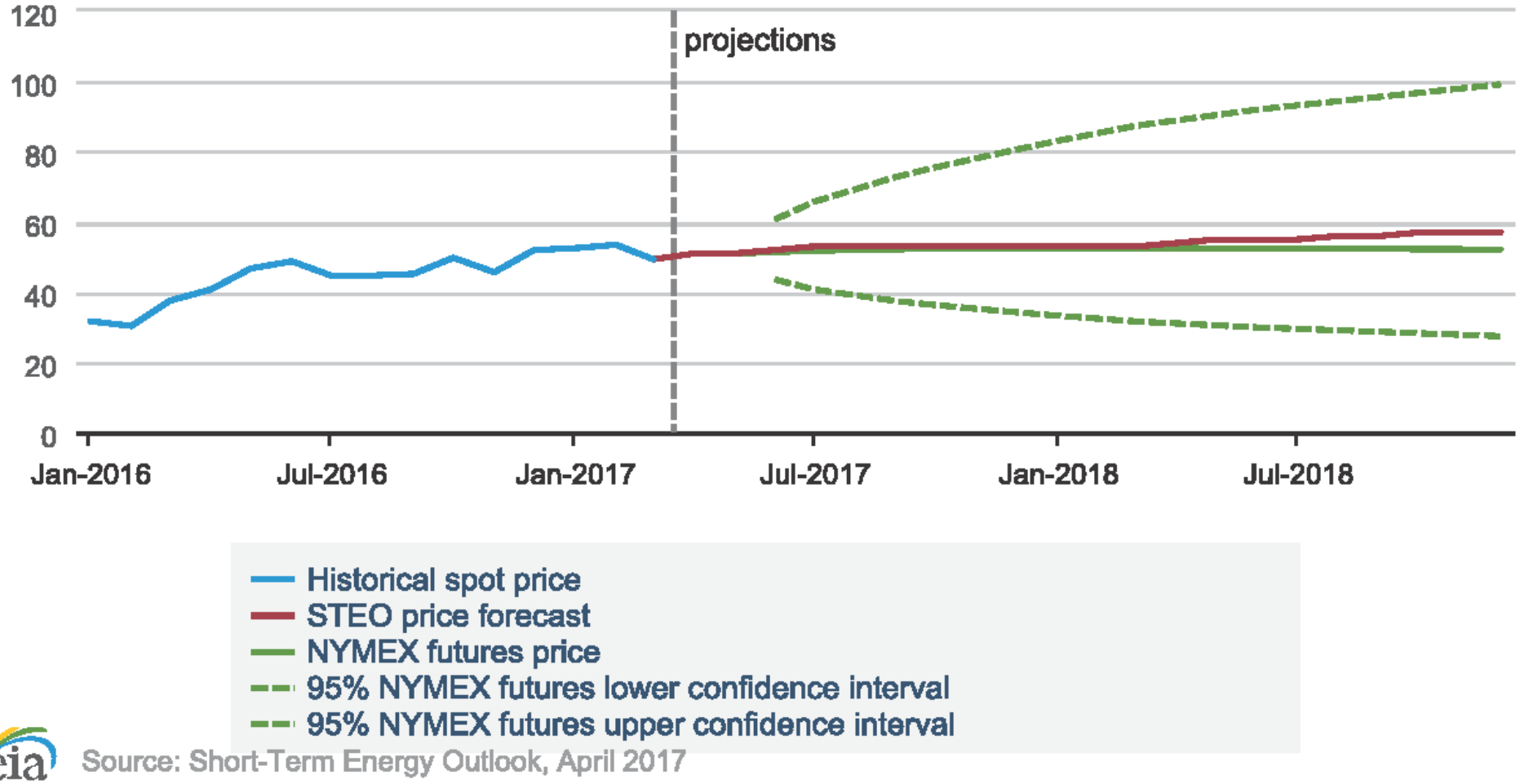
AND MORE FORECASTS



THE FUTILITY OF "TECHNICAL ANALYSIS"

CRUDE OIL TECHNICAL ANALYSIS – A seventh consecutive daily drop has given crude oil prices their worst losing streak in over a year. From here, a daily close below the 48.56-85 area (trend line, 61.8% Fibonacci expansion) paves the way for a test of the 47.08-69 zone (March 22 low, 76.4% level). Alternatively, a reversal above the 50% Fib at 49.78 exposes the 38.2% expansion at 50.71.

WHAT DOES FUTURES MARKET SAY?



Source: Short-Term Energy Outlook, April 2017

Note: Confidence interval derived from options market information for the 5 trading days ending Apr. 6 2017. Intervals not calculated for months with sparse trading in near-the-money options contracts.

Note that 95% confidence interval is huge. Lots of uncertainty!

WHY DOES UNCERTAINTY MATTER?

- Suppose you own an undeveloped oil reserve.
  - To produce oil, must first develop the reserve. Expensive: cost is $1 billion.
  - After developing the reserve, you can produce oil from it for the next 10 years.
  - Revenue you get each year depends on price of oil. But oil prices fluctuate – lots of uncertainty.
- Question: Does greater uncertainty raise or lower the value of your undeveloped reserve?
- Answer: It raises the value of the reserve.
- Reason: The reserve is like a call option. More uncertainty raises option value.

OPTION VALUE OF OIL RESERVE

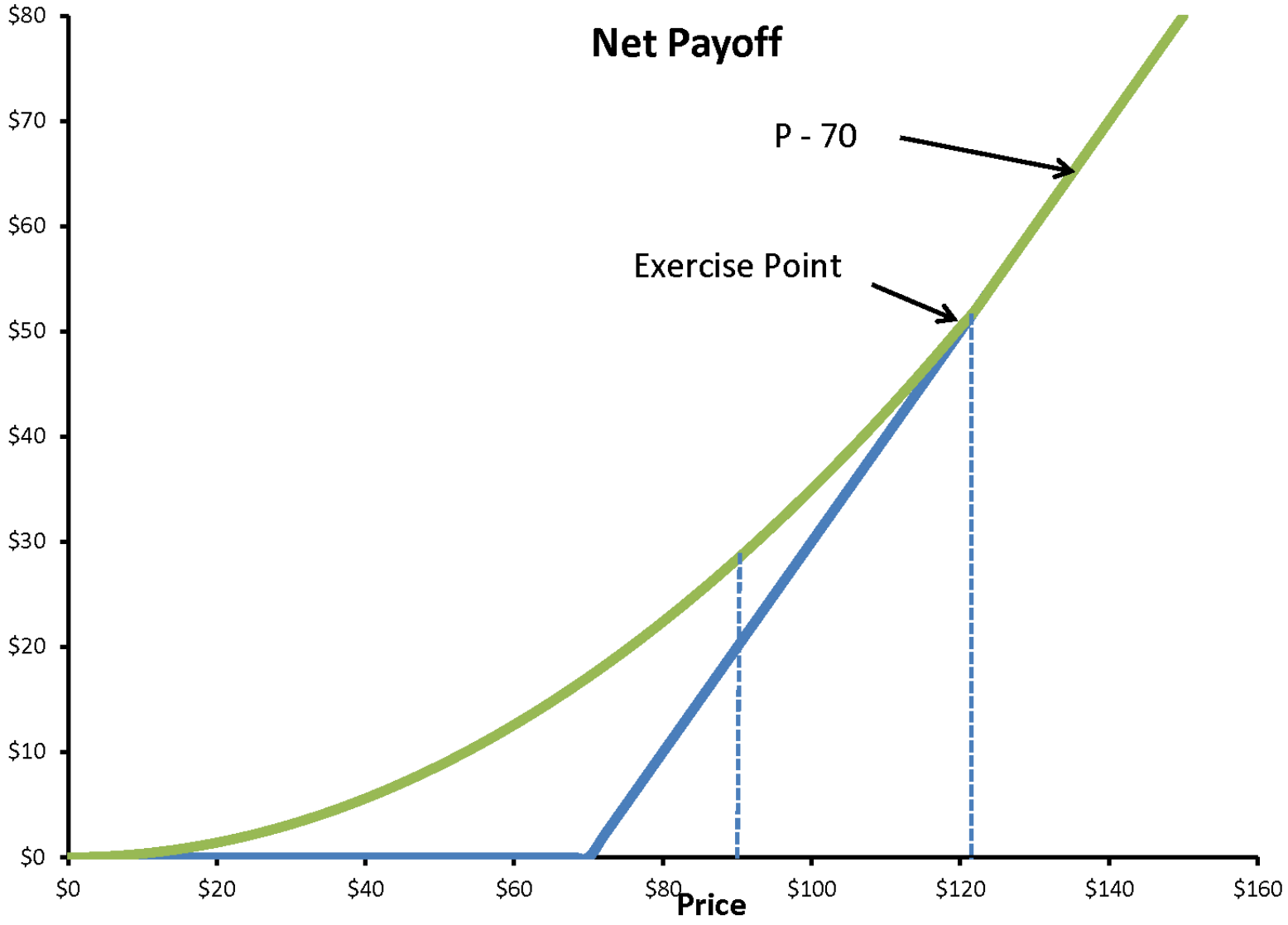


Table 1: Comparison of Stock Call Option and Undeveloped Petroleum Reserve

Stock Call Option	Undeveloped Reserve
Current stock price	Current value of developed reserve
Variance of rate of return on the stock	Variance of rate of change of the value of a developed resource
Exercise price	Development Cost
Time to expiration	Relinquishment requirement
Riskless rate of interest	Riskless rate of interest
Dividend	Net production revenue less depletion

NATURAL GAS, COAL, NUCLEAR

- Prices of natural gas and coal only loosely connected to oil price.
  - Oil is easy to transport, so world market. Natural gas is not. So even when WTI oil was $100, natural gas price in US was $4.00/mcf (equivalent to oil at $24/barrel).
  - Natural gas today is $3.00/mcf in US, $10 in Europe and somewhat more in Japan.
  - Coal somewhat easier to transport, but dirty, so use subject to regulation. Thus price not tied to oil price.
- Nuclear: Not economical, even at $100 oil and $15 natural gas.
  - Capital costs huge.
  - Regulatory environment very uncertain.
  - Little or no construction of new plants.

SUMMARY

- Oil prices very volatile. Reason: short-run elasticities of demand and supply very small.
- What will oil price be in five years? Don't even ask that question.
- What matters is nature and extent of uncertainty.
- More uncertainty raises value of oil reserves. Reason: like a call option.
- Prices of natural gas and coal only loosely connected to oil price (if at all). Equally unpredictable.
- Bleak future for nuclear.