

THE OUTLOOK FOR THE U.S. SHALE INDUSTRY

MICHAEL C. LYNCH

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THE BOOK IS FINALLY HERE! (JULY 2016)



Primary lesson is that much knowledge is superficial, and incorrect. In-depth understanding usually trumps clichés.

CAUTIONS

HIGH LEVEL VIEW

- ANY GIVEN COMPANY MIGHT BE DIFFERENT
- GEOGRAPHY AS WELL AS GEOLOGY

ACCOUNTING ALWAYS TRICKY

- NO EFFORT TO CORRECT
- AGGREGATION

TOO MUCH SUPERFICIAL THINKING

- STATIC NOT DYNAMIC

PRIMARY TOPICS

DECLINE RATES

CAPITAL DISCIPLINE

PERMIAN TAKEAWAY

OUTLOOK FOR LNG

HISTORY OF CONTROVERSY

GEOLOGISTS: HUGE RESOURCE!

- ENGINEERS: IMPOSSIBLE TO EXTRACT

COMPANIES: GREAT GEOLOGY!

- AS GOOD AS/BETTER THAN THE EAGLE FORD/BAKKEN
- ANALYSTS: TOO EXPENSIVE

PESSIMISTS:

- ONLY BARNETT
- OIL WON'T WORK
- BAKKEN UNIQUE
- HIGH DECLINE RATES
- CASH-FLOW IS NEGATIVE
- SWEET SPOTS INSUFFICIENT

E PUR SI MUOVE!

CAPITAL DISCIPLINE: BANKERS VS. DRILLERS

SHOW US YOUR CAPITAL DISCIPLINE!

- “Please for the love of God, don’t do it!”

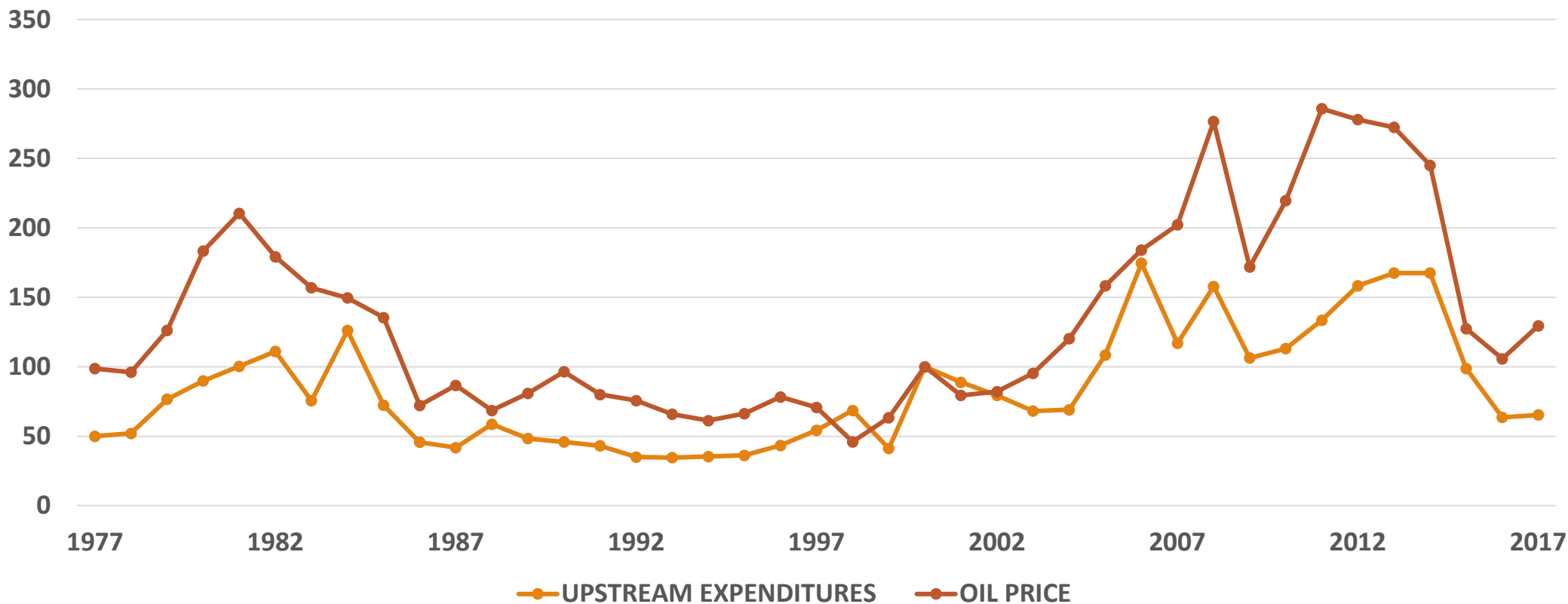
SURPLUS WEIGHING ON PRICES

- PERMIAN TAKEAWAY
- NEGATIVE GAS PRICES, DISCOUNTED CRUDE

GROWING DUCS

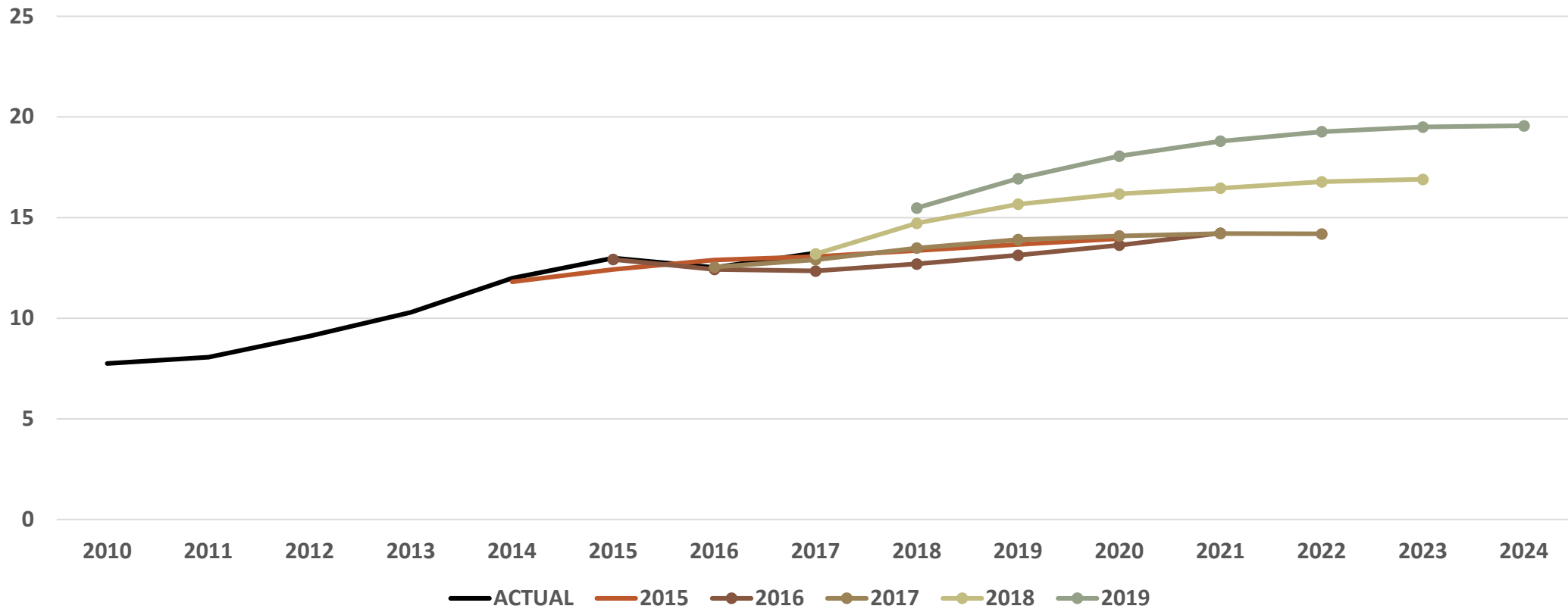
ANIMAL SPIRITS VS. IRRATIONAL EXUBERANCE

WHAT DRIVES SPENDING?



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION.

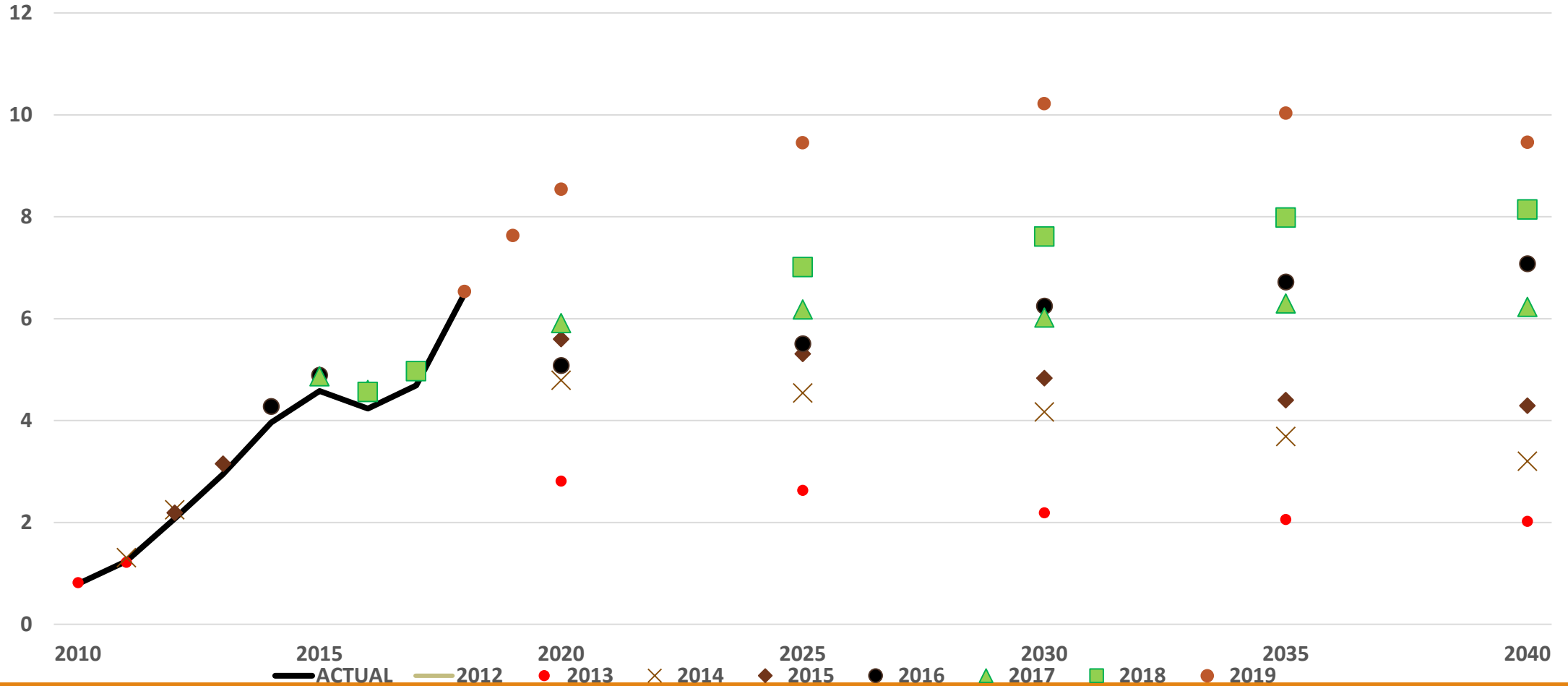
PESSIMISM IN SHORT-TERM IEA FORECAST OF US SUPPLY



SOURCE: INTERNATIONAL ENERGY AGENCY *OIL MARKET REPORT*.

CONTINUING PESSIMISM IN SHALE OIL

(EIA FORECASTS)



BREAKEVEN CONTROVERSY

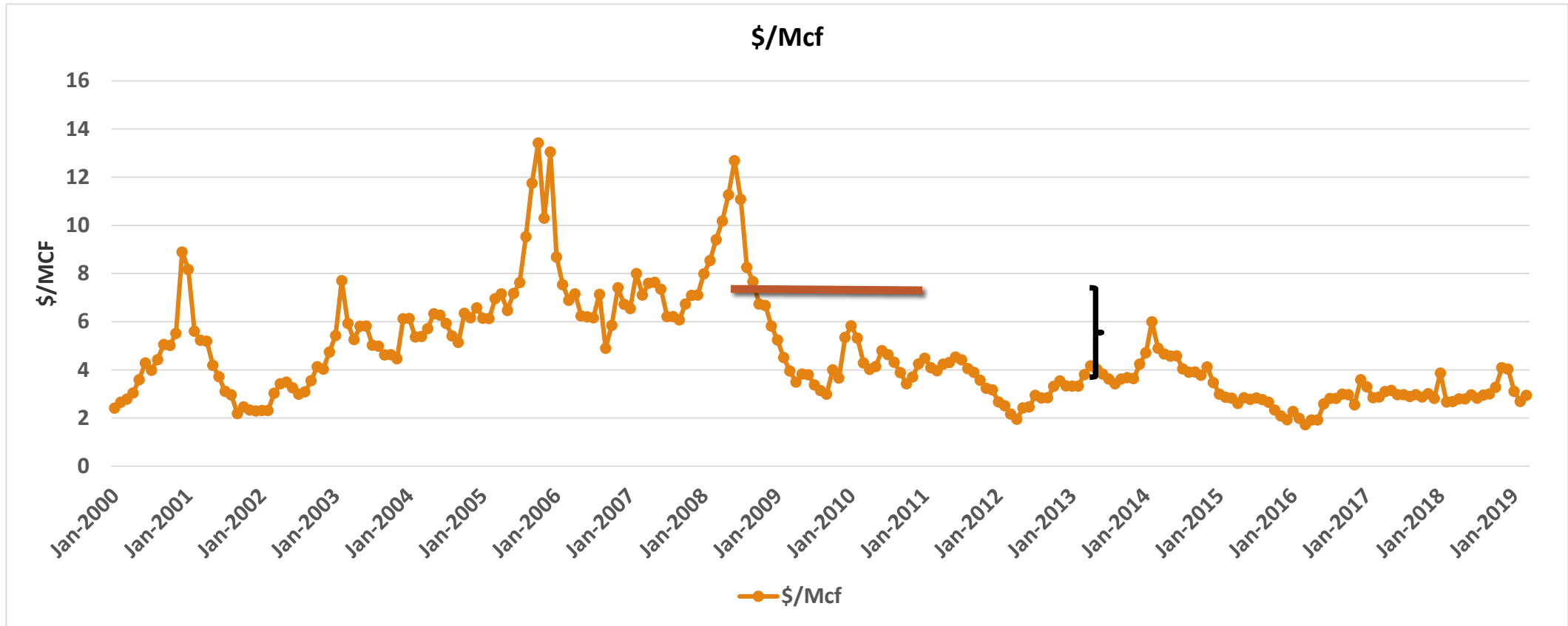
“NO WELL IS PROFITABLE”

- “ALL OUR WELLS ARE PROFITABLE”

BREAKEVEN ESTIMATES UNRELIABLE

- SHORT-RUN NOT LONG-RUN COSTS
 - EXCLUDING G&A, INTEREST?
- REALITY BITES
 - MARGINAL COSTS \$7.50/MCF (2010)
 - MARGINAL COSTS \$3.81-7/MCF (2013)

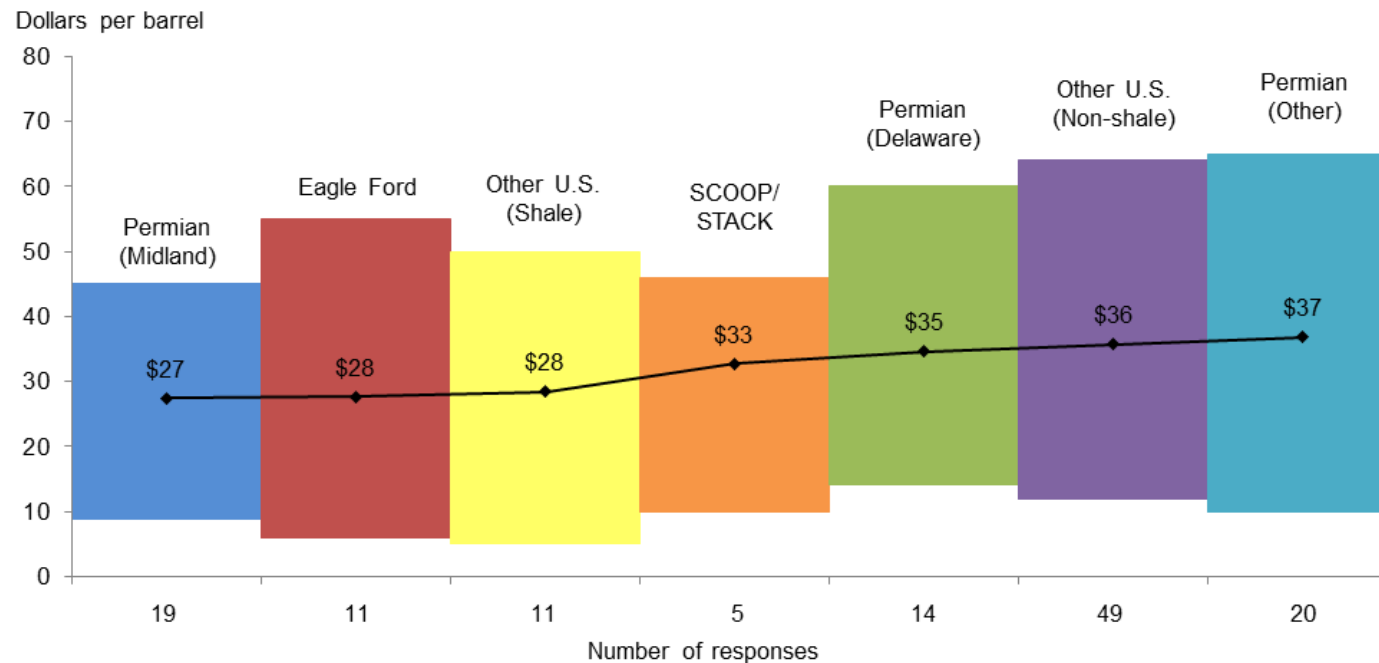
GAS BREAK-EVEN AND PRICE



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION AND THE AUTHOR.

MARGINAL COSTS (SHORT-RUN)

In the top two areas in which your firm is active:
 What WTI oil price does your firm need to cover operating expenses for existing wells?

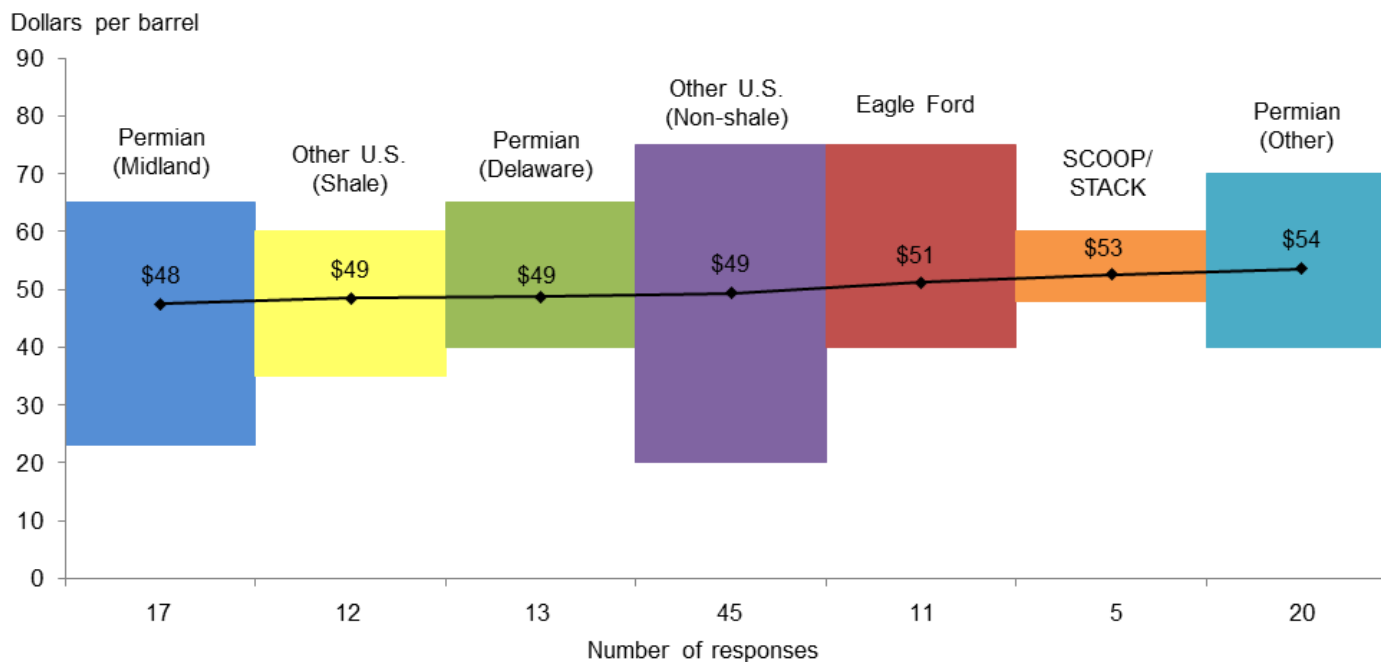


NOTES: Lines show the mean, and bars show the range of responses. Executives from 87 exploration and production firms answered this question during the survey collection period, March 13–21, 2019.

SOURCE: Federal Reserve Bank of Dallas.

MARGINAL COSTS (LONG-RUN)

In the top two areas in which your firm is active:
What WTI oil price does your firm need to profitably drill a new well?



NOTES: Lines show the mean, and bars show the range of responses. Executives from 82 exploration and production firms answered this question during the survey collection period, March 13–21, 2019.

SOURCE: Federal Reserve Bank of Dallas.

DECLINE RATES

PRODUCTION DROPS OFF SHARPLY

MUCH FASTER THAN CONVENTIONAL OIL

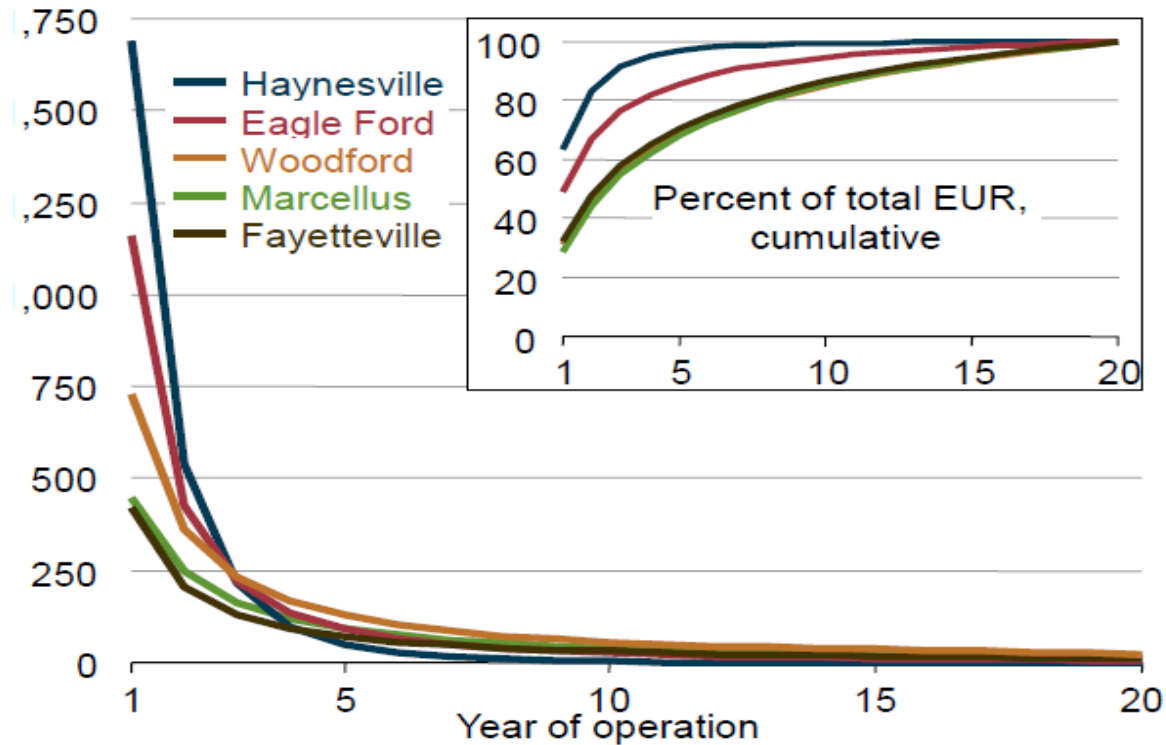
FOCUS IS ON THE WELL LEVEL

IMPACT ON OUTPUT MIXED

DRILLING LEVELS NEED TO BE MONITORED CLOSELY

SHALE GAS DECLINE CURVES

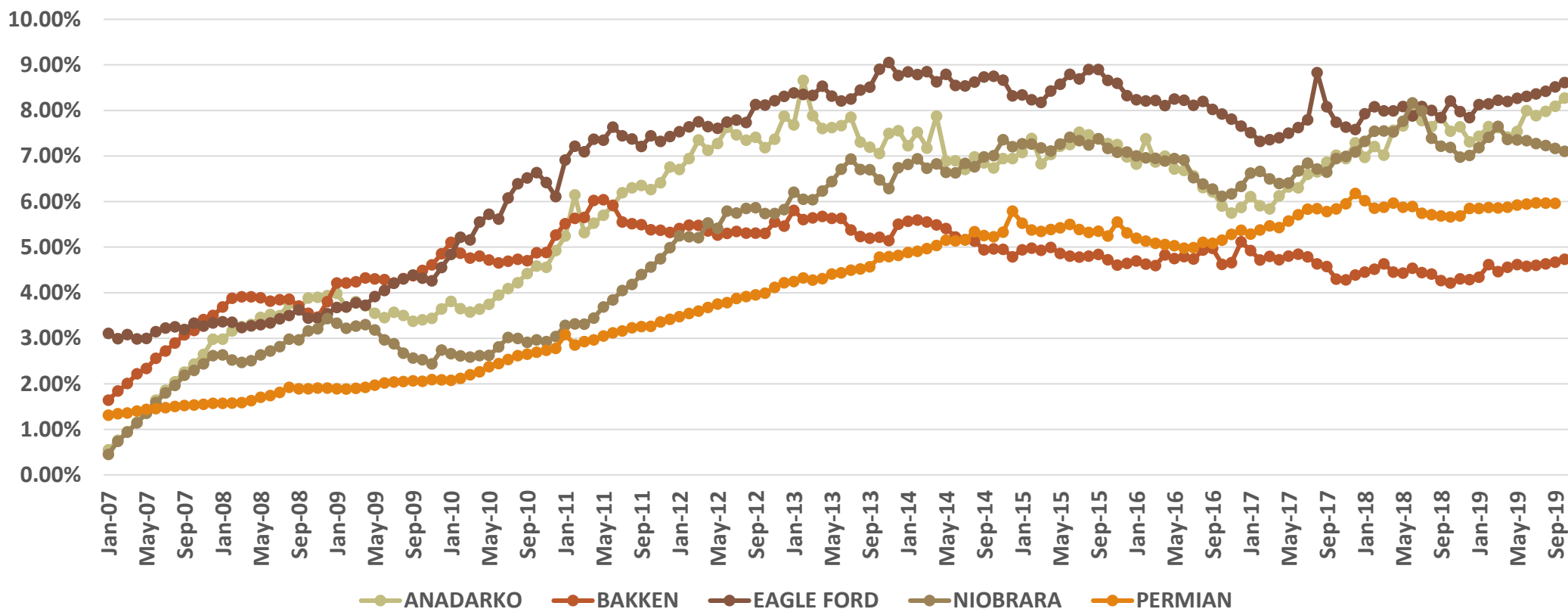
Figure 54. Average production profiles for shale gas wells in major U.S. shale plays by years of operation (million cubic feet per year)



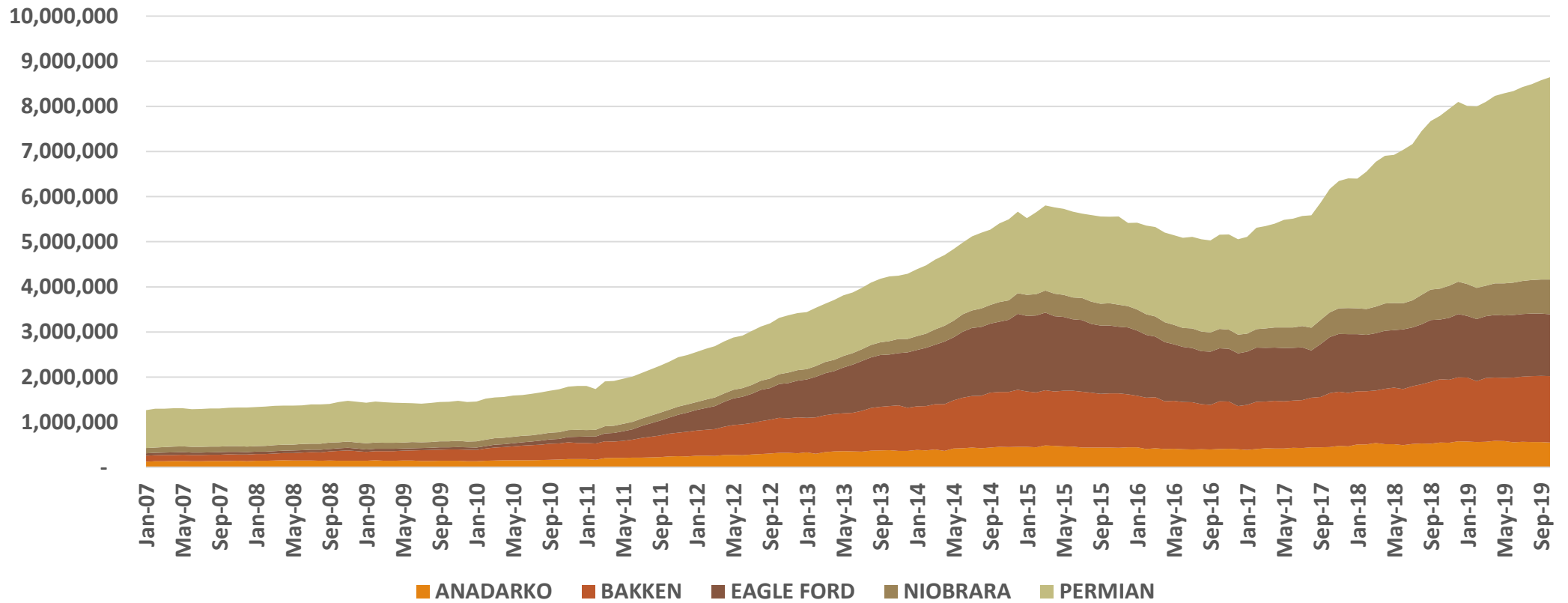
SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION

SHALE OIL DEPLETION RATES

(LEGACY / PRODUCTION)

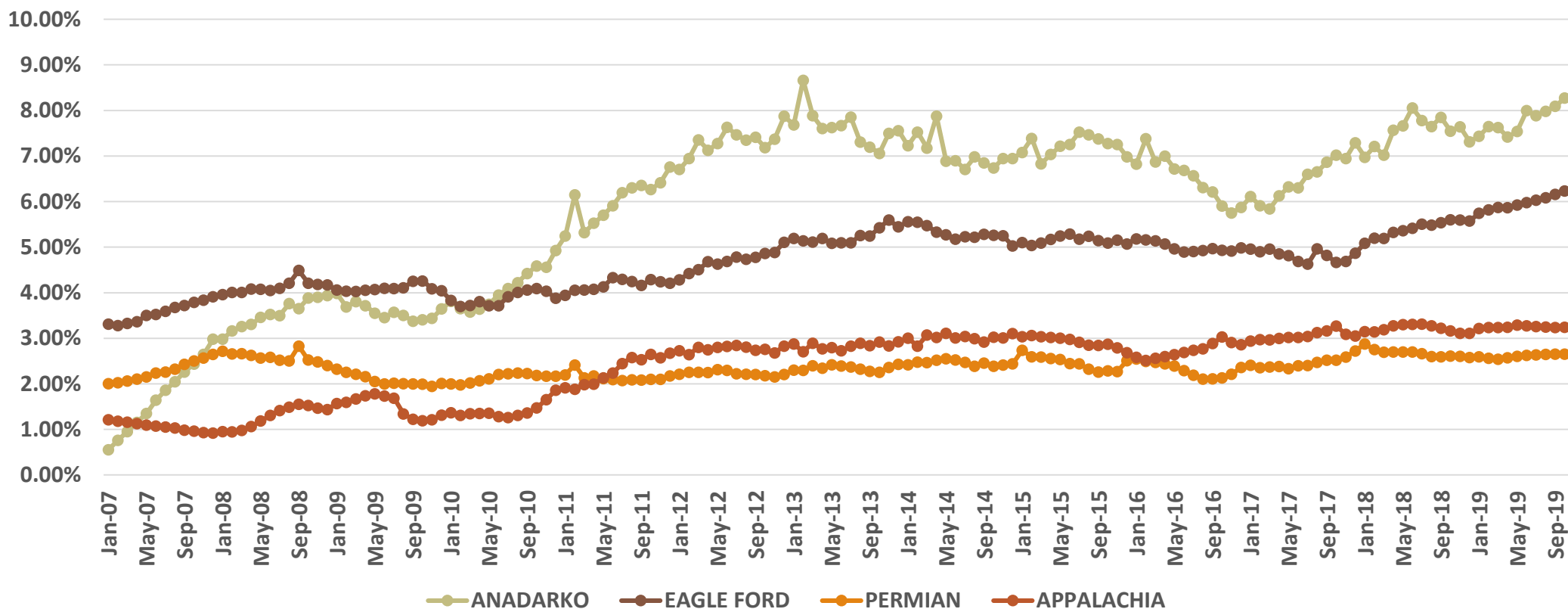


SHALE OIL PRODUCTION



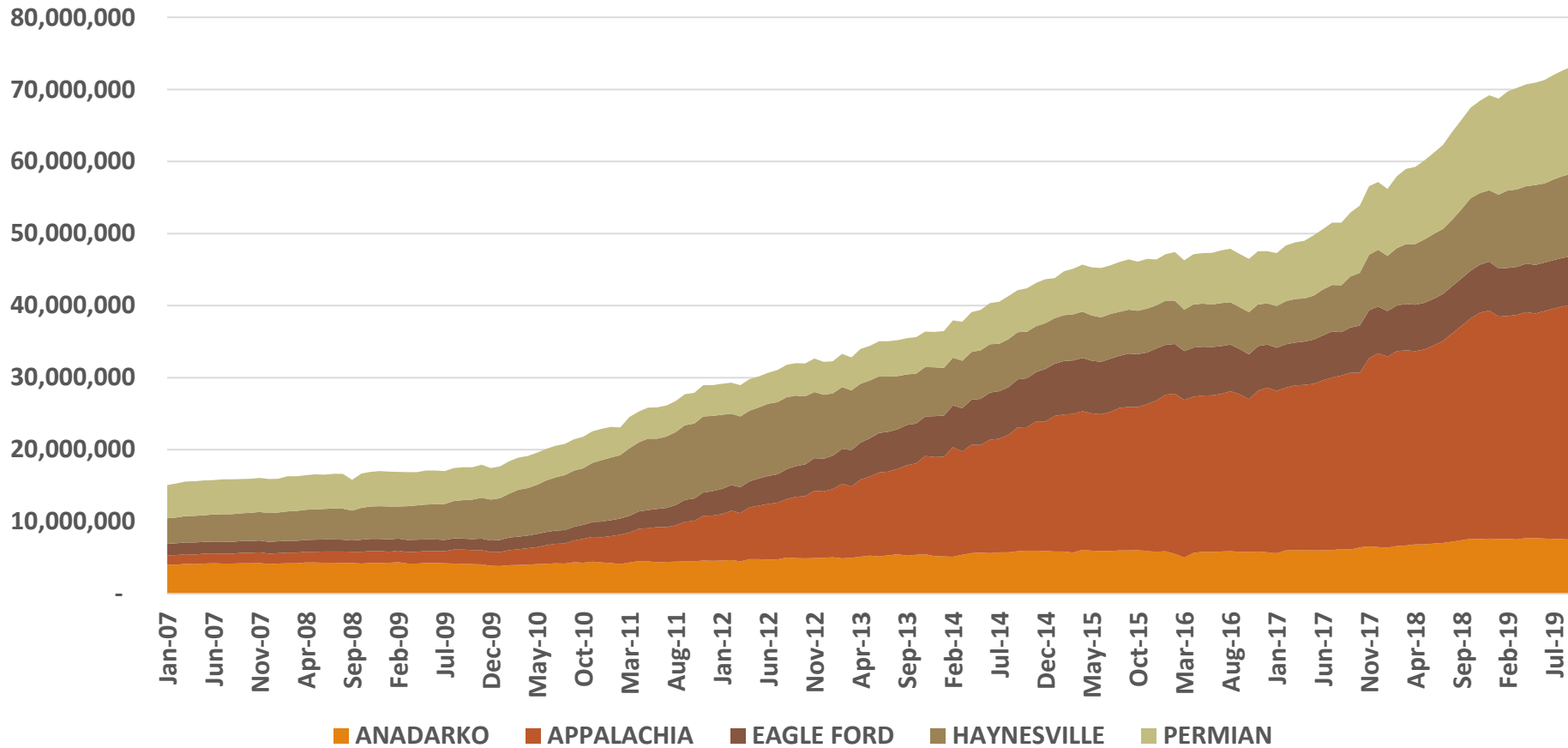
SHALE GAS DECLINE RATE

(LEGACY / PRODUCTION)



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION AND THE AUTHOR.

SHALE GAS PRODUCTION



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION

CAPITAL DISCIPLINE (OR NOT)

EARLY BOOM YEARS

CASH FLOW NEGATIVE/NO PROFITS

IRRATIONAL EXUBERANCE

- WALL STREET THE ENABLER
- LOTS OF DUMB MONEY

WINNER'S CURSE

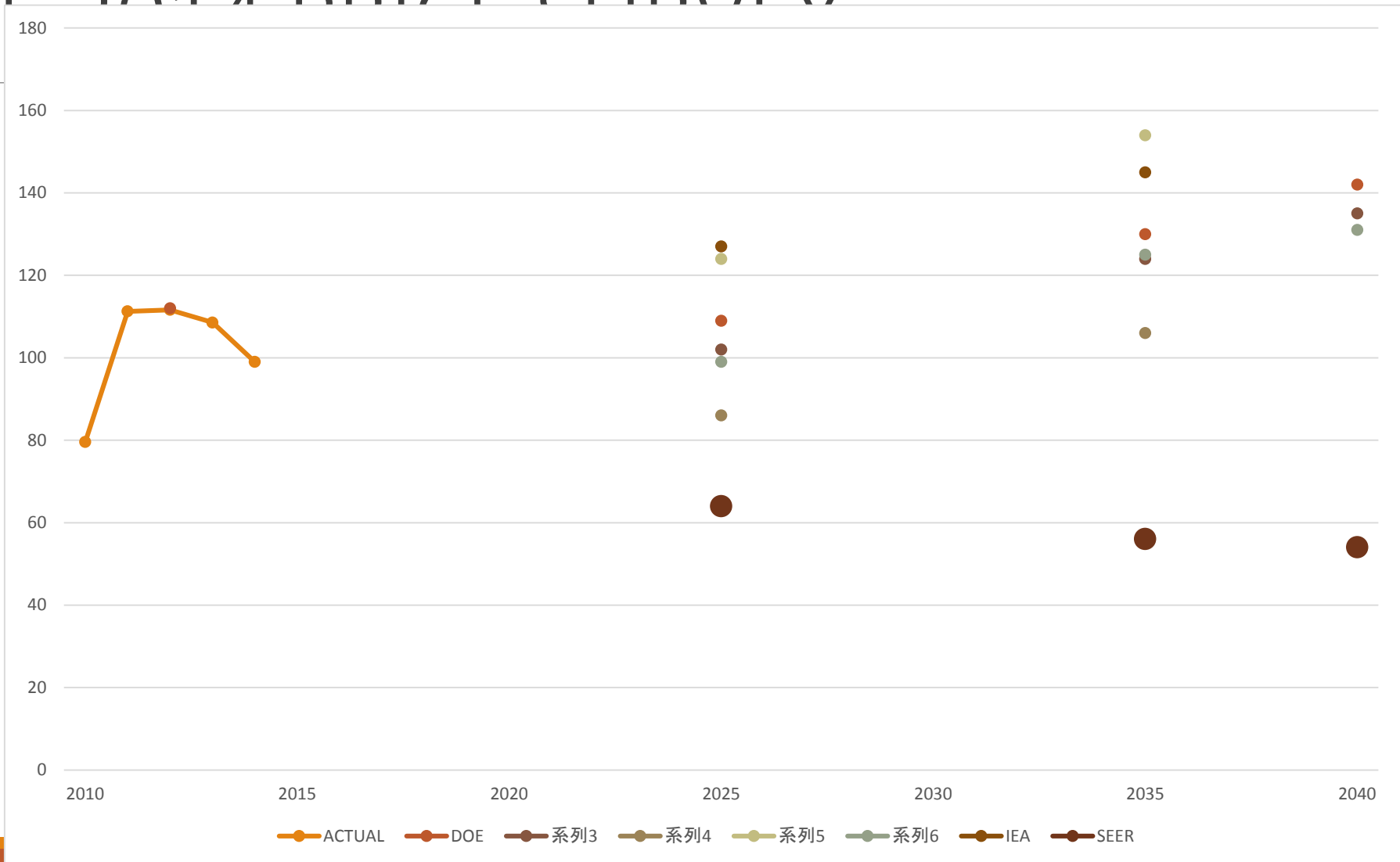
APPLIED TO UNCERTAINTY

- GEOLOGICAL
- PRICE

FORMER A MAJOR FACTOR IN EARLY SHALE DAYS

- LATTER THE ENTIRE INDUSTRY
 - PHILOSOPHER BjM: "THIS TIME FOR SURE!"

DOE 2014 PRICE SURVEY



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION, ANNUAL ENERGY OUTLOOK 2014.

BIG FAILS

SAMSON: HAYNESVILLE EMPHASIS

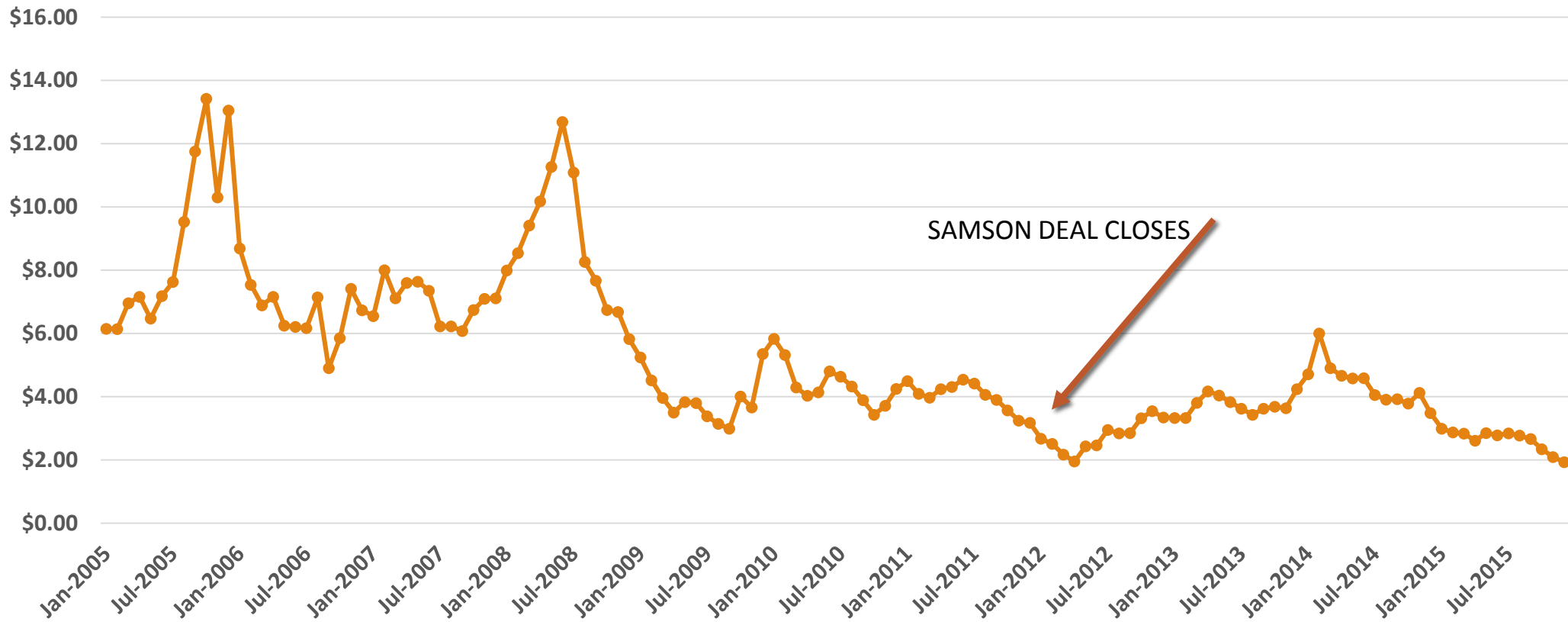
CHESAPEAKE: AGGRESSIVE LEASE ACQUISITION

MANY OTHERS

COMMON ELEMENTS

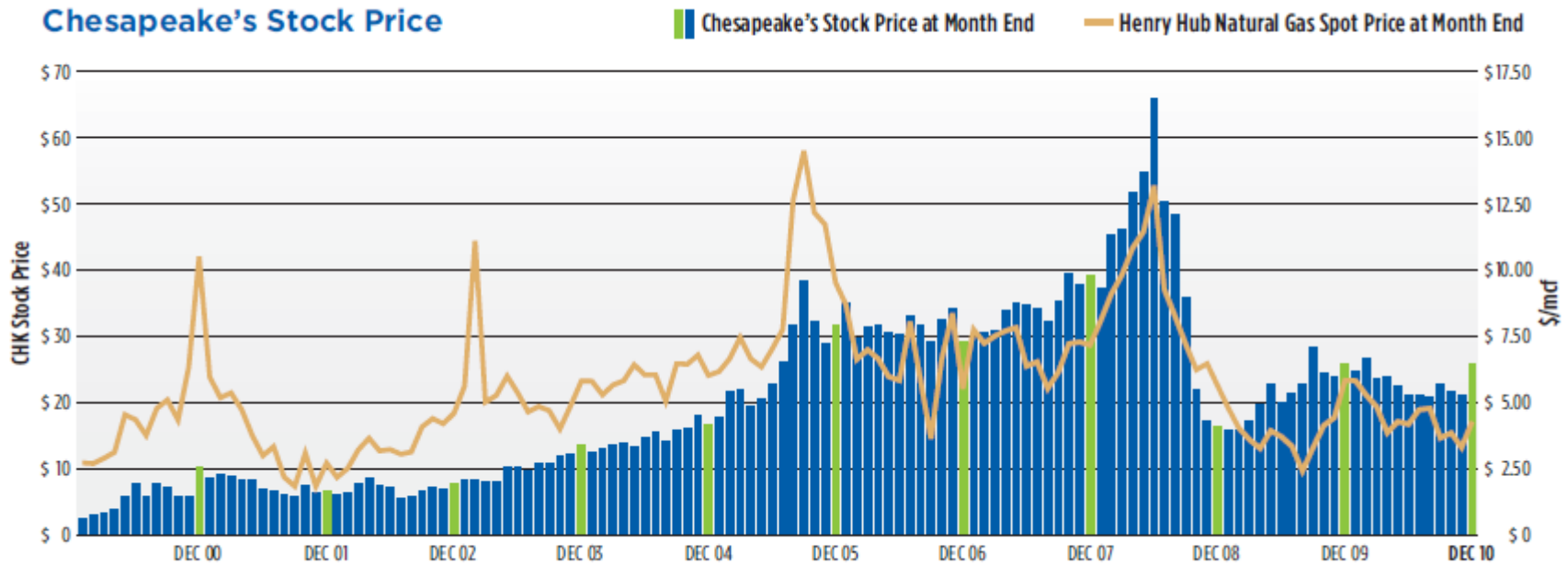
- NATURAL GAS HEAVY
- UNEXPECTED PRICE DROP
- HEAVY DEBT/EQUITY

GAS PRICES



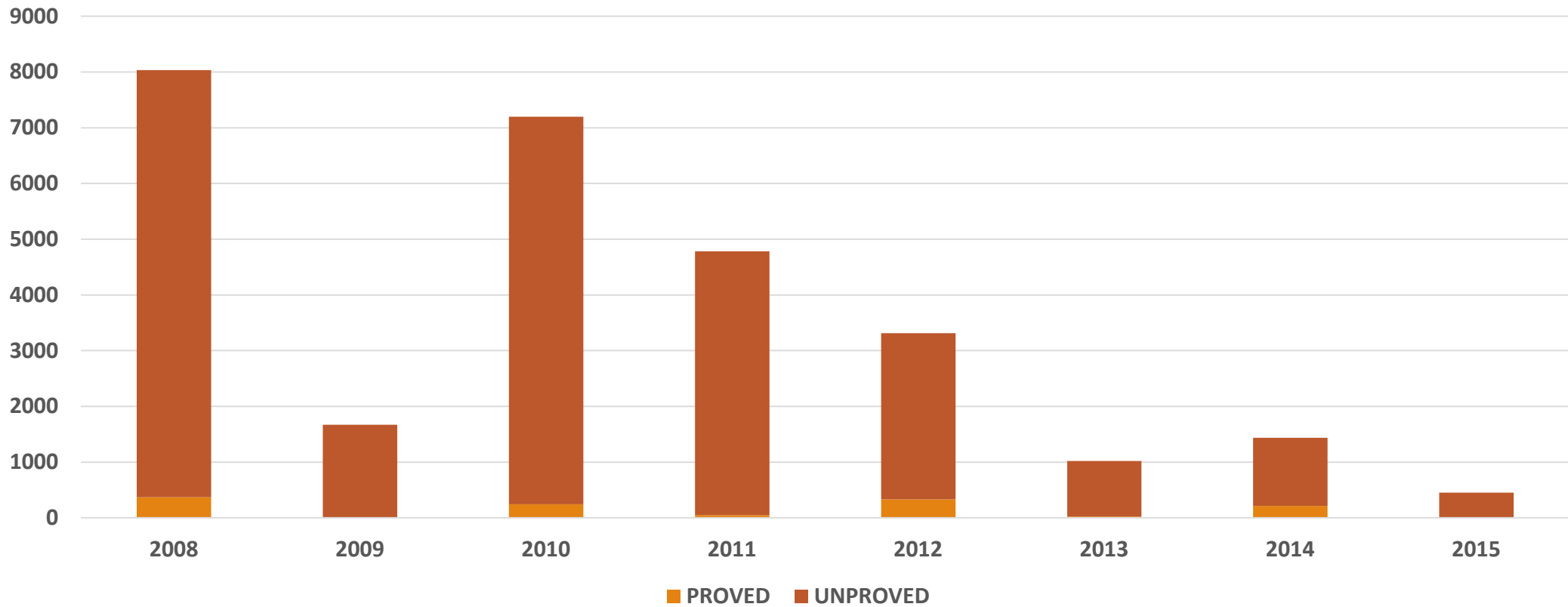
SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION

...SORT OF OBVIOUS



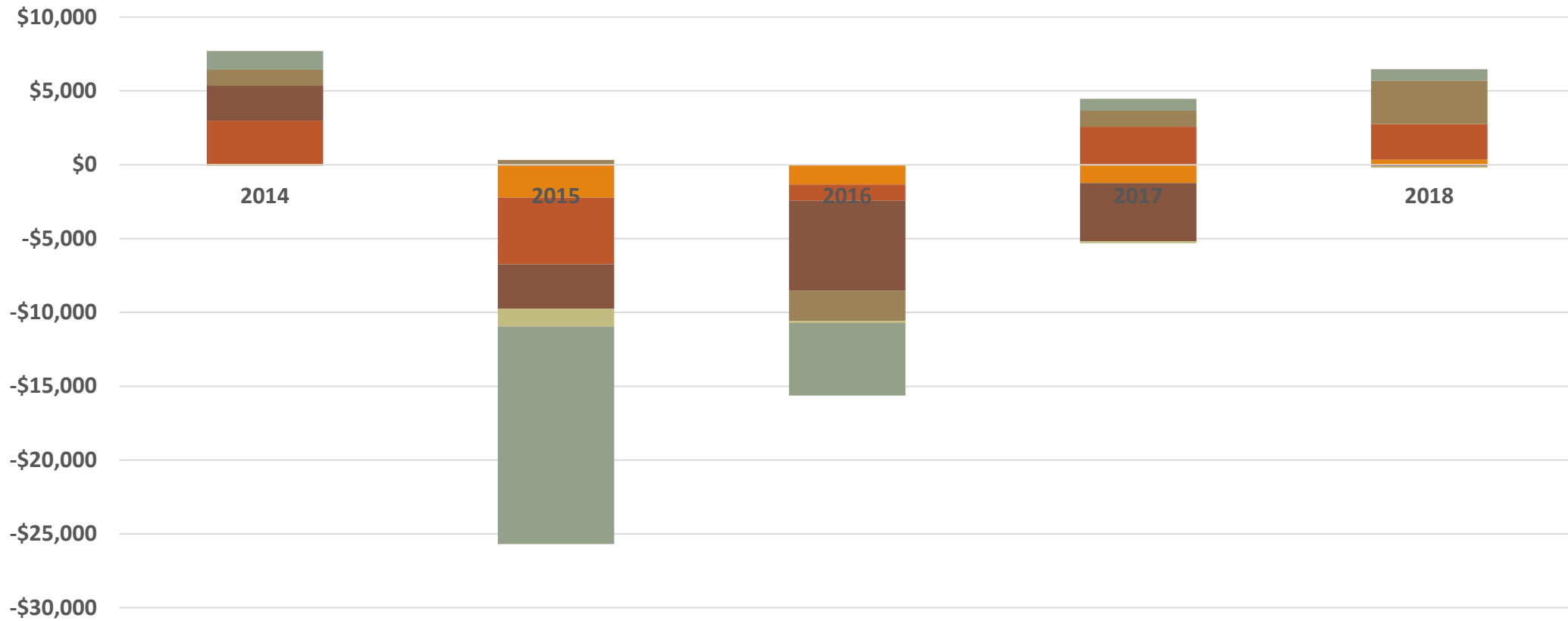
SOURCE: CHESAPEAKE ENERGY ANNUAL REPORT 2011.

EMPHASIS ON FUTURE REVENUE



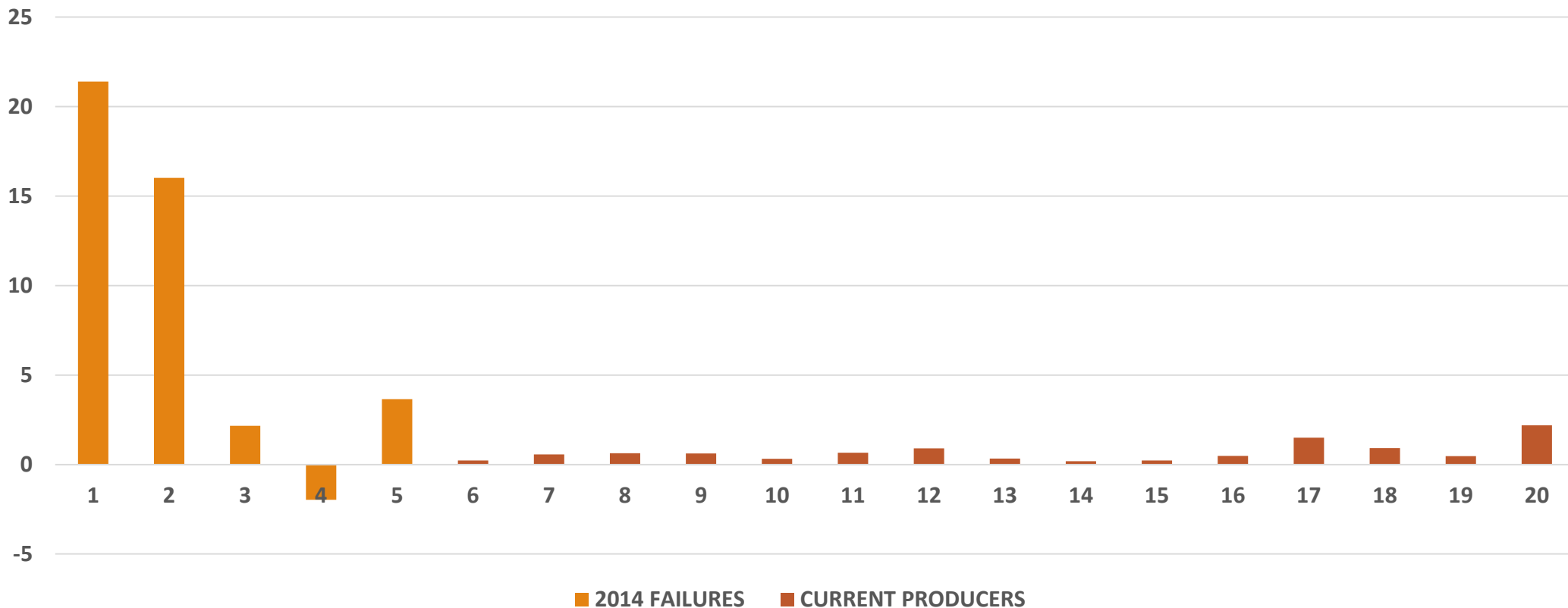
SOURCE: CHESAPEAKE ENERGY ANNUAL REPORTS.

LOSSES CONCENTRATED IN 2015/2016



SOURCE: VARIOUS COMPANY ANNUAL REPORTS

DEBT/EQUITY RATIOS IMPROVED



SOURCE: COMPANY ANNUAL REPORTS

COULD IT REPEAT?

REPEATING THE 2008 COLLAPSE WOULD MEAN:

- DROP OF 60% IN GAS: TO \$1.20/\$1.50?
- DROP OF 40% IN OIL: TO \$35?

REPEATING THE 2015 COLLAPSE WOULD MEAN:

- DROP OF 45% IN GAS: TO \$1.60?
- DROP OF 48% IN OIL: TO \$32?

OTHER CONCERNS

- SHARP INTEREST RATE RISE
- FLARING BAN

SHARP RISE IN PERMIAN TAKEAWAY

TRANSPORT COSTS SHOULD DROP

MORE REVENUE FOR PRODUCERS

SHOULD MEAN MORE DRILLING

WILL DUCS BE COMPLETED RAPIDLY?

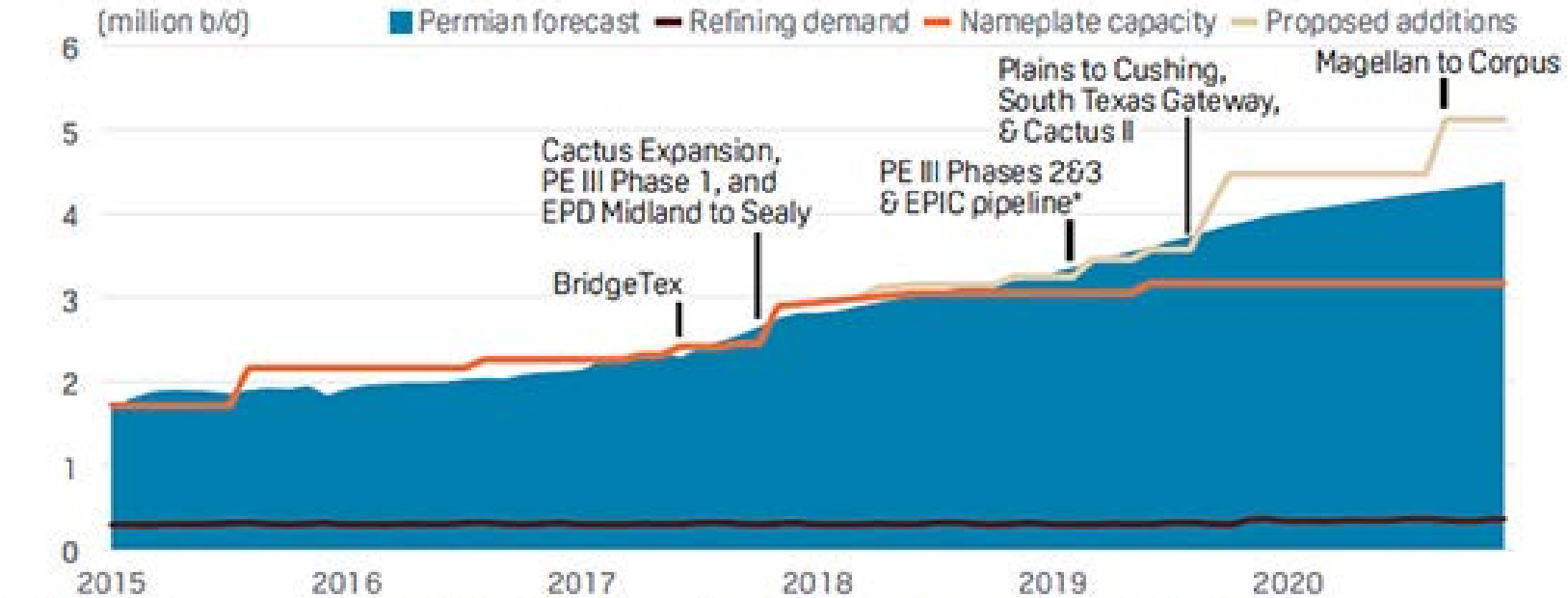
COULD BRENT/WTI DIFFERENTIAL DROP?

MORE NATURAL GAS TO BE FLARED?

- OR LARGER PRICE DISCOUNT
- GOOD FOR LNG EXPORTS

PERMIAN TAKEAWAY GROWS

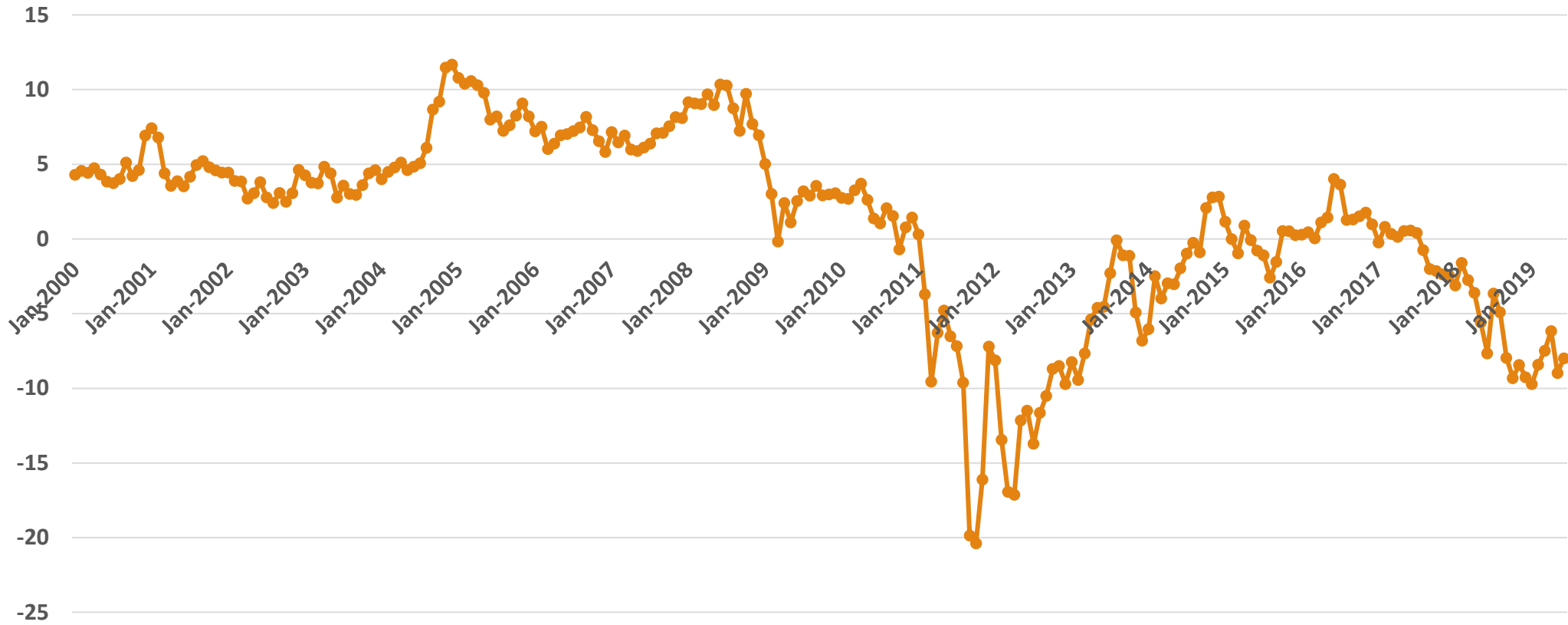
ADDITIONAL PIPELINE CAPACITY WILL BE SUFFICIENT, BUT MAY HAVE PERIODS OF TIGHTNESS



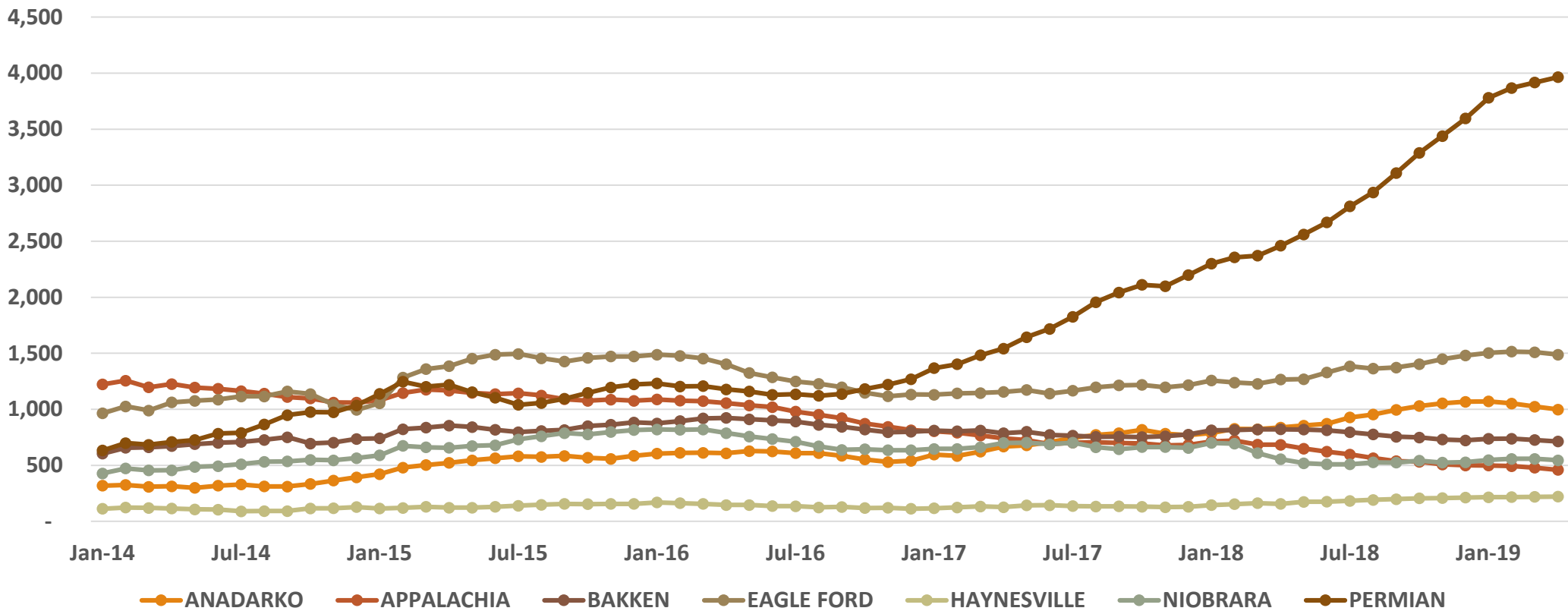
*Only takes into account original 200Mb/d EPIC capacity. Has proposed increasing to 440Mb/d.
Source: Platts

WTI DISCOUNT

(API 40+MINUS 20-)

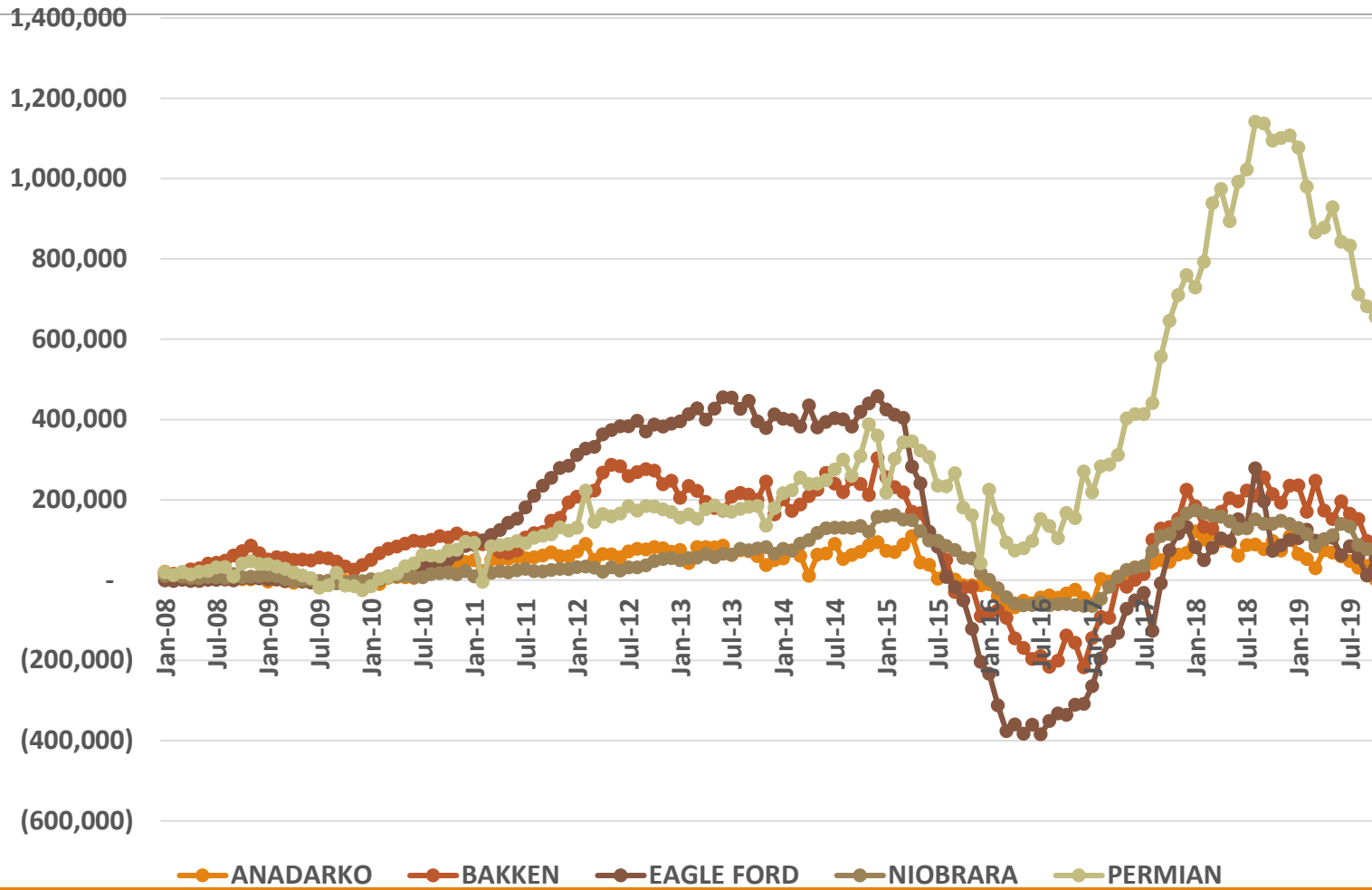


DUCS BY BASIN



SOURCE: U.S. ENERGY INFORMATION ADMINISTRATION

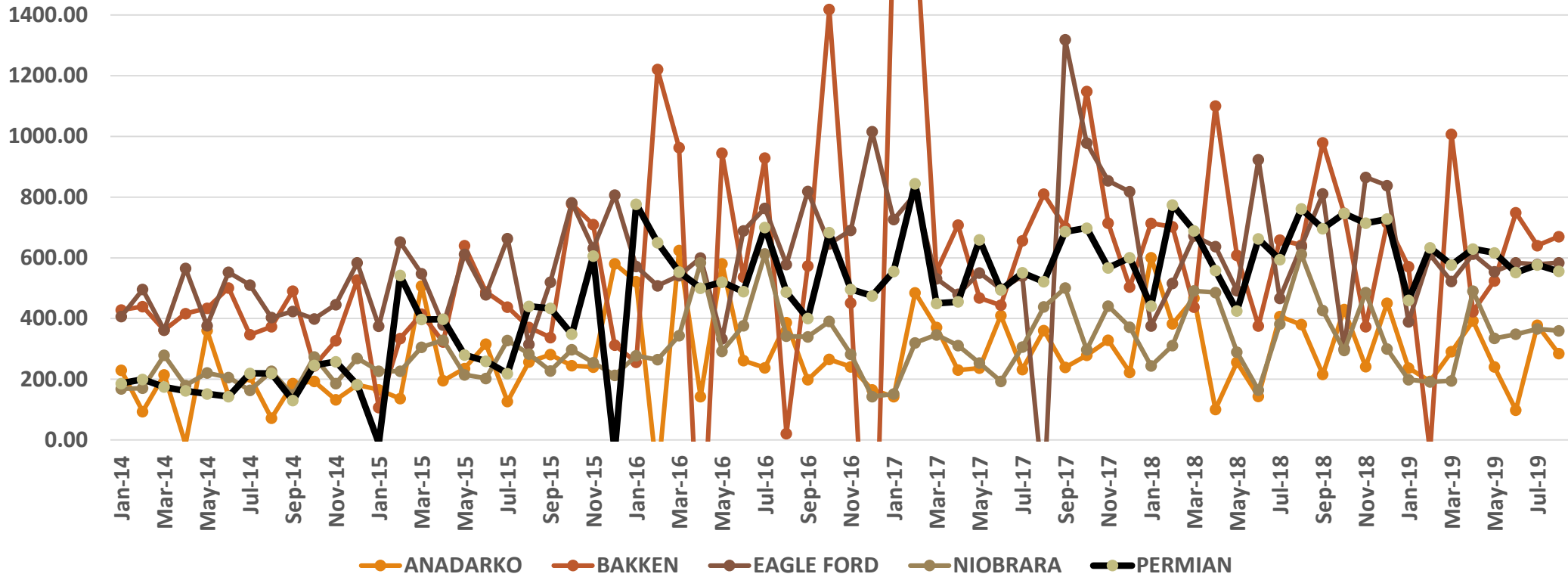
TIGHT OIL YEAR ON YEAR CHANGE



Source: DOE.

BASIN PRODUCTIVITY

(B/D/WELL ADDED)



WHY IS SHALE DIFFERENT?

GEOLOGICAL AND POLITICAL RISKS SMALL

- OUTSIDE OF NEW YORK (COLORADO)

PRICE RISKS HIGH

- TAXES AS SHARE OF PRICE SMALLER

QUICK MONEY

- CASH IN ON PRICE SPIKES? MOSTLY OIL.

SHALE REVOLUTION AND LNG MARKET

TWO BIG DIFFERENCES

- HIGH COST FEED GAS
- ANIMAL SPIRITS

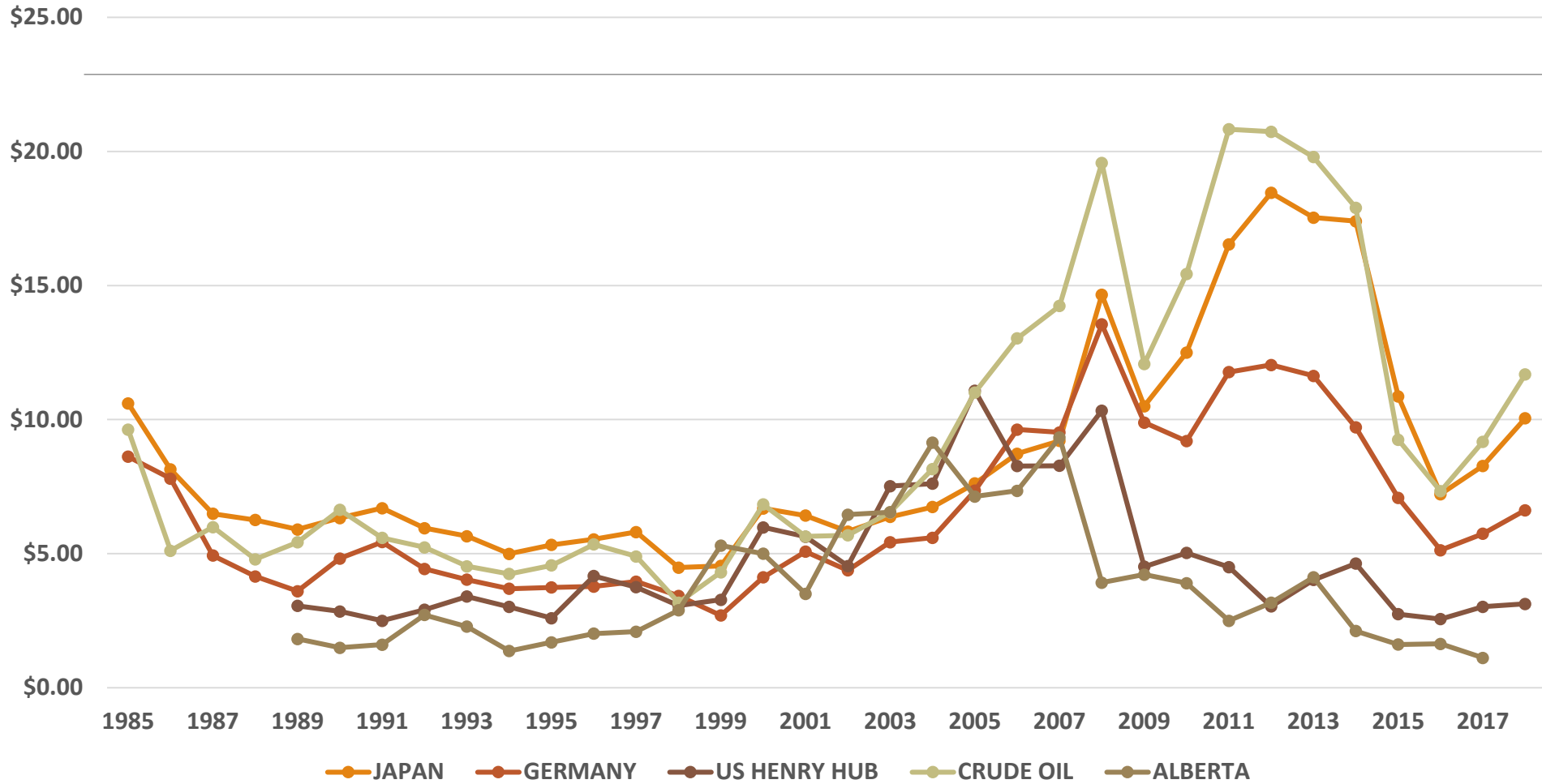
WILLINGNESS TO BE FLEXIBLE

- BUILD WITHOUT COMMITTED PURCHASES
- NEW CONTRACT STRUCTURES
 - NO OIL PRICE INDEXING
 - DESTINATION RESTRICTIONS

RESULT: LOWER PRICES, LESS UPSTREAM PROFITS

BUT MAYBE IRRATIONAL EXUBERANCE?

GLOBAL GAS PRICES 2018\$/MMBTU



See: "Uncertainties Threaten Natgas Development," *Oil & Gas Journal*, 3/4/13.

EXPECTATIONS

SHAPE PRODUCTION TO BE ROBUST

- INCREASINGLY DOMINATED BY LARGER PLAYERS
- 2020 SURGE COULD PRESSURE MARKETS

BOOM AND BUST CONTINUE

- SMALLEST AND MOST VULNERABLE DISAPPEAR

UNCERTAINTY REIGNS

- NEW BASINS TOUTED AND DECRIED
- RATE OF TECHNOLOGICAL PROGRESS UNCLEAR