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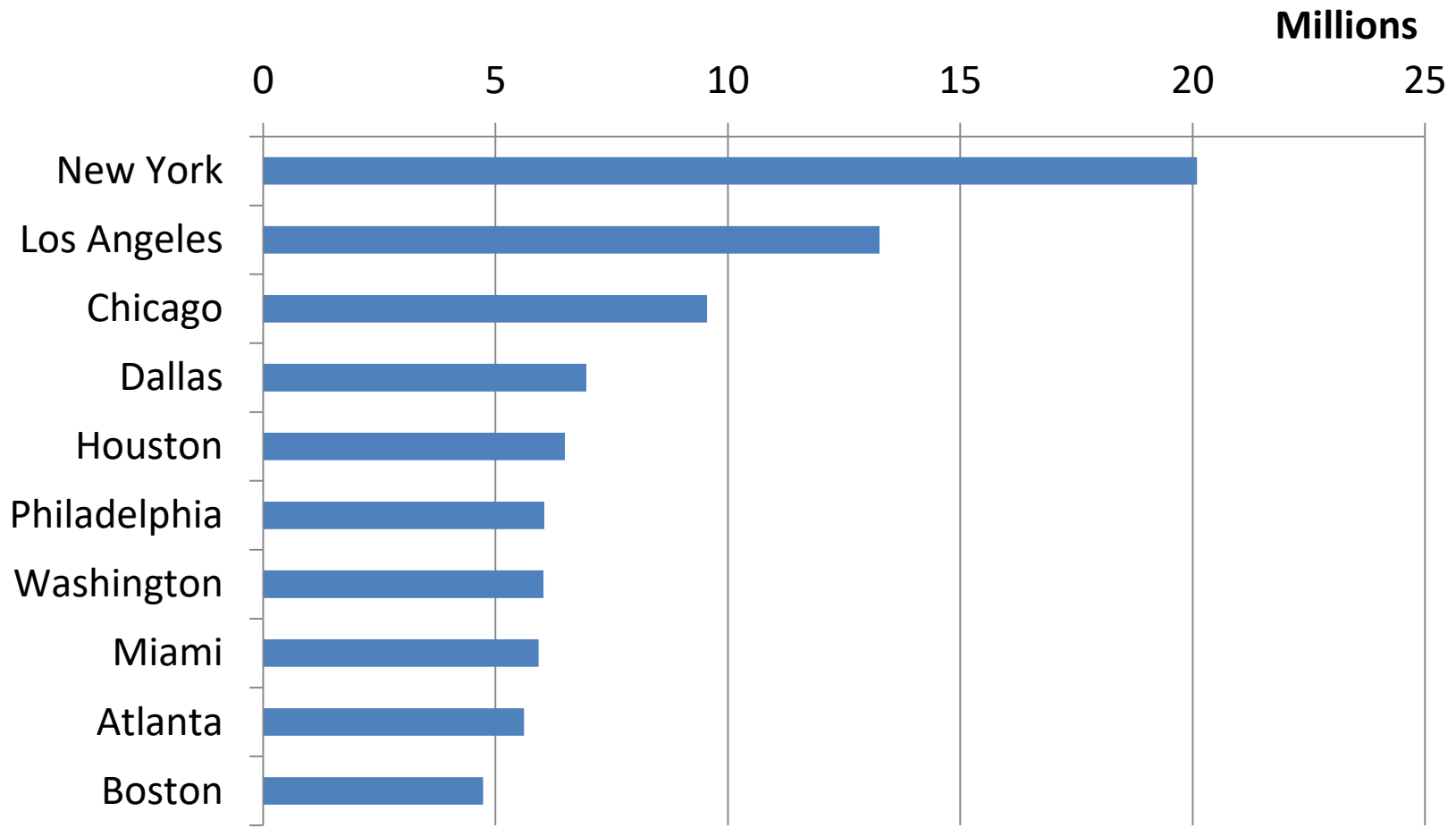
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Houston's Economy Powered by Oil

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Houston ranks fifth in population among U.S. metropolitan areas



Houston's economy rests on four major roles

- Medicine and the Texas Medical Center
- Aerospace and the Johnson Space Center
- Upstream oil exploration and production
- Downstream oil refining and petrochemical production

A quick tour of the Houston economy's many links to oil

Houston is one of many cities built on an industrial cluster of activity

- New York – financial services
- Detroit – automobiles
- San Jose – tech
- Hollywood – movies
- Houston - oil

Why do these clusters form?

- What economists call “economies of urbanization and agglomeration” lower the cost of doing business for every member of the industry that participates
- Provides a large labor force with highly specialized skills needed for the industry
- Skilled/specialized workers have choices among employers
- Customers of the dominant firms join the cluster, and local financial institutions know the business
- The business “...is in the air.” All the most important knowledge about this industry is found inside the cluster

Three rules for clusters

- The bigger you are the more competitive you become. The more competitive you are, the bigger you get ...
- Hard times drive consolidation. If outside the cluster, one way to reduce cost is to move inside
- The cluster provides short-term shelter, but cutting-edge knowledge and competitive advantage are still essential for long-term survival

Upstream oil services and production

- Oil producers decide what to drill for, where to drill, finance the exploration, and assume the risk and reward
- May be independents (Apache, Anadarko) or integrated into downstream (Shell, BP, Exxon)
- Oil service companies accompany the producer to the wellhead to carry out the drilling, downhole testing, completion, and all phases of delivering a finished well

How did upstream oil and gas exploration come to Houston?

- Spindletop in 1900 was the first great U.S oil discovery, a salt dome, it brought the age of the gusher
- Texaco, Gulf Oil, Sun Oil all born at Spindletop as refining companies
- Houston was the nearest city with good rail links, telephone and telegraph service
- The trail of salt dome discoveries leads to the Houston area by 1915, with the Humble oil fields and Humble Oil – today's Exxon

Integrated oil companies with presence in Houston

Company	Number of Local Employees
ExxonMobil	13,000
Shell	11,892
Chevron	9,000
BP	6,787
ConocoPhillips	3,762
Occidental	2,390

Houston Business Journal, recent issues of *Book of Lists*

Independent producers in Houston

Company	2011 Revenue (\$ million)
Anadarko	\$18,470
EOG Resources	\$18,040
Apache	\$13,850
Marathon	\$11,260
Noble Energy	\$5,100
Linn Energy	\$4,980

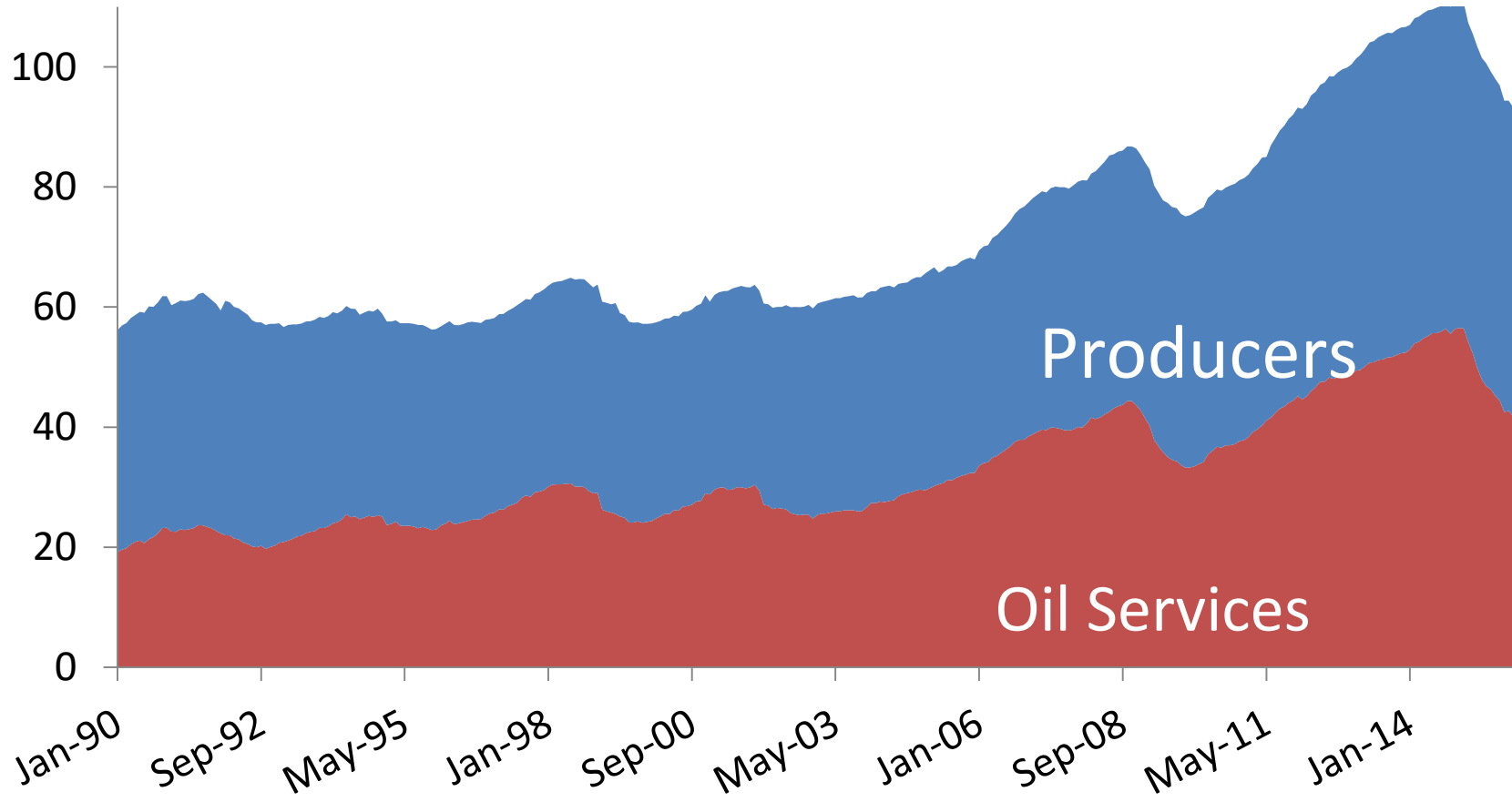
Houston Business Journal, recent issues of the *Book of Lists*

Largest U.S. oil service companies

(ranked by 2014 revenue)

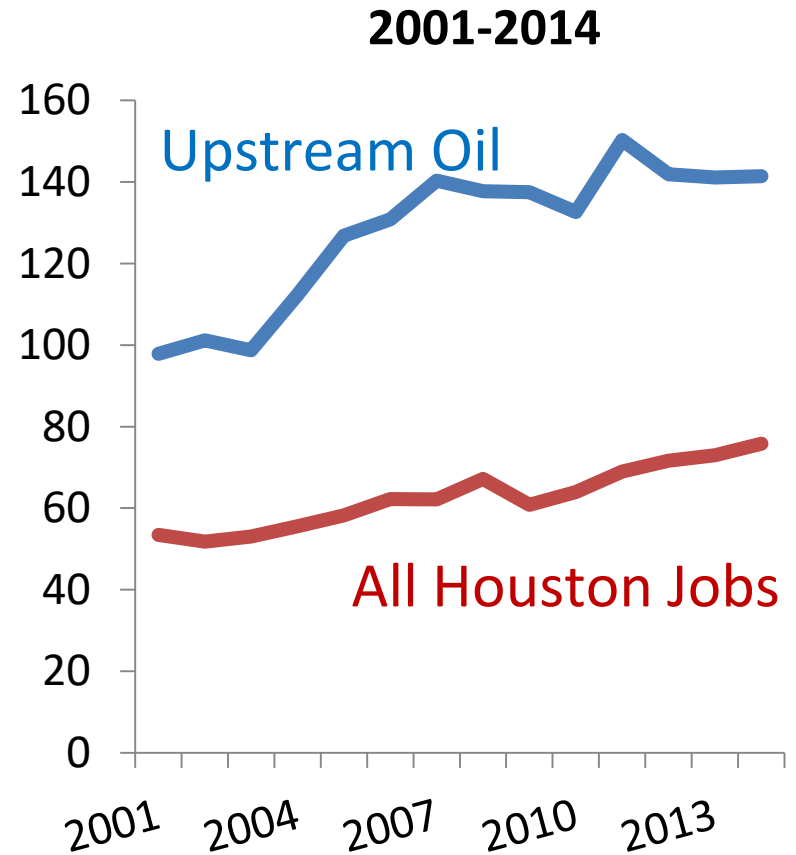
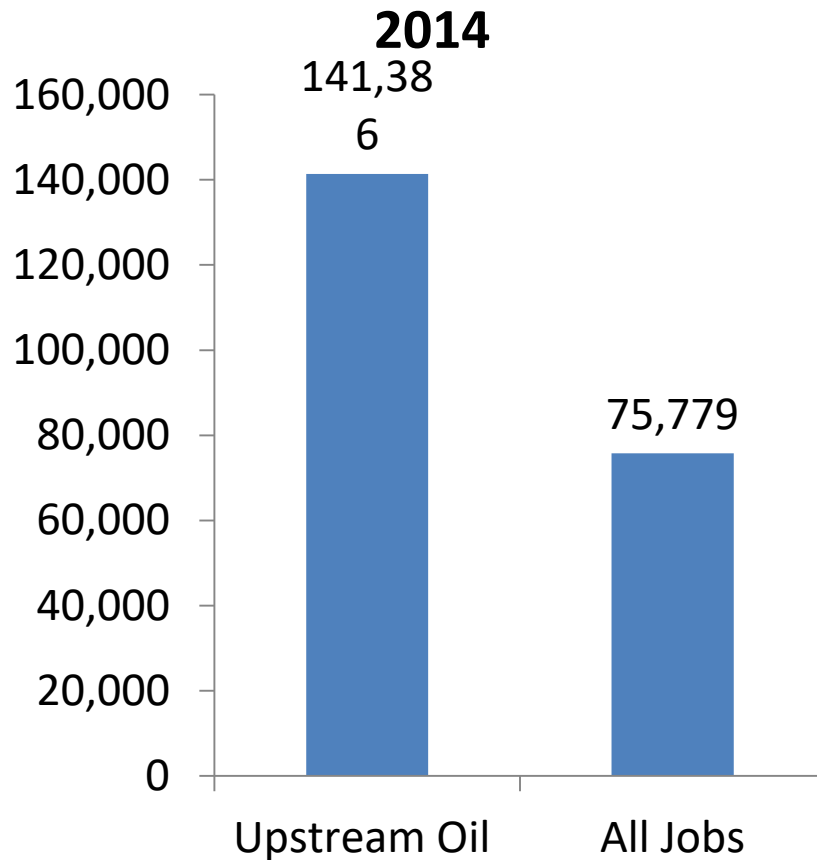
Company	Revenue (\$ billion)	Headquarters
Schlumberger	48.6	Houston, Paris, the Hague
ABB	39.8	Switzerland
Halliburton	32.9	Houston and Dubai
Baker Hughes	24.6	Houston
Emerson Process Mgmt	24.5	St. Louis
National Oilwell Varco	21.4	Houston
Aecom	19.0	Los Angeles
Weatherford	13.0	Switzerland
Cameron	10.4	Houston
FMC Technologies	7.9	Houston
Nabors Industries	6.8	Houston

Houston's upstream exploration jobs total over 100,000



Bureau of Labor Statistics

Annual compensation in upstream oil nearly double the typical Houston job (\$000/worker)



Energy engineering in Houston

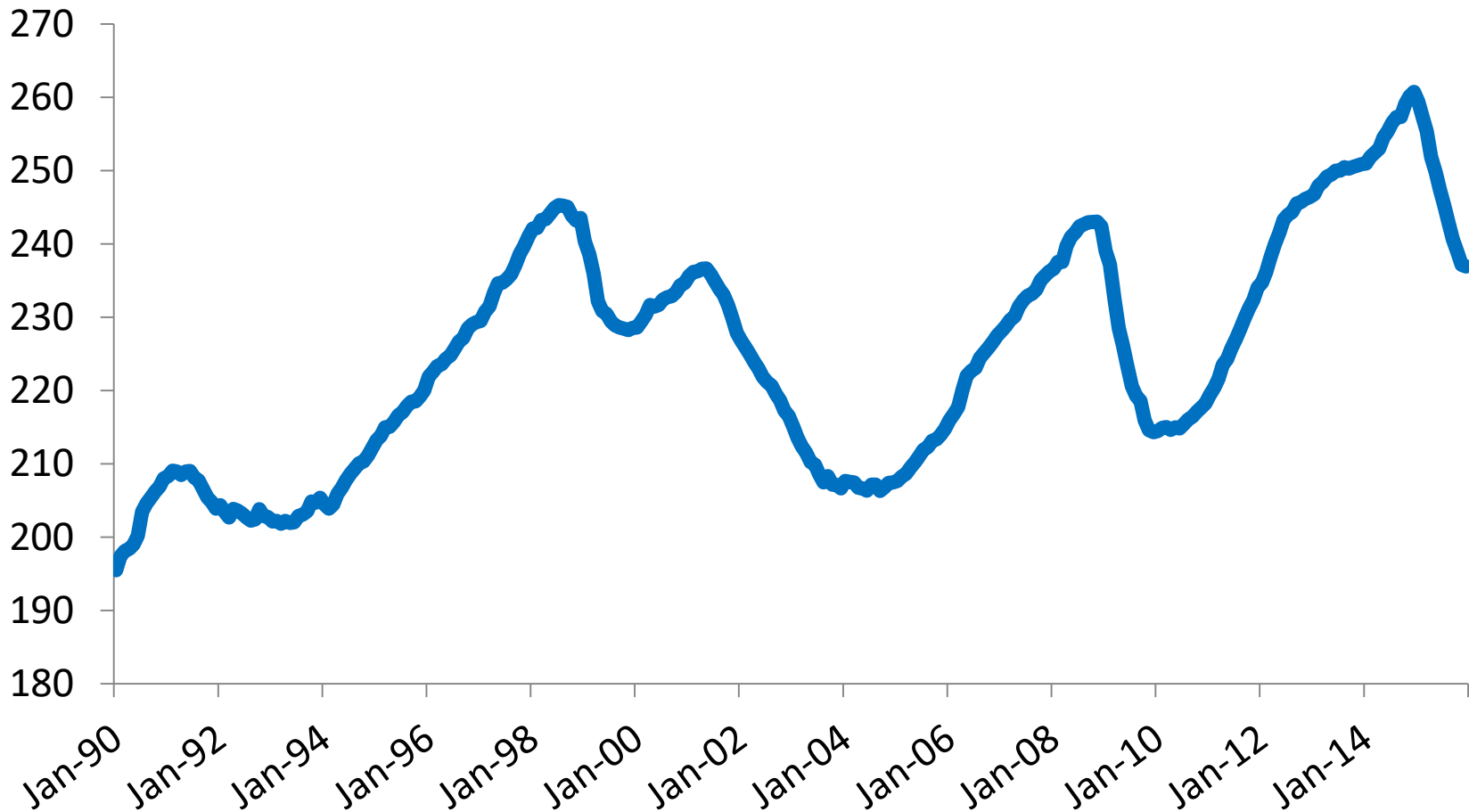
Company	Licensed Engineers	Local Employment
Jacobs	412	2,988
Flour	395	6,224
KBR	342	5,000
Wood Group-Mustang	342	4,140
Technip	229	3,500
CB&I	130	3,200
Gulf Interstate	112	1,069
S&B Engineers	106	1,699

Houston pipelines/transmission

Company	Revenue (\$ billion)
Phillips 66	\$164.1
Enterprise Products	\$48.0
Plains All-American	\$43.5
Kinder Morgan	\$16.2
NRG	\$15.9
CVR	\$8.8

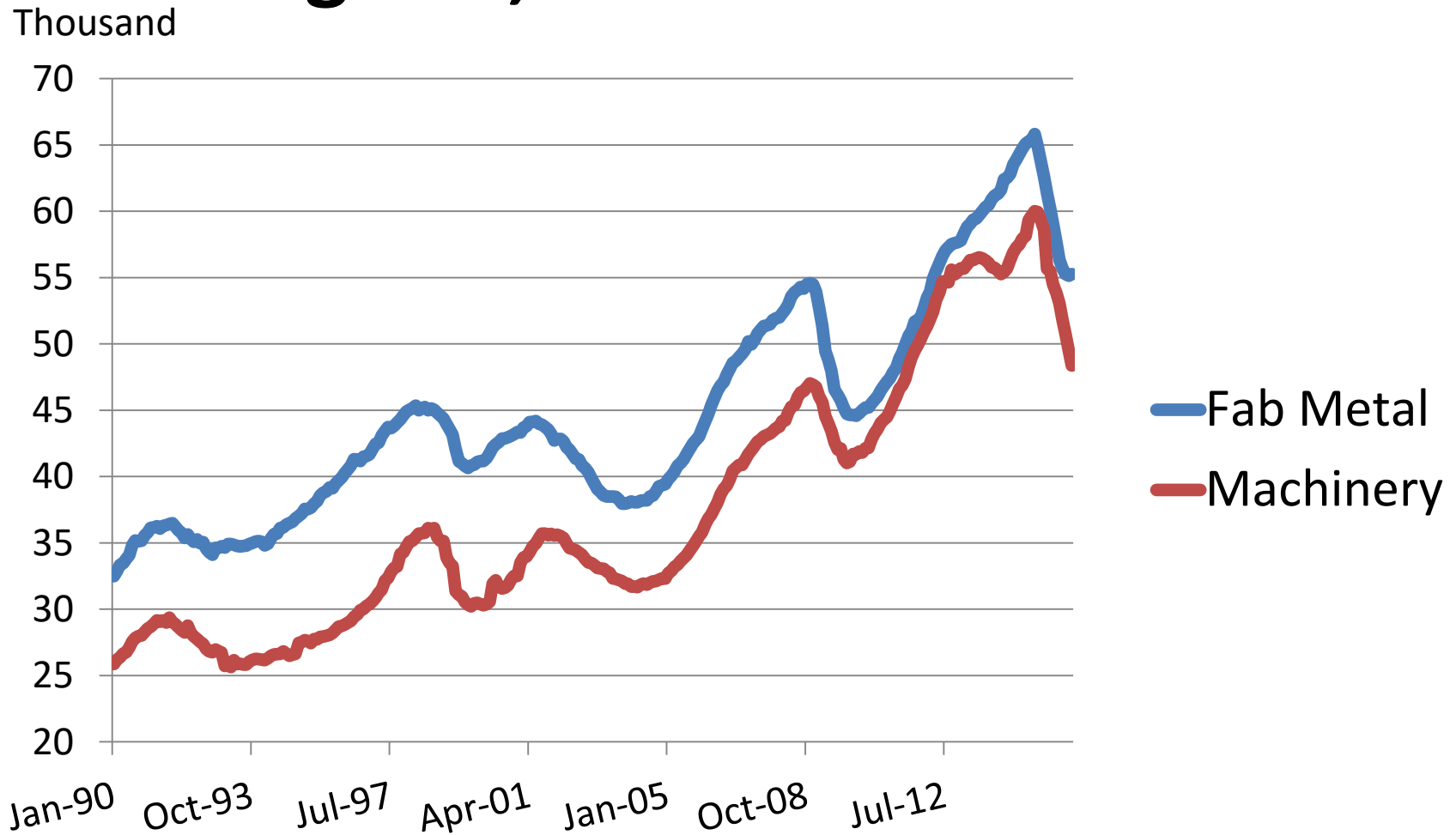
Manufacturing in Houston Strongly Tied to Oil

manufacturing employment (000)



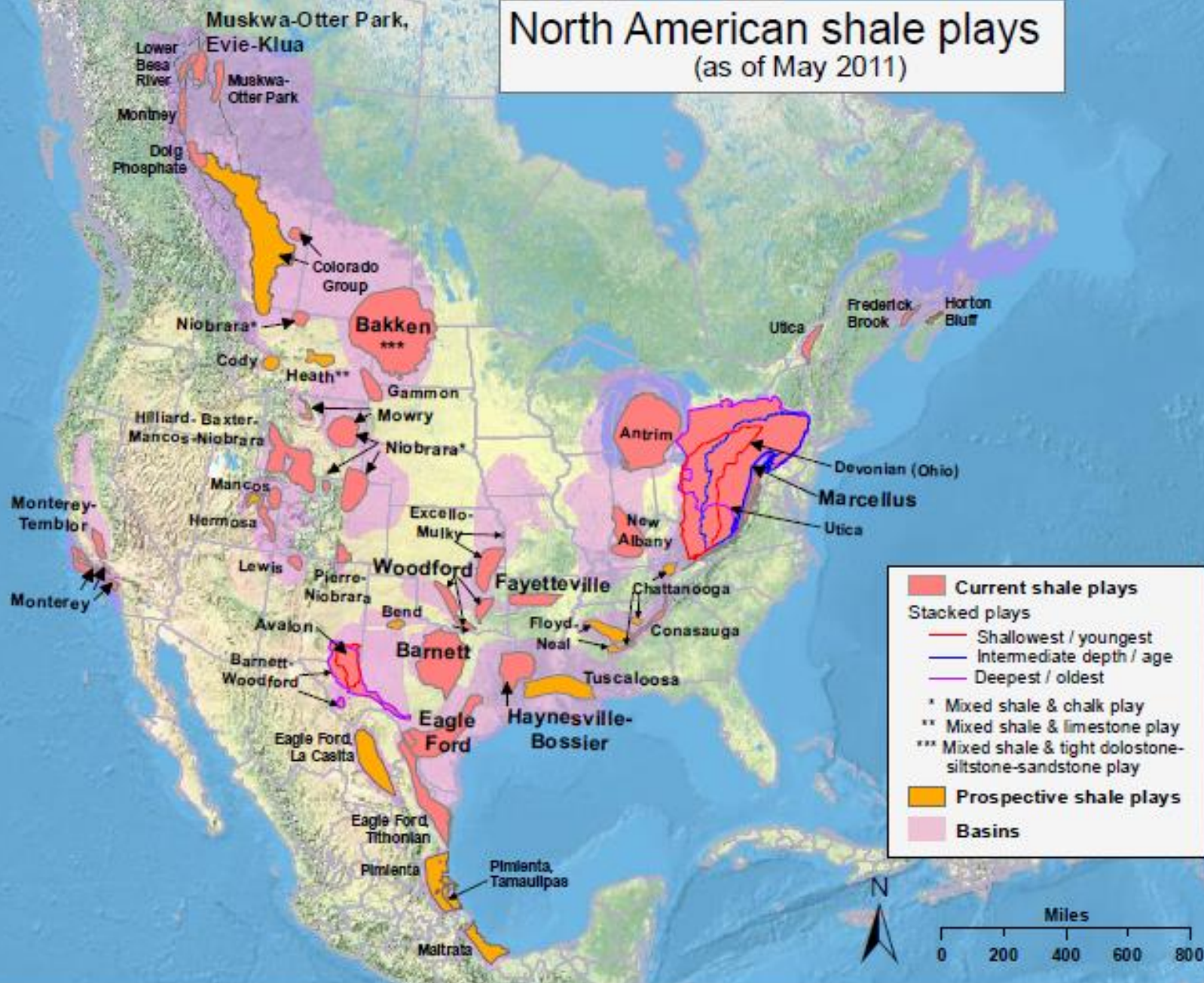
Bureau of Labor Statistics

Machinery and Fabricated Metal Bring 115,000 Jobs to Houston

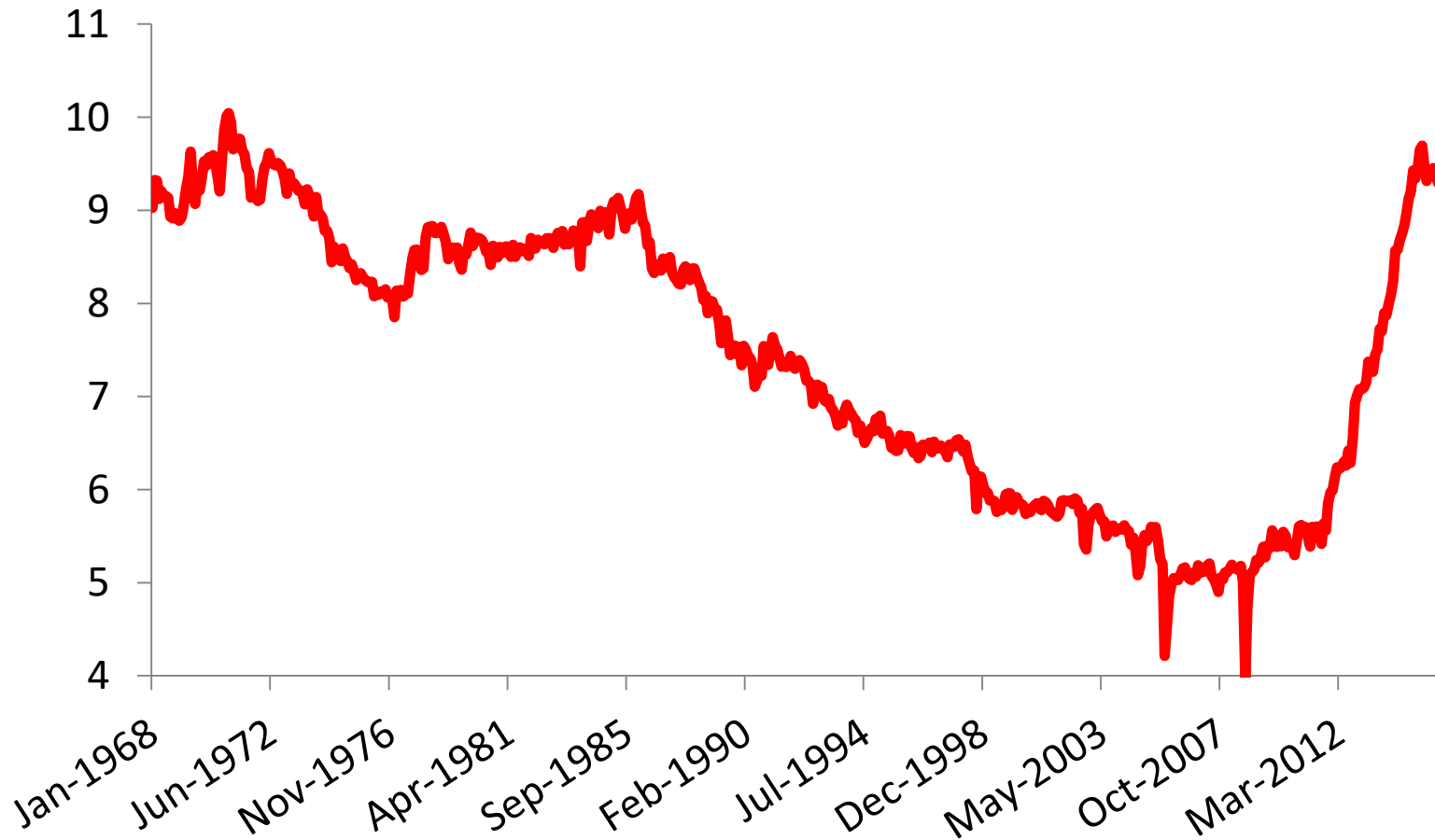


Bureau of Labor Statistics

North American shale plays (as of May 2011)



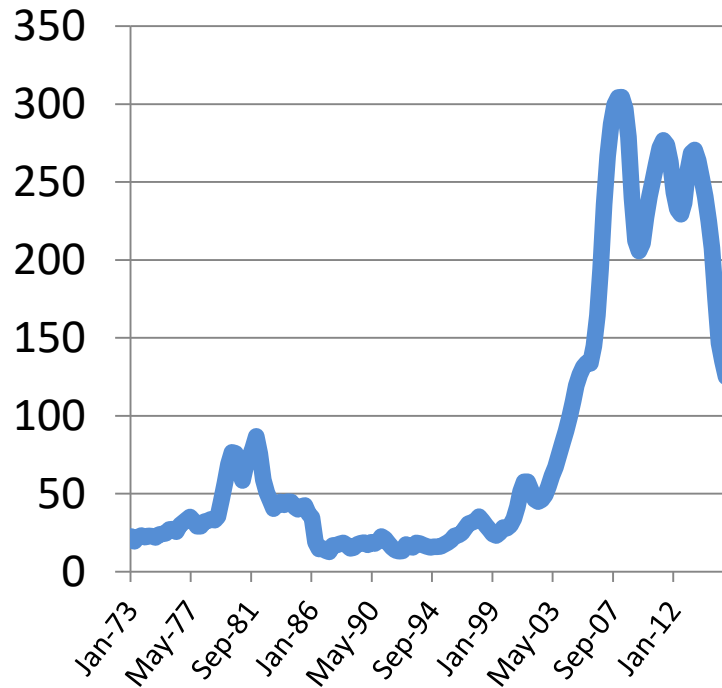
On Supply Side? U.S. Shale Reversed 40 Years of Declining Oil Production (million barrels/day)



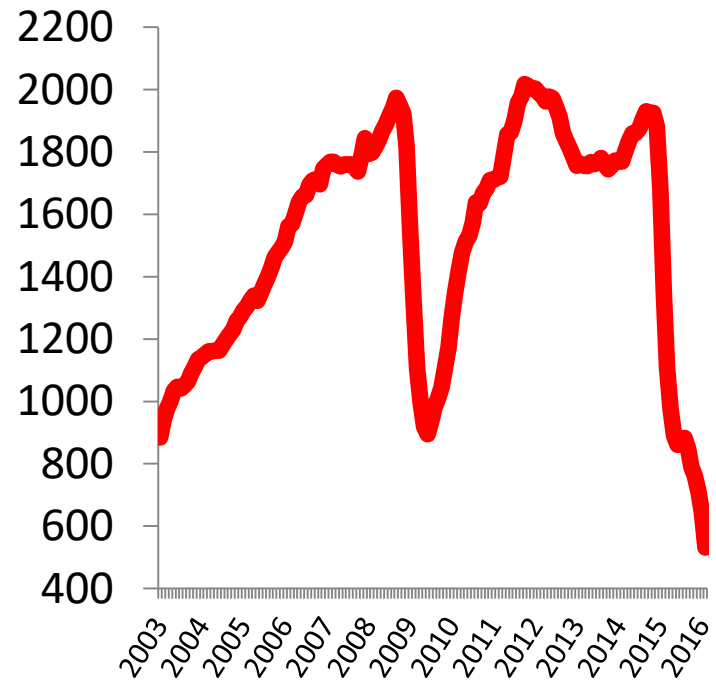
DOE/EIA, Seasonally adjusted by IRF

The Greatest Oil Boom Is Over for Now

**Drilling capital expenditures
(\$2015 billion at annual rates)**



**Baker Hughes rig count
(working rigs)**



Job Losses Or Gains By Sector:

January 2014 to January 2015

(000 Workforce estimates, s.a.)

Sector	Number of New Jobs	Percent Change
Total Payroll	16,400	0.6%
Mining	-19,600	-15.8
Construction	8,600	4.1
Manufacturing	-22,500	-8.7
Wholesale Trade	-1,300	-0.8
Retail Trade	6,600	0.2
Transportation and Utilities	-1,200	-0.9
Information	-800	0.8
Banking, Finance, and Real Estate	3,000	2.0
Professional and Business Services	-8,200	-1.8
Education and Health	18,000	5.0
Leisure and Hospitality	21,400	7.6
Other Services	1,400	1.3
Government	6,7000	1.8



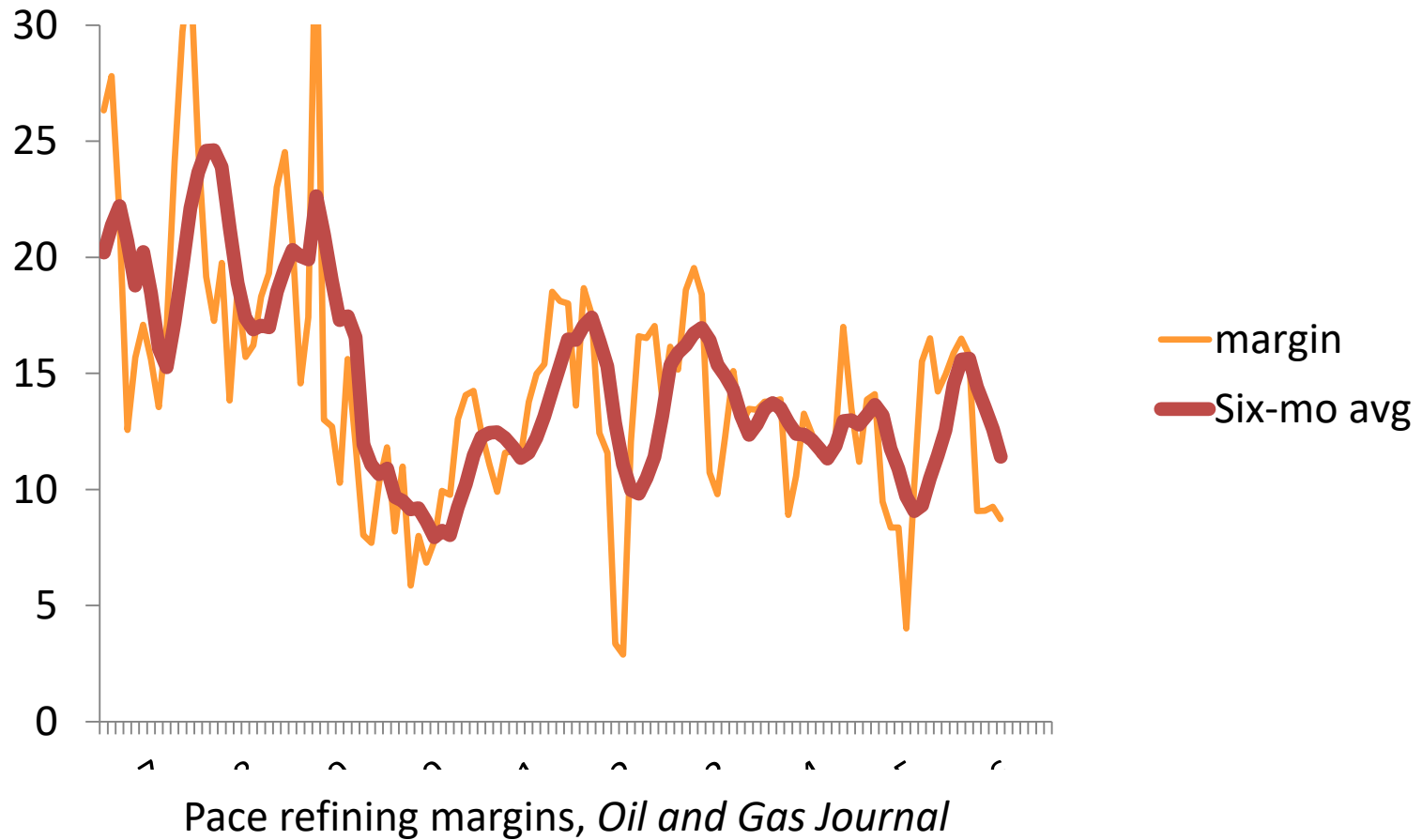
GULF OF MEXICO

Refining Capacity on the Texas and Louisiana Gulf Coast

Region	Number of Refineries	Distillation Capacity (000 b/d)
Houston/Texas City	9	2,347.8
New Orleans	8	2,024.4
Baton Rouge	1	502.5
Beaumont/Lake Charles	6	1,554.9
Corpus Christi	3	647.2
Total	26	7,076.8

Low Oil Prices Keep Gulf Coast Refining Margins Strong

(\$/bbl)



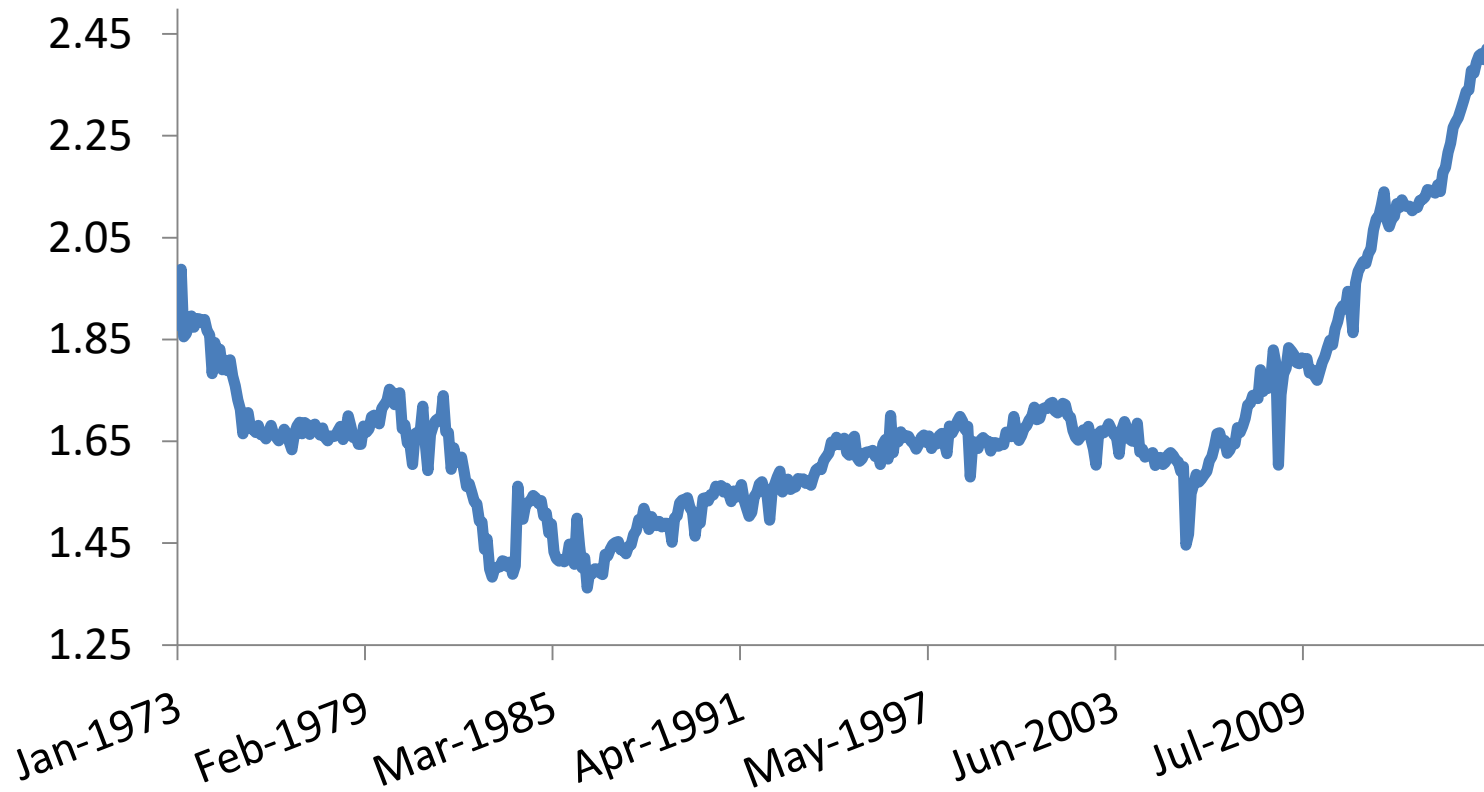
Four of eight largest ethylene complexes in the world are in Houston

Company	Plant location	Capacity (million tpy)
Formosa	Taiwan	2,935.0
Nova	Alberta	2,811.7
Arabian Petrochem	Saudi Arabia	2,250.0
ExxonMobil	Baytown	2,197.0
ChevronPhillips	Sweeny	1,865.0
Dow	Netherlands	1,800.0
Ineos	Chocolate Bayou	1,752.0
Equistar	Channelview	1,750.0
Yanbu	Saudi Arabia	1,705.0
Equate	Kuwait	1,650.0

Oil and Gas Journal, 7/1/2013

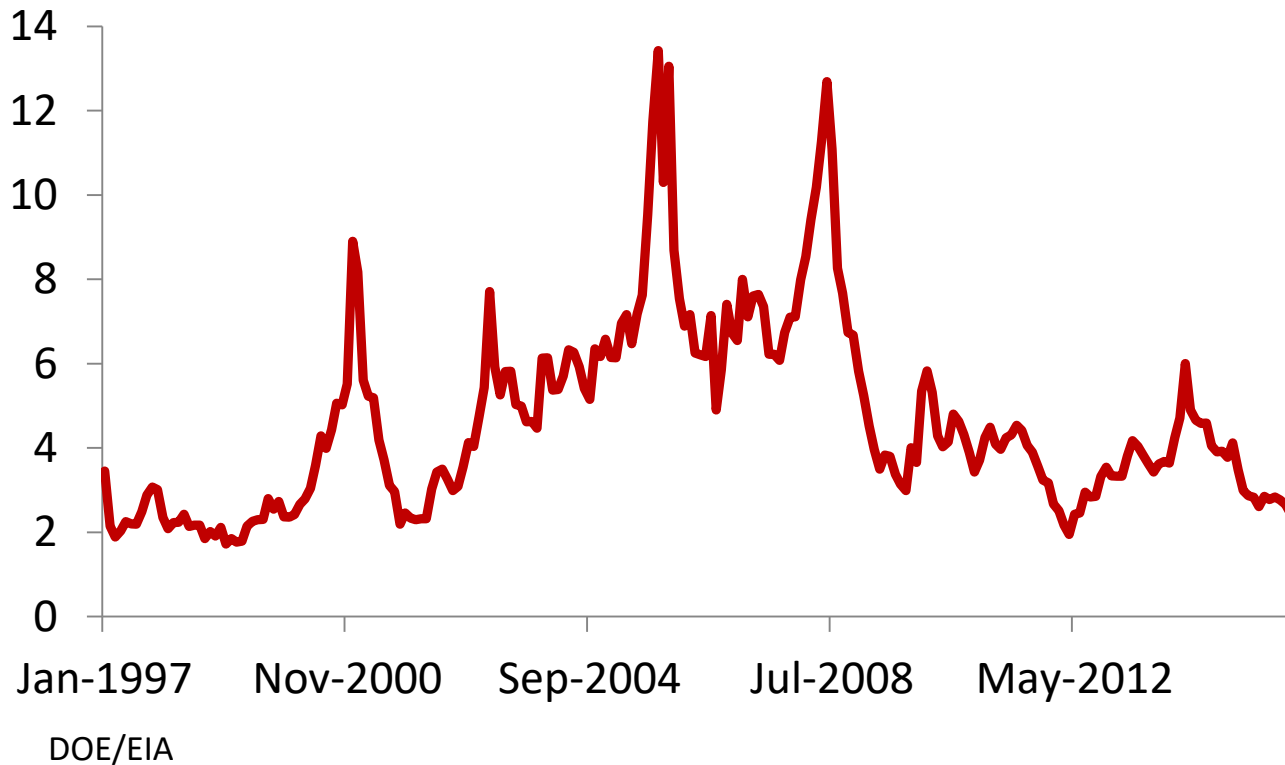
Natural Gas Production Shares Oil's Hockey Stick Surge

Marketed production, Bcf/mo, seasonal adj



Natural gas prices collapsed in late 2011

(\$/mcf)

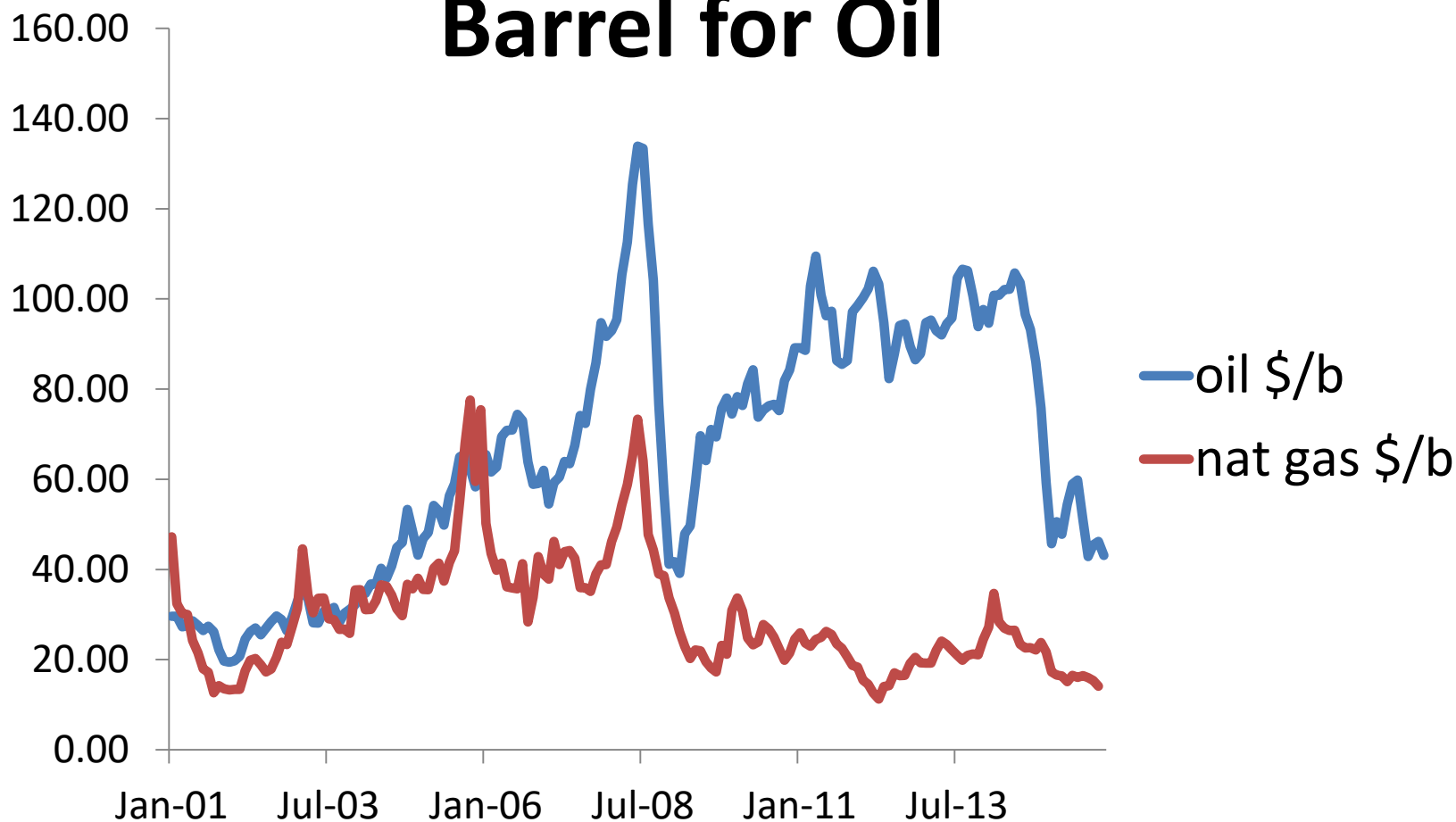


\$153 Billion U.S. Construction Boom is Based on Cheap Energy and Exports

- This \$153 total includes many industries and all of the U.S.
- New ethylene crackers, more ethylene-related expansion in PE, PVC and other derivative plants
- LNG export terminals to sell surplus natural gas into global markets
- Refiners have joined in with additional expansions

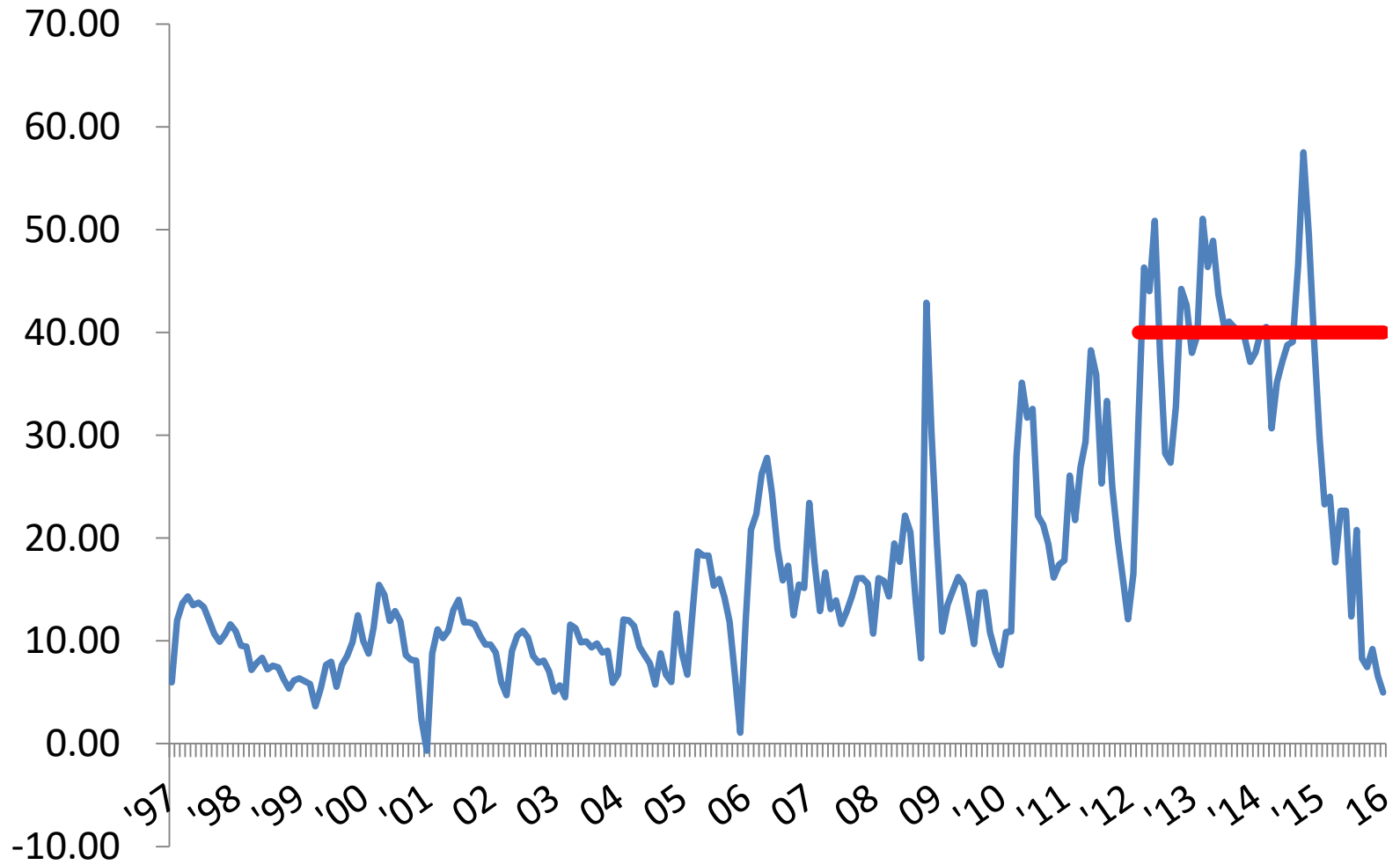
Note: The \$153 billion figure is based on all shale-related expansion, estimated by the American Chemistry Council in October, 2015

Natural Gas Energy Content Equivalent to \$20-\$40 per Barrel for Oil



Ethylene Margins

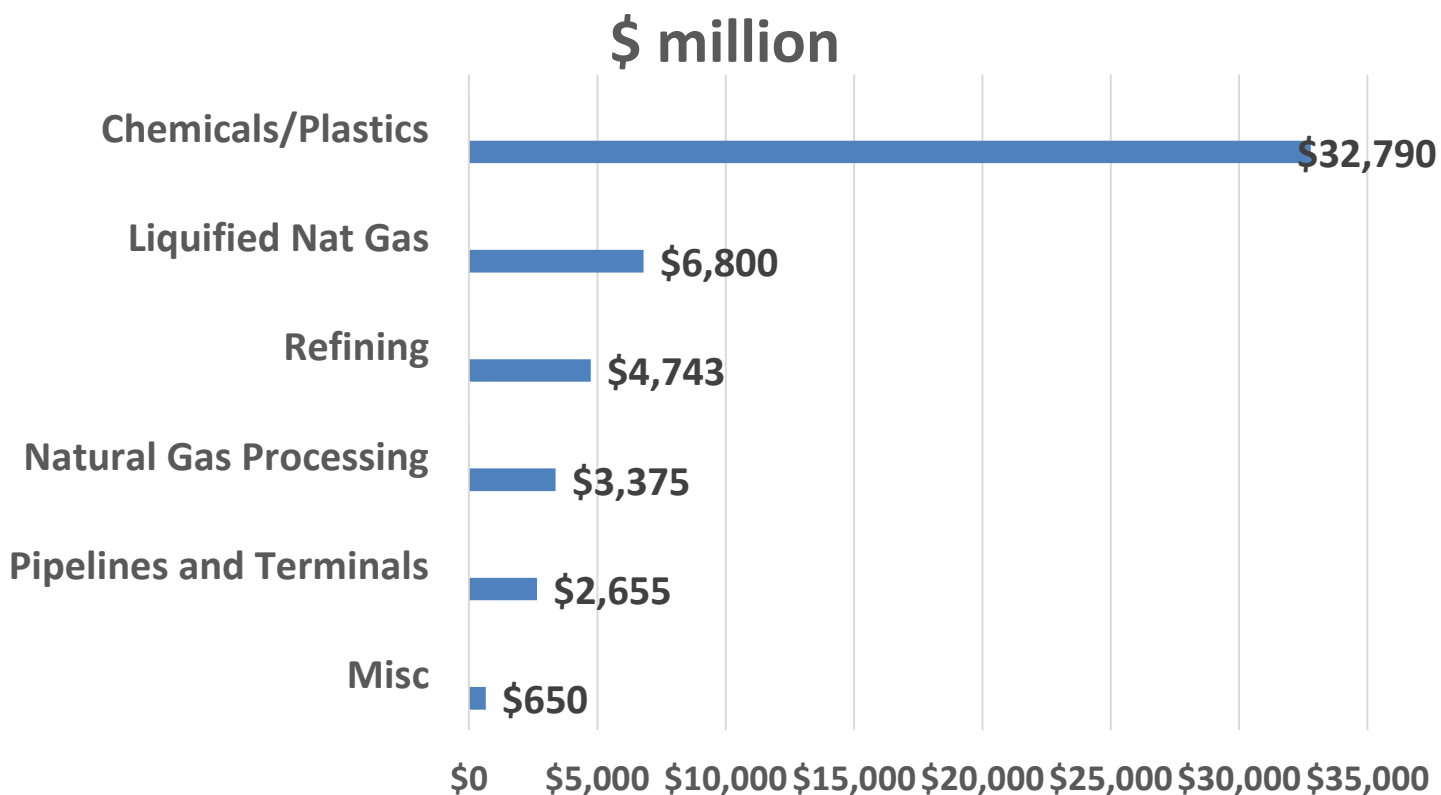
(cents per pound)



Large Projects Headline Over \$50 Billion in East Houston Construction

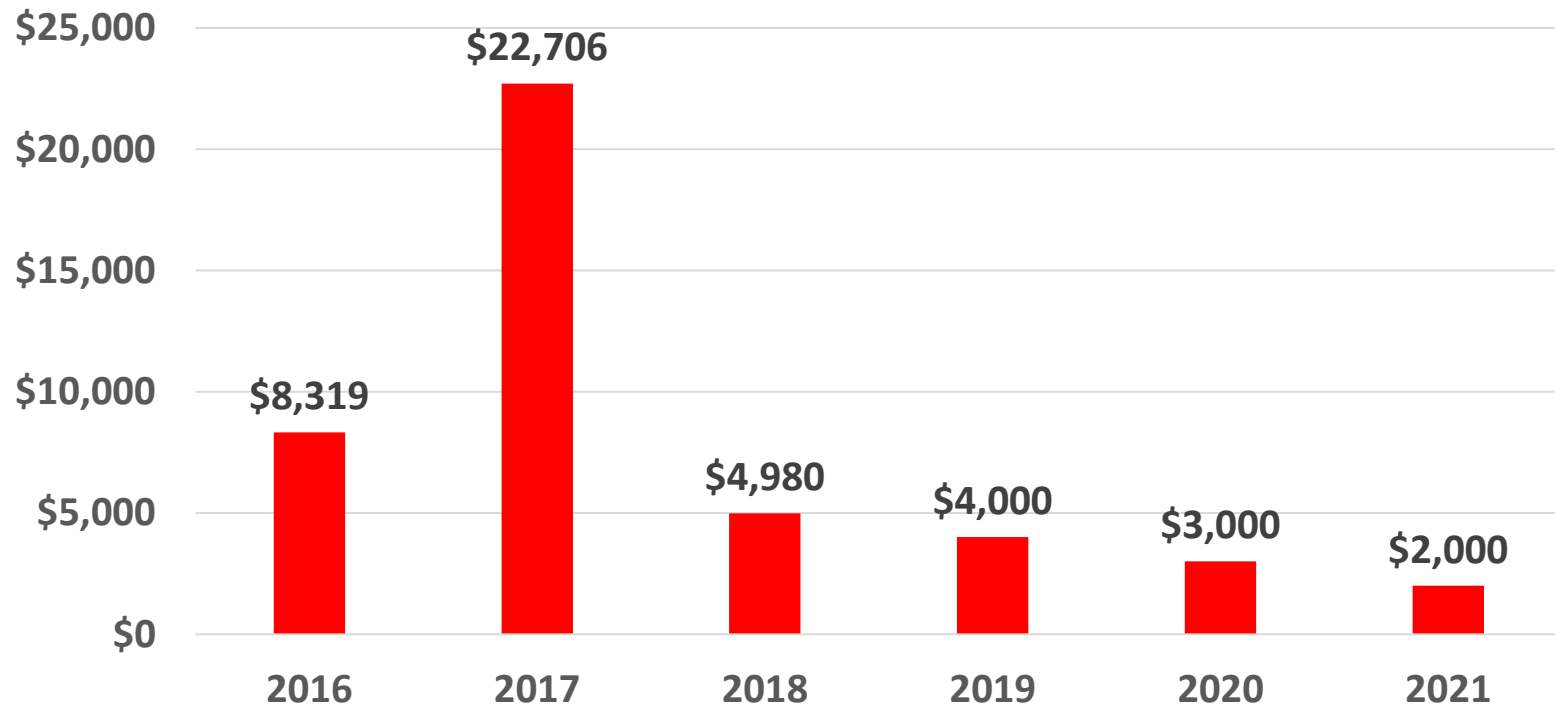
Company	Location	Project	Completion	Value (\$ mil)
Exxon	Baytown	Ethylene	2017	\$5,000
Chevron	Freeport	Ethylene	2017	\$4,000
Dow	Baytown	Ethylene	2017	\$3,500
BASF	Freeport	Ethylene	2017	\$3,000
Freeport LNG	Freeport	LNG Export	2019	\$3,000
Freeport LNG	Freeport	LNG Export	2020	\$3,000
Bayer	Baytown	PUR Facility	2021	\$2,000
CPV	Freeport	Gas to Polypropylene	2017	\$1,500
Freeport LNG	Freeport	Methane to Propylene	2018	\$1,400

Petrochem and LNG Still Dominate Figures



Projects Begin to Wind Down Rapidly After 2017

(Value of Projects Completed, \$ million)



A Counterweight to Upstream Damage From Low Oil Prices

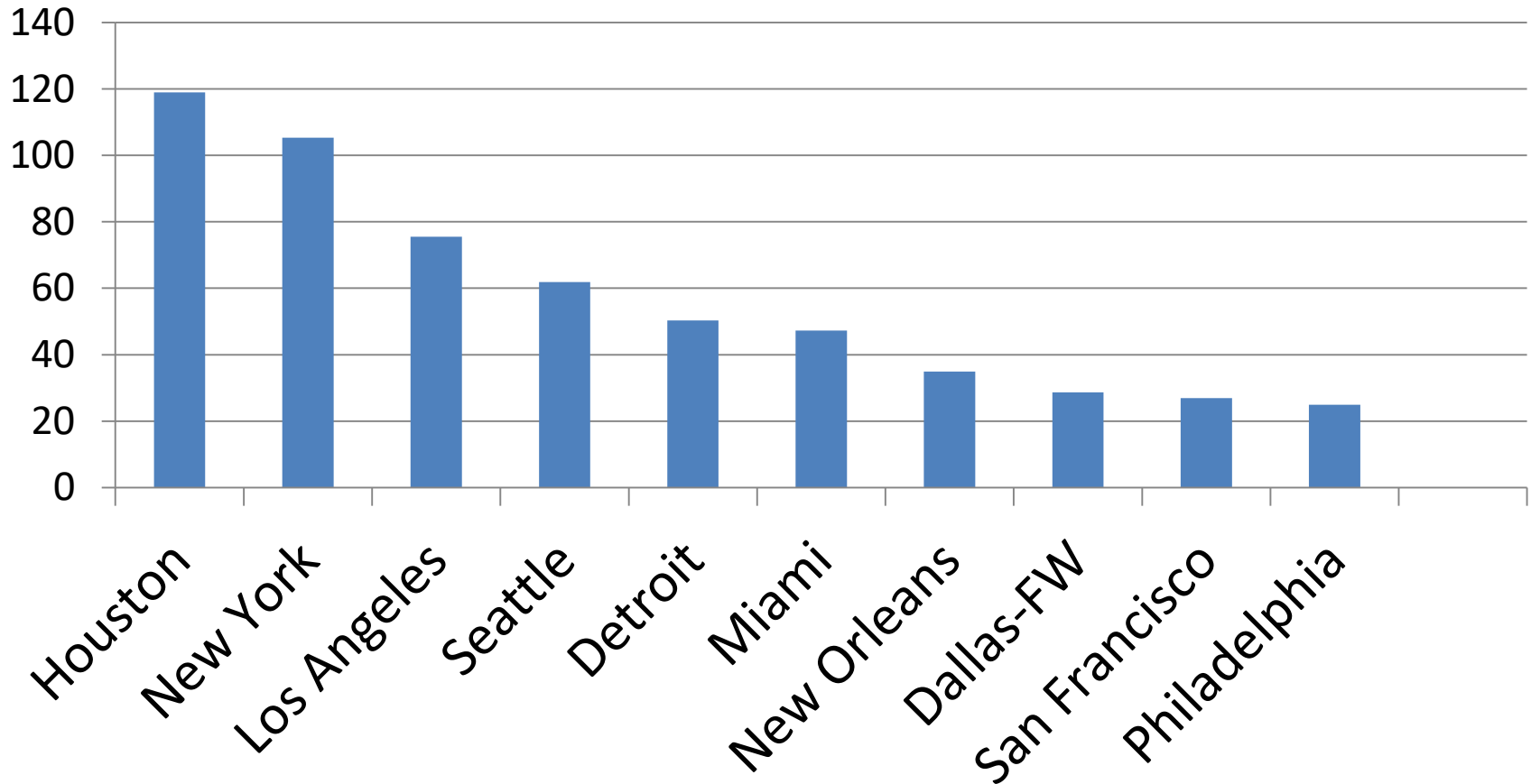
- Jobs adds up quickly given the number and scale of proposed construction projects in 2015-2017
- These are temporary jobs, disappearing as projects end and capital expenditures wind down
- Normally, downstream capital expenditures are small compared to the upstream, move in a narrow range, and create relatively few jobs
- The construction projects just described means the downstream can't be ignored right now. Can this spending substitute for losses upstream?

Temporary Jobs, Temporary Workers

- Does one construction job equal one lost in drilling? In professional and business services? Compensation is good for the skilled, unionized jobs
- BUT we are replacing long-term employment with temporary construction jobs
 - These jobs will be important in keeping machine shops and industrial base for machinery and fabricated metal busy
 - But they won't need high-end apartments, luxury retail, office space, or other amenities?
- Industrial east side booms while the air could be sucked out of the white-collar west side. There is plenty of scope for economic disruption, even if overall job numbers stay healthy
- Assume multipliers for the construction workers are half of the white-collar jobs they replace

Houston was the number one metro area exporter in 2014

(Billion \$ of Exports)



78 percent of Houston exports are petroleum related

(percent of value)

- Refined products – 29.3%
- Petrochemicals – 25.4%
- Machinery – 12.7%
- Crude oil – 10.5
- Computer/Electronics – 6.0%
- Other – 13.5

Oil makes Port of Houston the second largest in US by tonnage (million total tons annually)

- South Louisiana – 238.6
- Houston – 229.2
- New York – 123.3
- Beaumont – 94.4
- Long Beach – 84.5
- New Orleans – 77.2
- Corpus Christi – 76.2
- Baton Rouge -- 63.9
- Los Angeles – 57.9

More than Oil in Houston?

More than oil in Houston?

Companies with Houston headquarters & 1.0 billion plus in revenue

- Sysco
- Waste Management
- Group 1 Automotive
- Crown Castle International
- Men's Wearhouse
- American National Insurance
- Service Corporation International
- Benchmark Electronics
- HCC Holdings
- HCC Holdings Insurance
- Insperity
- Waste Connection
- Stewart Information Services
- Mattress Firm
- Stage Stores
- Comfort Systems HVAC
- NCI Building Systems
- Cardtronics

Texas Medical Center

54 institutions in patient care, research and education

- 106,000 employees
- 45.8 million square feet of buildings
- \$15 billion annual budget

Patient care

- 13 hospitals, 7000 patient beds
- 7.1 million annual patient visits
- 5000 physicians and 15,000 nurses

Texas Medical Center

- *Education*

- Three medical schools and state dental school are the flagship institutions
- 11 affiliated universities with institutions on campus
- 17,500 faculty; 33,000 full-time and 75,000 part-time students

- *Research*

- \$3.4 billion in committed funds
- Best known for cancer and heart research

Obama administration cancels the Constellation program in 2011

- Constellation was to develop a heavy lift rocket and new crew capsule
- Would deliver crews to the space station by 2015, return a crew to the moon by 2020, and on to Mars after that
- With cancellation, the International Space Station was extended to 2020, and serious funding was given commercial development of delivery of supplies and astronauts to the space station
- Cancellation would mean 7,000 jobs lost in Clear Lake area

Funding restored with a new and reconfigured program

- NASA is now developing a new heavy lift SLS rocket, crew capsule, service module, and launch abort system
- Goals remain the ISS, the moon and Mars
- Exploration Test Flight-1 was December 2014 will see a Delta VI rocket take an un-crewed Orion capsule/spacecraft on an orbit deeper into space than we have been since 1972
- The first flight of the SLS rocket will take Orion and circumnavigate the moon in December 2017

Back to deep space

- The plan is once more for the moon -- and perhaps Mars -- to be in Houston's future
- JSC and Clear Lake dodged a big bullet in 2011, but both are now preparing for exciting and stable economic times ahead
- The current plans envision 2-3 launches per year. Test flight 1 in December 2014 was a success
- The main question still open is where we are going once the tools are in place – to harness an asteroid, to establish a moon base, or on a mission to Mars?

The bumpy ride for the Clear Lake area over for now

- 2010 employment of 16,500 Space Center and NASA contractors has stabilized at 14,000
- Payrolls have declined further because of the retirement opportunities for many senior staff
- But many of these retirees remain in the area
- Many of those laid off found opportunities in a hot technical and engineering market in Houston

Three big events now shape Houston's economic outlook

- Continued growth in the U.S. economy
- The biggest drilling and exploration downturn in U.S. economic history
- The biggest construction boom to ever reshape the refining and petrochemical industry
- How does it add up?

How Did 2015 Turn Out?

Very Slow, But No Recession ... So Far

	December to December Changes	
	Jobs	Change
2012	118.6	4.3
2013	89.8	3.2
2014	117.8	4.0
2015		
Before Revision	23,200	0.8%
After Revision	15,200	0.6%
Spring 2015 Forecast	12,900	0.5%

Allow for the Petrochemical Expansion: Houston Skirts Recession



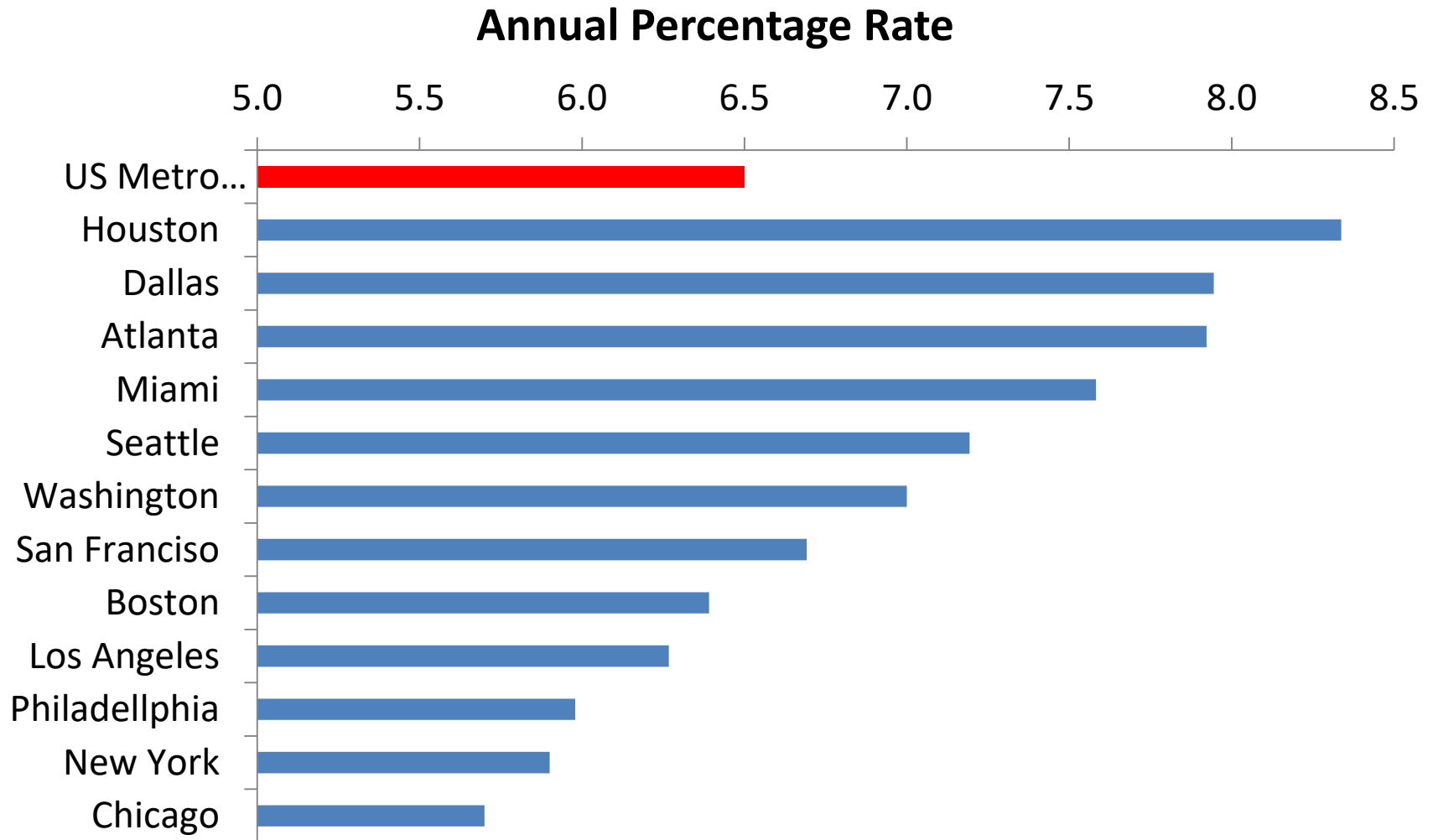
Job Growth in Houston, 2013-2019

(000 Jobs, Q4/Q4)

Year	Scenario			
	U-Shape	Check Mark	Damage	40/40/20
2013	90.3	90.3	90.3	90.3
2014	103.6	103.6	103.6	103.6
2015	14.0	14.0	14.0	14.0
2016	27.5	17.0	16.8	21.1
2017	100.8	69.0	48.5	77.6
2018	88.9	93.8	66.3	86.3
2019	82.4	78.1	49	74.0

Time to diversify?

Growth of personal income among 12 largest US metros: 1969-2014



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