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REGIONAL FORECASTING

Houston's Economy in 2019: Sorting Out the Right Path Forward as Growth Returns

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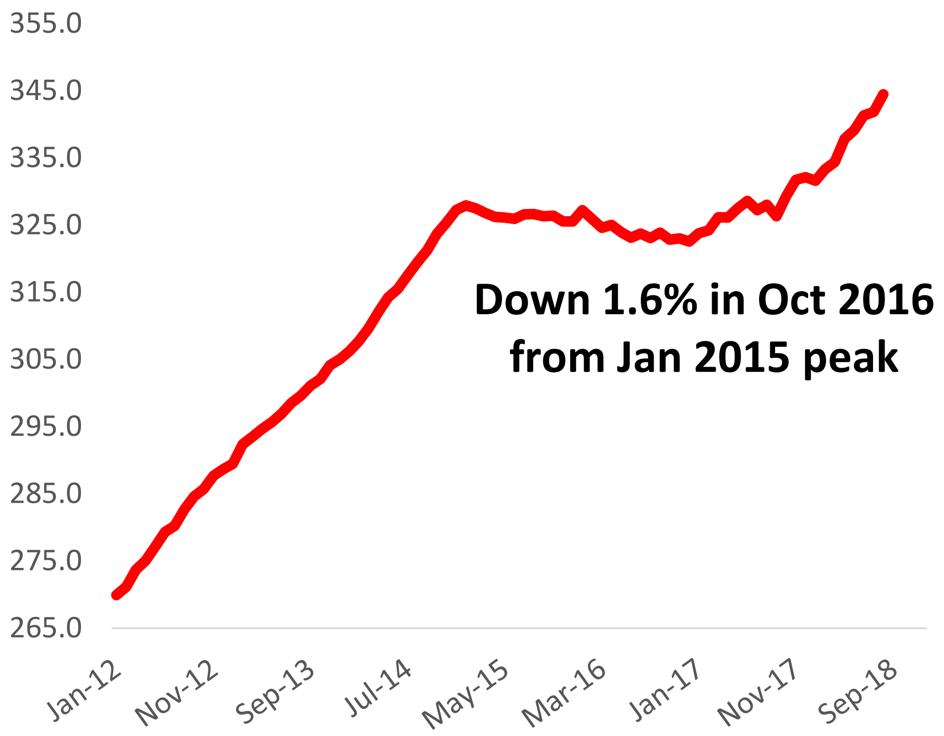
For Houston, 2014 to 2017 Brought Several Years of Very Weak Growth

Despite a Severe Oil Downturn, Four Positives Kept Us Out of Recession

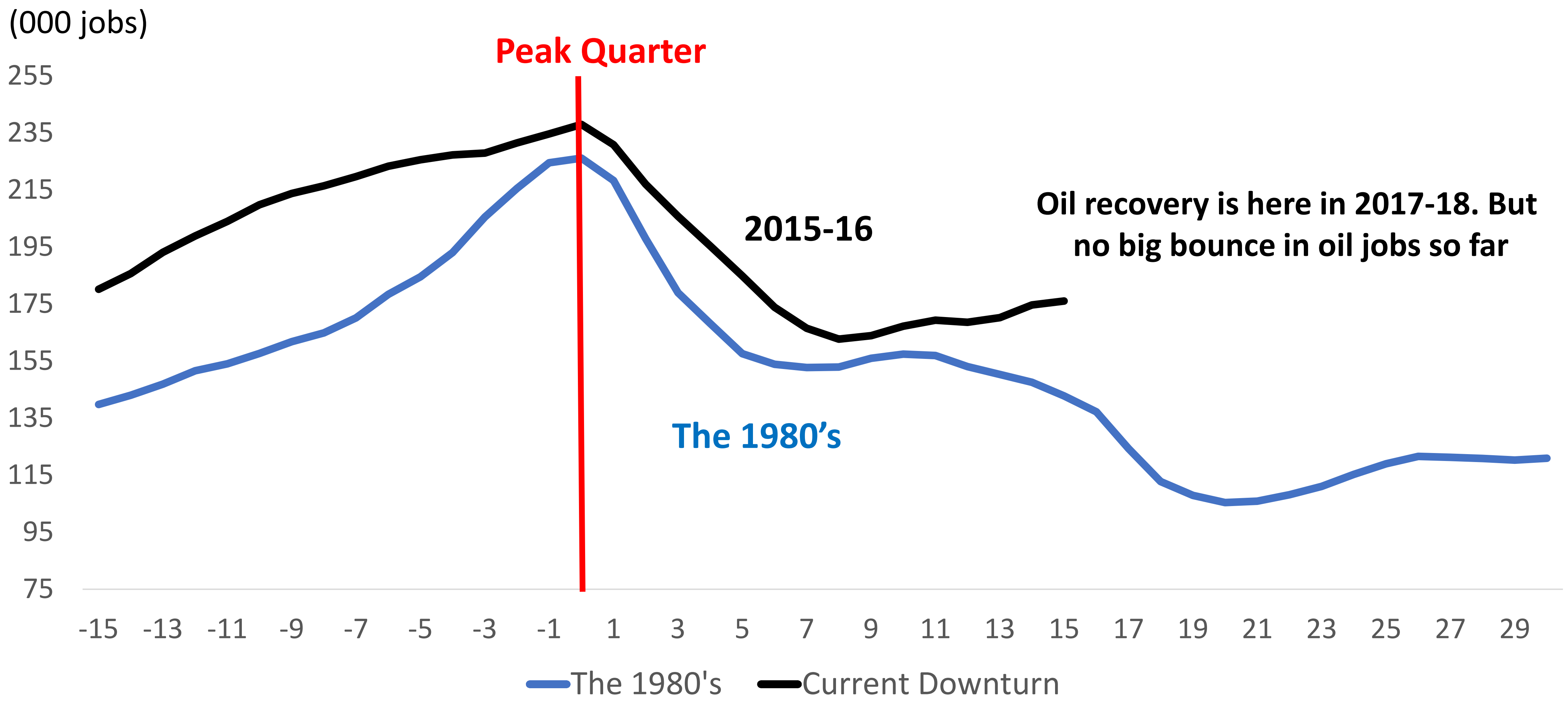
- The economic damage was done by the loss of 74,000 oil-related jobs
- The biggest plus for Houston was a strong U.S. economy
- This was followed by sustained economic momentum from the fracking boom
- The Ship Channel chemical boom and Hurricane Harvey retail and construction carried the local economy forward

Dallas Fed Business Cycle Index Shows Very Small Decline in 2015-16



Dallas Fed data through August 2018; R.W. Gilmer, *How Houston Survived the Oil Bust of 2014-15*, https://www.forbes.com/sites/uhenergy/2018/07/24/how-houston-survived-the-great-oil-bust-of-2015-16/#16b2769155db

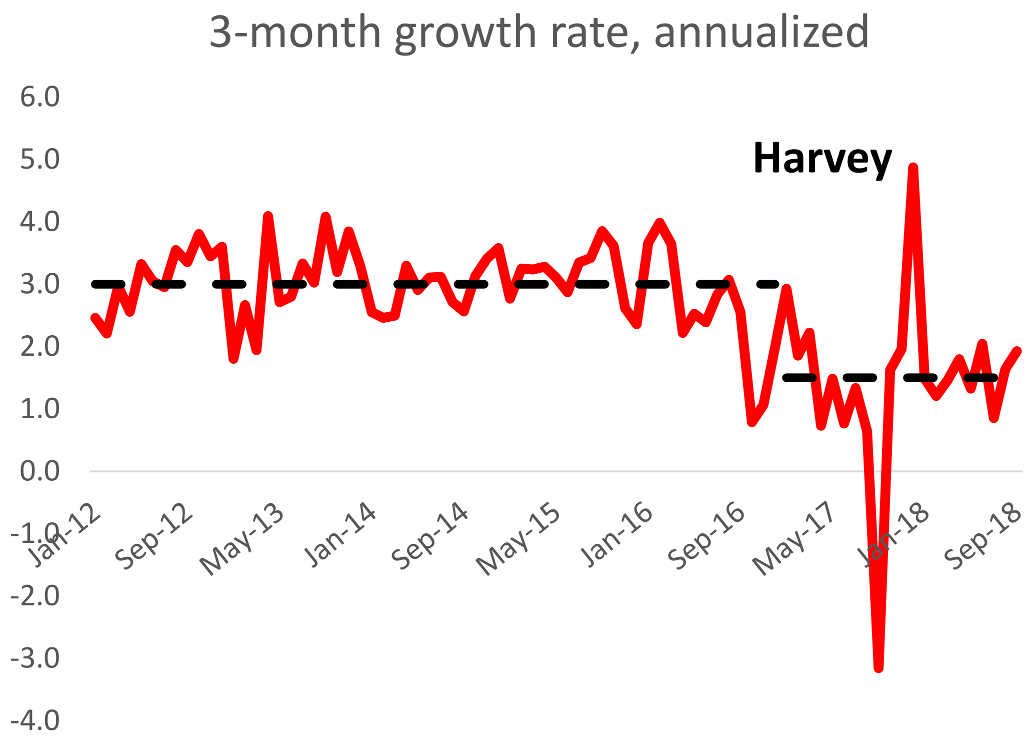
It Was a Severe Oil Downturn in Houston:
Local Job Losses Matched the 1980s, But Have Stabilized



Bureau of Labor Statistics, calculations of the Institute for Regional Forecasting, University of Houston

Nine Service Sectors Account for Half of Houston Jobs: They Carried the Economy in 2014-15

Job Growth in 9 Key Service Sectors Has Slowed from 3.0 to 1.5 Percent



New Jobs Added in Recovery: December 2016 to Present

- 8,659 retail trade
- 8,526 health care
- 6,897 finance
- 6556 bars and restaurants
- 3,216 local gov't
- 2,534 private education
- 1,544 state gov't
- 1,433 arts and entertainment
- 1,419 accommodation
- 35,694 all 9 sectors

Ship Channel Chemical Boom Slows Down, But Continues at Lower Levels

Chemical Expansion Essential to Helping Houston Offset Drilling Bust

- Driven by low natural gas prices that reduce chemical feedstock costs
- America Chemistry Council estimates $220 billion in nationwide construction, 70% on the Gulf Coast
- Houston metro area saw at least $50 billion in first wave that is now finishing up, 80% already complete
- New proposals and projects continue, but total construction is winding down, becoming a modest drag on the economy

Big New Projects Still Coming on Line But Not Replacing All Completions

- Total/NOVA: high-density PE, $1 billion, Pasadena
- ONEOK: gas processing, $750 million, Mont Belvieu
- COVESTRO: MDI foam precursor, $1.72 billion, Baytown
- Lyondell: propylene oxide/butyl alcohol, $2.4 billion, Channelview
- Chevron: possible refinery, $5-$15 billion, Houston Ship Channel

Hurricane Harvey Impacts Are Behind Us

- Storm-wide property damage was huge: $125 billion, but the effect on the flows of local jobs, income and production was limited. We see a storm-driven economic reversal as we take shelter and close businesses, followed by a surge in construction and retail sales
- The net effect on jobs and income is a small net change that is slightly positive or negative
- This pattern prevails for storms across the southeastern U.S., and for eight Houston storms dating back to Alicia in 1983. There is no evidence that impacts of Harvey or other Houston storms lasted past 6 months
- Harvey's impact on local payroll employment was a positive one percent or roughly 30,000 jobs in the fourth quarter of 2017. As this work winds down, Harvey becomes a small drag on the local economy

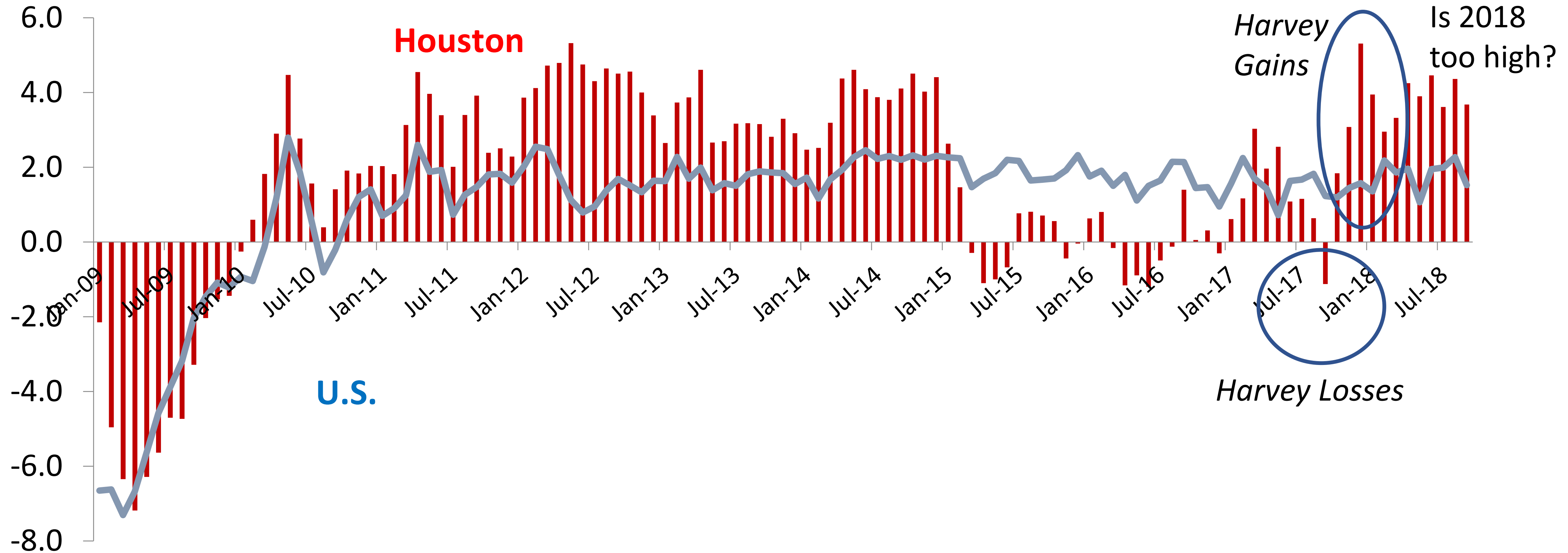
The Continuing Local Legacy of Harvey Is Disaster Relief and Infrastructure Improvements

- The standard formula for the economy – limited short-term impacts – works only if there is sufficient infrastructure in place. Harvey's economic impacts were limited, but the storm also provided a big warning about infrastructure adequacy. New Orleans and Puerto Rico provide examples.
- Harris County has approved a $2.5 billion bond issue for drainage improvements, warning systems, infrastructure improvements, and more retention ponds
- Since October 2017, two federal bills provide $126 billion in disaster relief and infrastructure to be divided among Texas, California, Florida, Puerto Rico and Louisiana
- There is another $5.5 billion in immediate, targeted disaster relief for Texans, with $2.3 billion for Houston/Harris County

This Brings Us Back to Houston Fundamentals: Just Oil and the U.S. Economy Going Forward

Houston Saw Job Growth Return in 2018: But Is the Fracking Boom Really Back?

(3-month percent change at annual rates, s.a.)



Texas Workforce Commission and Bureau of Labor Statistics

Early Sample Estimates of Houston Employment Can See Meaningful Revisions

Houston Employment Estimates Based on Preliminary Sample
Meaningful Revisions Continue for Up to Two years

	Sample Year (000 jobs, Dec-Dec)			
Year	**2015**	**2016**	**2017**	**2018**
12	118.5	118.6	118.8	118.6
13	104.7	89.8	90.4	89.6
14	89.9	117.8	118.2	116.1
15	23.2	15.2	0.2	-2.1
16	--	14.8	18.7	-1.9
17	--	--	46	62.8
18	--	--	--	122.3*

* Based on sample data Jan through Sept and extrapolated to year-end

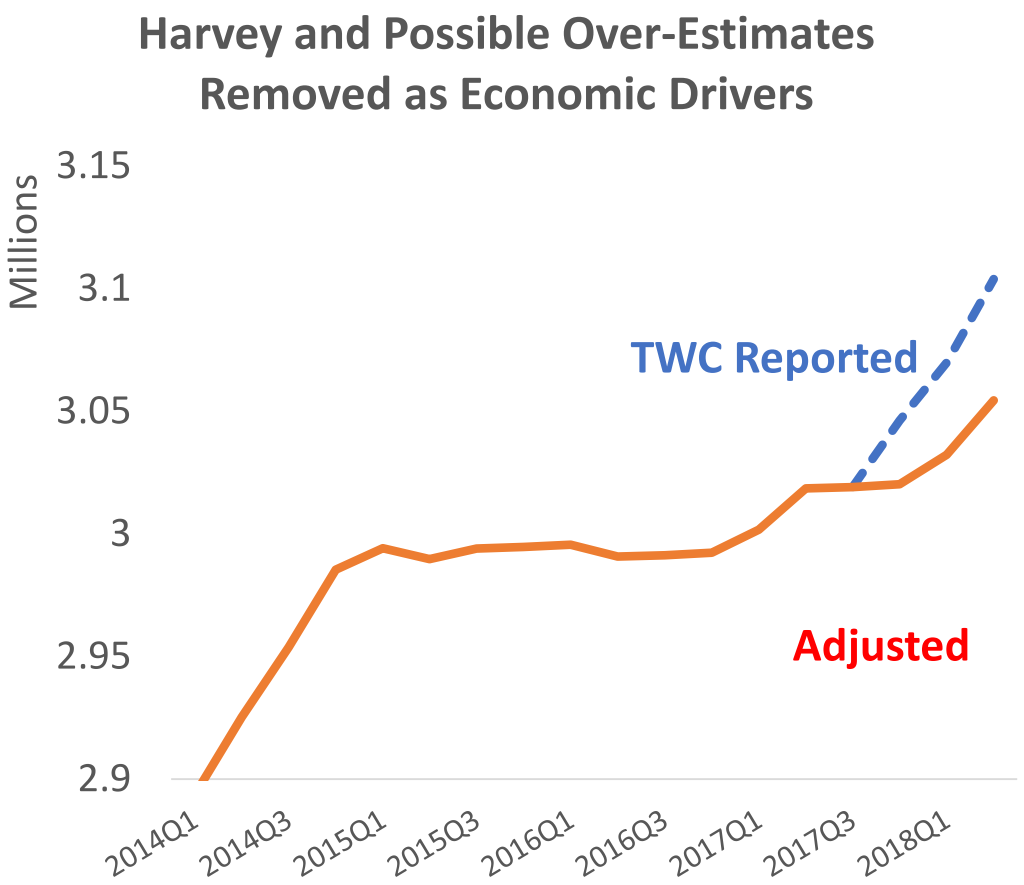
= sample data for year
= first benchmark
= second benchmark

- Workforce Commission data for the latest year is based on a sample of Houston employers
- Each March the sampling is halted to turn to administrative records for a comprehensive revision or benchmarking of the data
- The revisions can be relatively large, and take two or more years to stabilize
- The large 122,300 jobs estimated for 2018 makes this a possible candidate for revision next year

Why Be Skeptical About Such Strong Local Job Growth?

- The rule of thumb is deep recession brings fast rebound, and mild recession modest rebound. Houston had no recession, just deep losses in the oil sector and a long period of no growth
- There has been only a moderate rebound in oil jobs, linked to a moderate rebound in oil prices and the rig count. It is not an oil-led recovery that looks like the boom years are back
- Half the jobs in Houston are tied to nine key service industries, like retail, bars and restaurants, local government, etc. These sectors carried the economy in 2015-16, but have since slowed for 3.0 percent growth to only 1.5 percent in 2017-18
- Hurricane Harvey had a one-time impact of 27,800 jobs in late 2017. Harvey was a short-lived event. The Harvey jobs count, take them out to better understand where the economy is headed
- The Dallas Fed does preliminary revisions, and they already point to deep cuts in the first quarter 2018 figures

Adjustments to Payroll Data Made to Better Reflect Recent Economic Activity

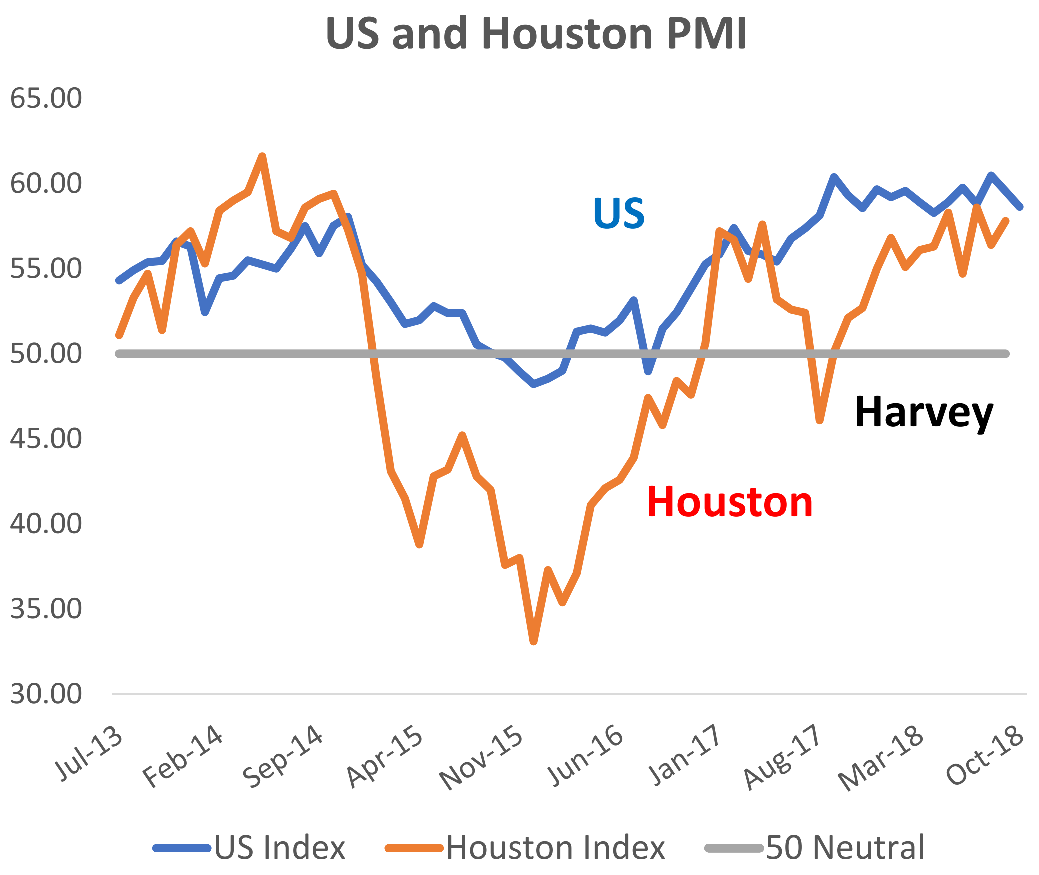


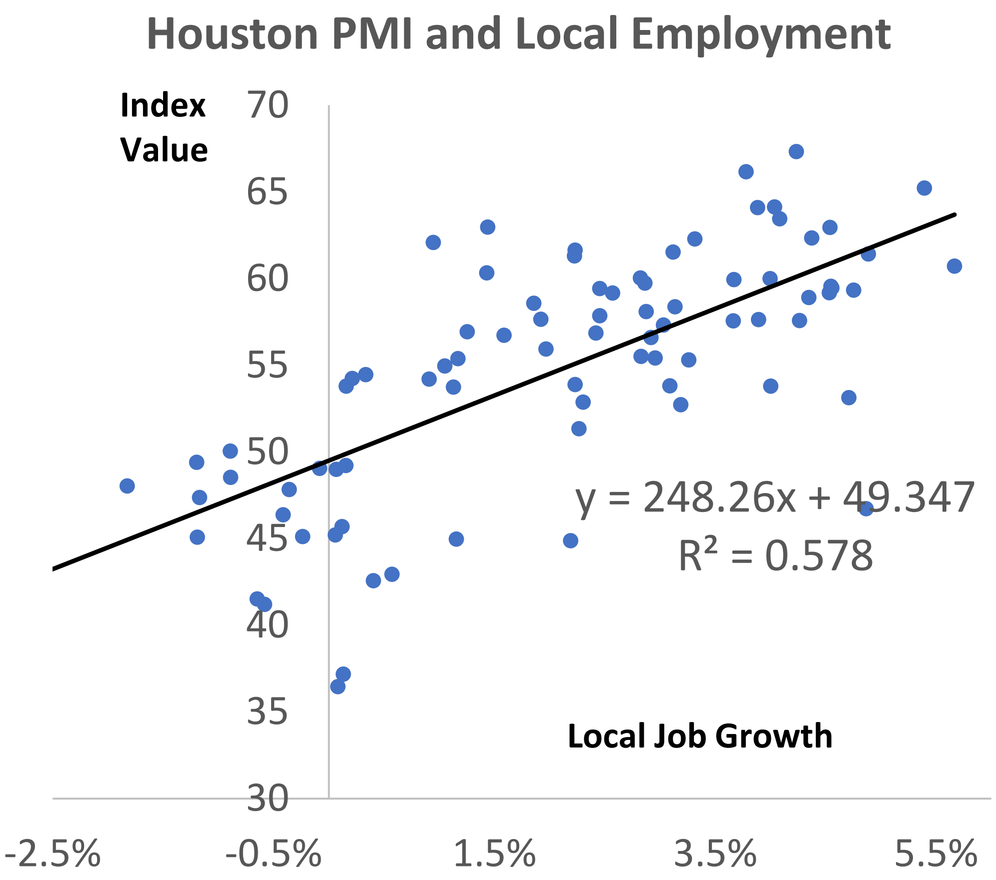
Likely Revisions Make Current Growth Look More Moderate

Two views on 2018 job growth:	Current Estimates TWC	Adjusted Dallas Fed & IRF
4-quarters through 18Q3	114.1	50,100*
Y-t-d to Q3 SA & annualized	122.3	69,400
Why adjust?		
Hurricane Harvey	--	-27,800
More Harvey? Over-estimates?	--	
2018Q1 IRF & Dallas Fed	--	-12,400
2018Q2 IRF	--	-11,100
2018Q3 IRF	--	-13,300

*One-time jobs related to Hurricane Harvey are removed to better track the business cycle.

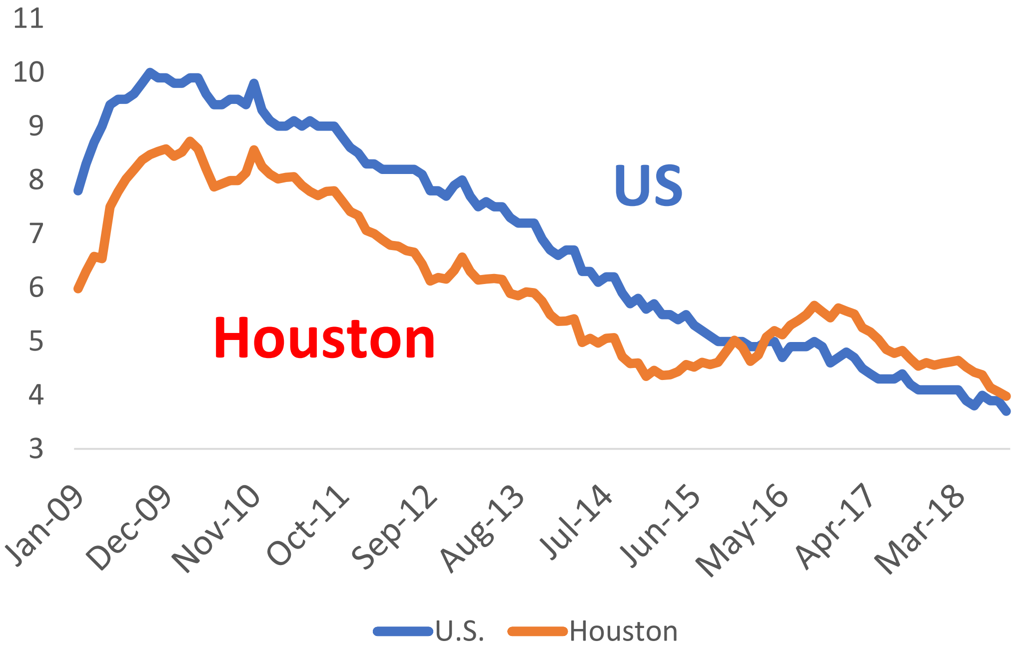
All the Basics of Houston's Current Economy Are Also Told by the Houston PMI



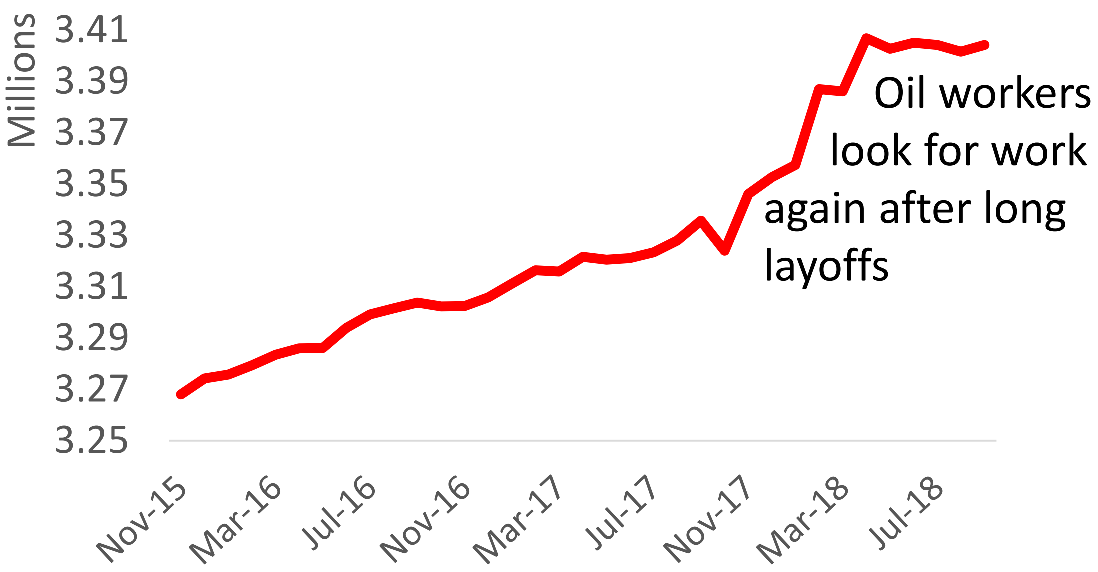


Houston Unemployment Rate Falls Steadily in 2018

Houston unemployment rate falls to U.S. levels Near 4.0%



With oil rebound, Houston's labor force surged by 80,000 Worker



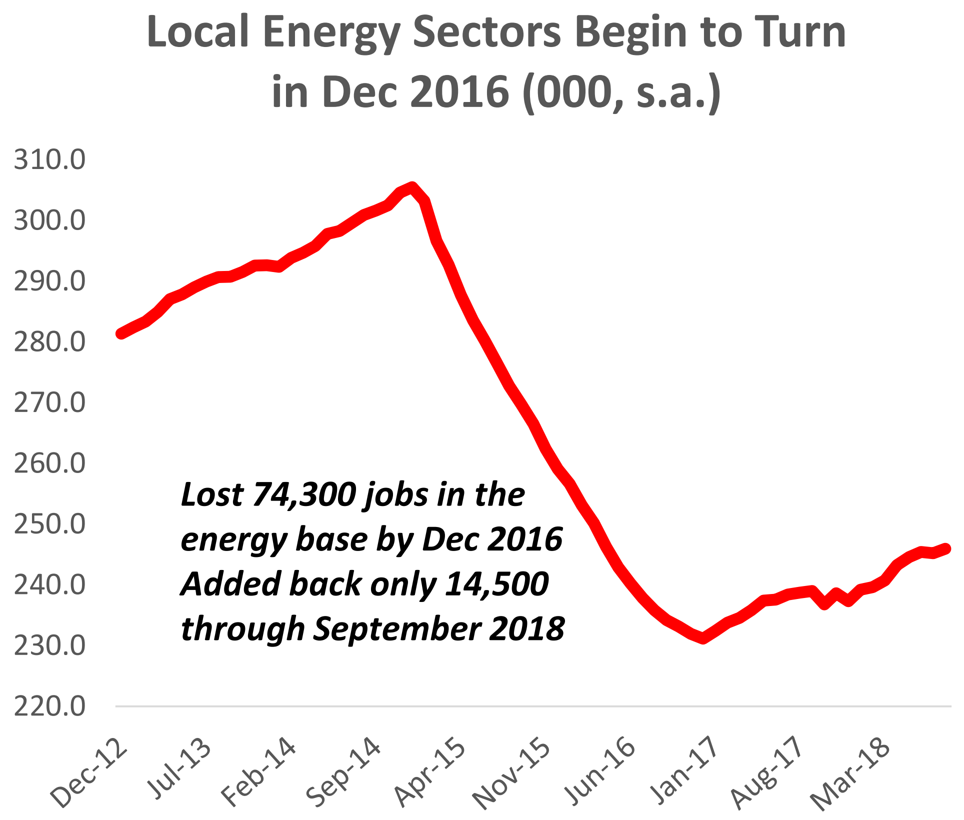
Summary of Where We Are Today

- The Fracking Bust is over and solid growth is back. Adjusted payroll employment stands at two percent growth or better, exceeding the strong 1.8 percent registered by the U.S. economy in 2018
- The Houston PMI has also recorded strong growth in 2018, although lagging the U.S. index
- The U.S. unemployment rate has been below four percent since April, something seen in only 105 previous months since 1948. Houston is catching up, again indicating growth matching or exceeding the U.S.
- The big question moving forward is oil jobs. The *oil-sector recovery* so far looks lackluster, slower than the last recovery and not matching the rate at which we lost oil jobs in 2015-16

The Big Question?
Houston Oil Jobs In the Fracking Era

Oil Jobs Are the Key to Faster Local Growth: Only About 20% Have Returned So Far

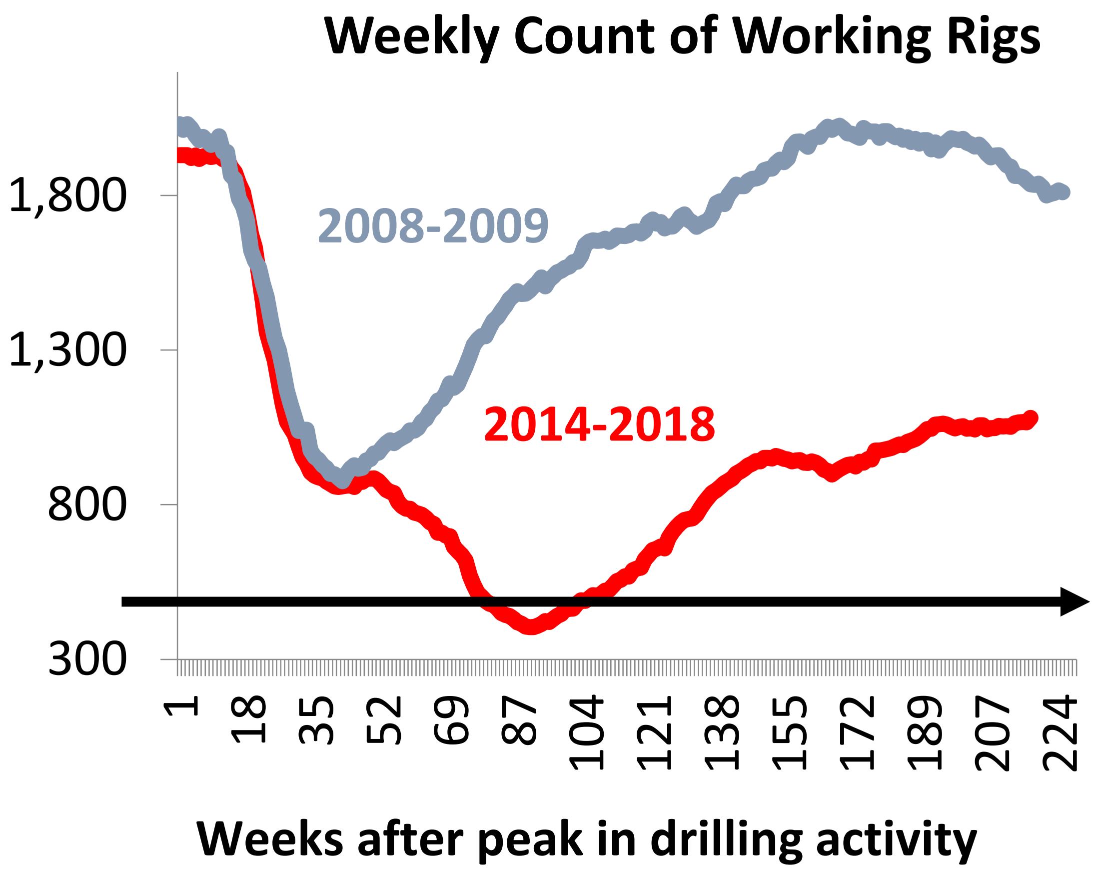
(Net Change in Jobs, Dec. to Dec.)



Sector	Change in Job Number (000)	
	Dec'14 to Dec '16	Dec '16 - Now
Upstream	-77.5	15.2
Oil Producers	-16.6	-2.6
Oil Services	-20.8	8.2
Machinery	-19.8	4.6
Fabricated Metal	-20.6	7.8
Downstream	1.5	0.9
Refining	-0.1	0.3
Chemicals	1.6	0.6
Energy Base	-74.3	14.5

*Texas Workforce Commission estimates. Oil-Related Jobs = Oil Producers and Services, Machinery and Fabricated Metal, Refining, Chemicals, Plastics, Pipelines, and some Wholesale Trade and Professional Services.

The Current Downturn and Recovery in Rigs Looks Very Different from The Last One in 2008-09

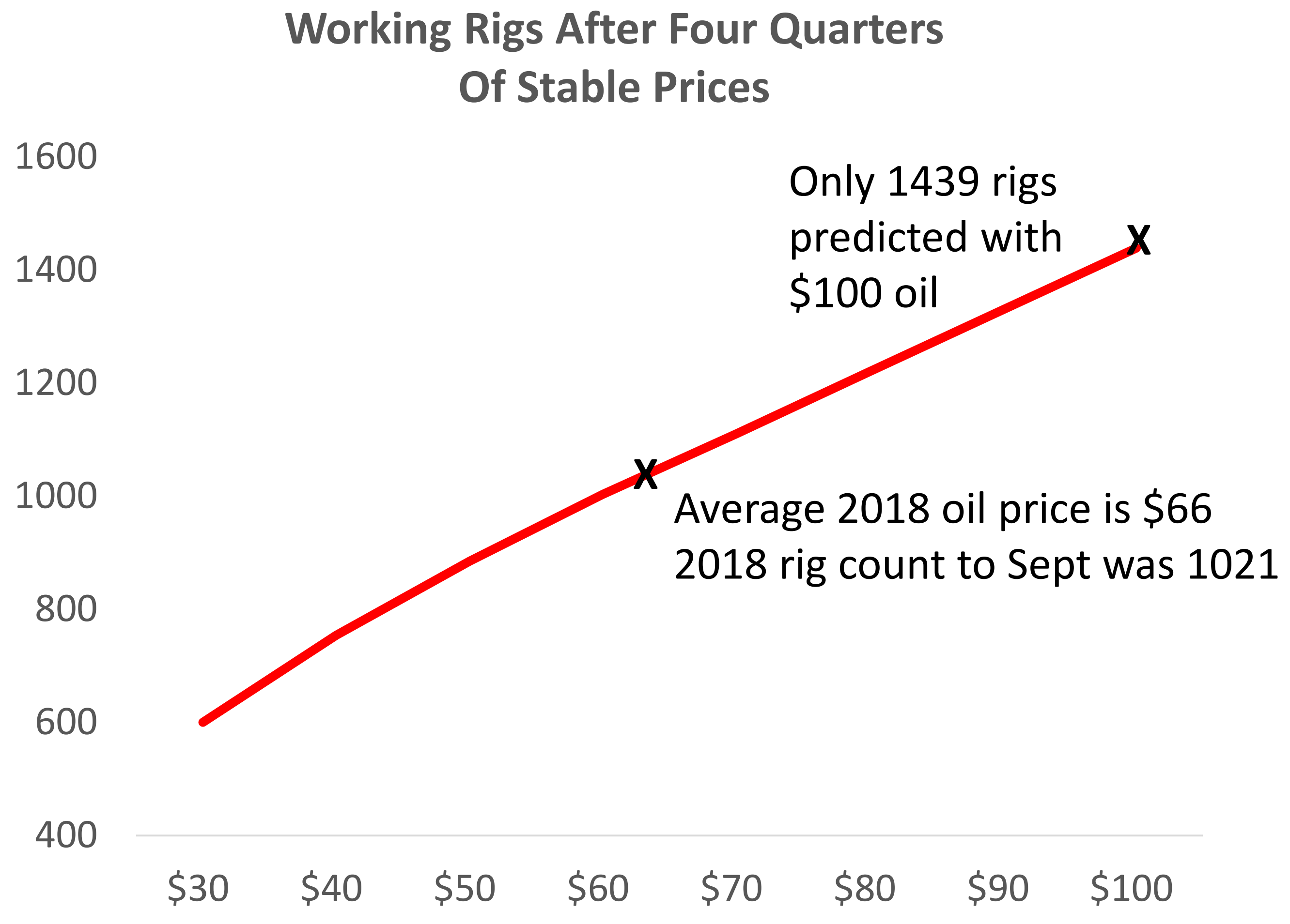


- In both cases, the initial oil downturn follows the same path, then Obama's Iran Accord turns 2016 into a rout
- *The 2008-09 recovery* brought an average of $95 oil and 1855 rigs after 2011
- *This 2018 recovery* is built on $67 oil and 1022 rigs in 2018
- The difference – then and now -- is lower oil and natural gas prices and new rig technology that reduces the number of rigs at work

Baker Hughes, IRF Calculations

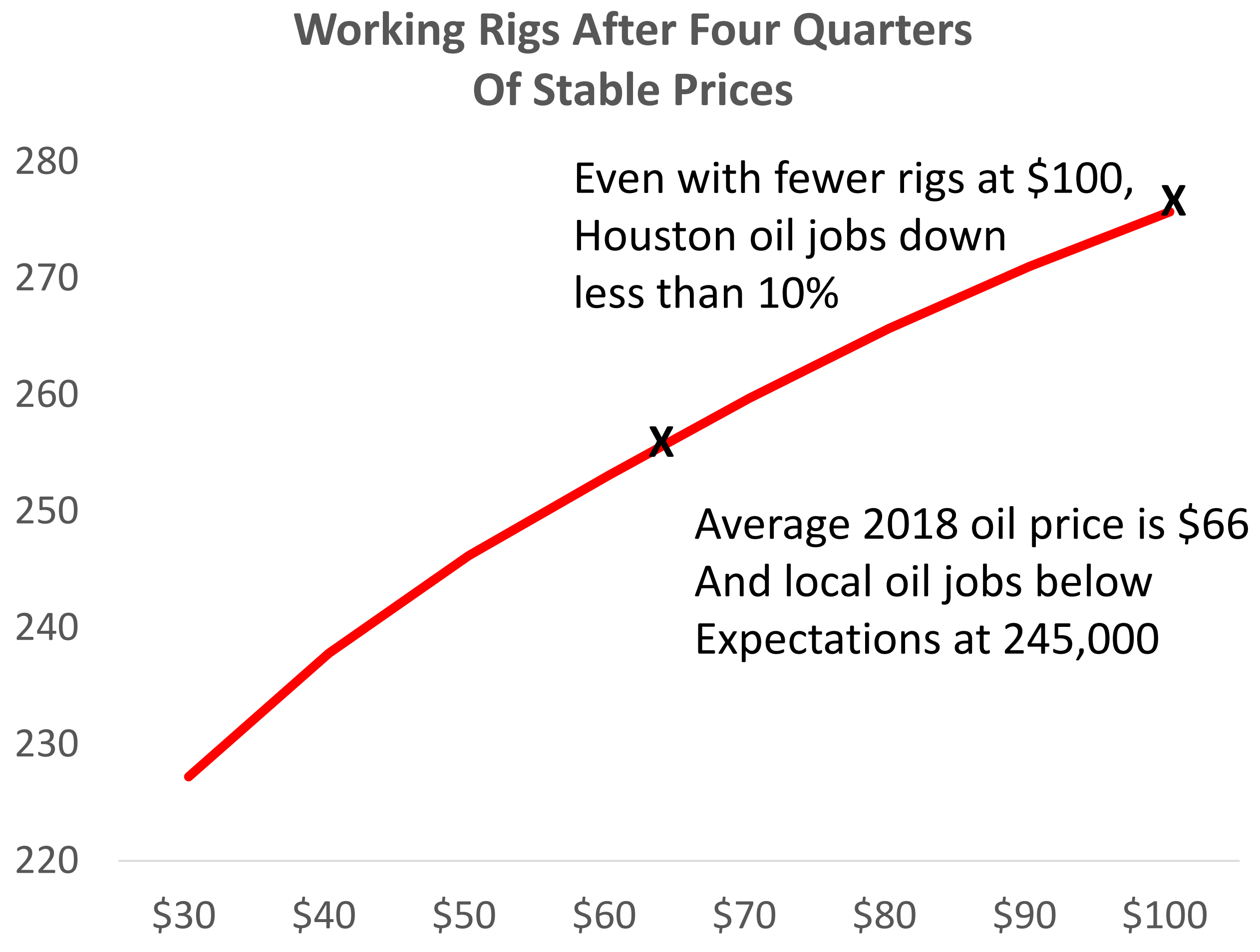
Given the Price of Oil: Where Should the Rig Count Be Today?

Oil Price ($/b)	Working Rigs
$30	600
$40	754
$50	885
$60	1003
$65	1056
$70	1110
$80	1220
$90	1330
$100	1439



Given the Price of Oil:
How Many Houston Oil Jobs in Our Future?

Oil Price	Working	Oil Jobs
$/b	Rigs	(000)
$30	600	227.2
$40	754	237.8
$50	885	246.2
$60	1003	253.1
$65	1056	256.4
$70	1110	259.7
$80	1220	265.7
$90	1330	271.0
$100	1439	275.7

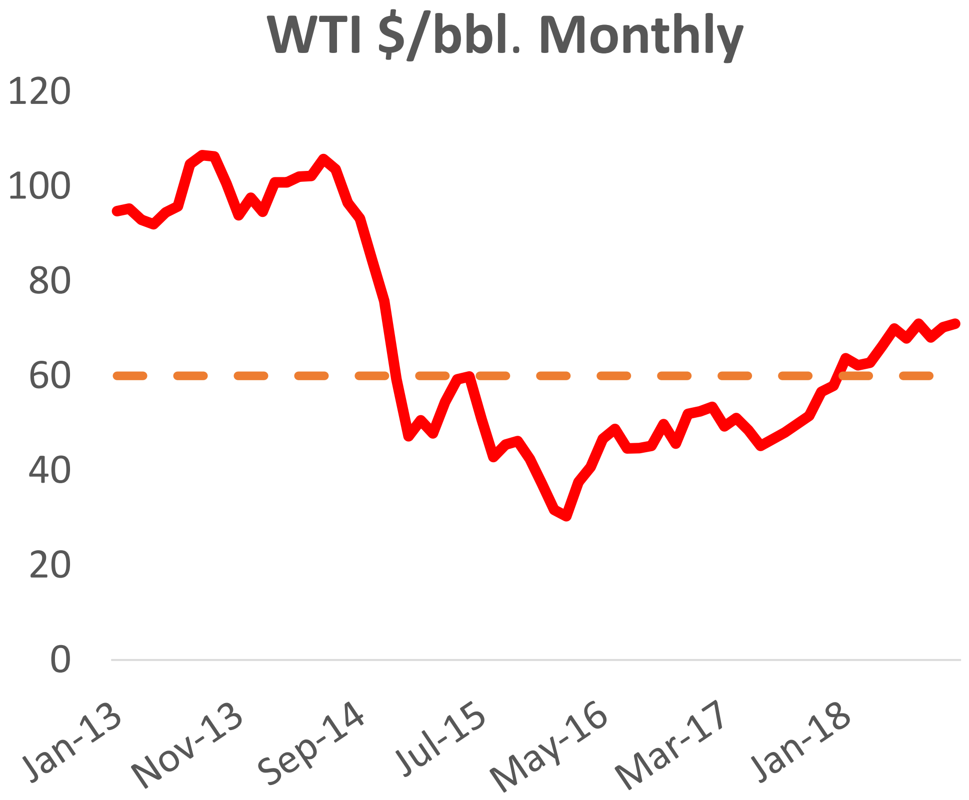


What We Have Learned About Oil Prices and Houston's Oil Sector?

- The rig count is still strongly tied to oil and gas prices, but technological change has altered the relationship. For example, in 2014 with oil at $100 the rig count was 2000; today $100 might bring 1450 working rigs
- Higher or lower oil prices still move the rig count around. A two percent change in oil prices will quickly move the rig count in the same direction and by one percent. Today's rig count of near 1050 is entirely consistent with recent technological change and an oil price of $65
- Oil prices move Houston's oil-related employment around cyclically, but long-term evolution of local employment is a slower, multi-year event
- The net effect of technical innovation on Houston's oil-related jobs is weaker than on the rig count. A $100 oil price brought 300,000 oil workers, in 2018 it would bring 275,000 or eight percent fewer. A similar comparison for the rig count is a 25 percent decline
- Why does local oil employment do better? Houston is the technological and engineering heart of the oil industry. Industry consolidation has favored Houston for decades. Rigs are fewer, but much bigger and more intensively used; the need for Houston-based engineering, oil services, machinery and fabricated metals does not fall nearly as fast as the number of rigs

Oil Markets Are Improved …
But Geopolitics Are Back As A Big Factor

A Quick Chronology of the Fracking Bust



- *Nov 2014* -- OPEC withdraws as swing producer
- *Feb 2016* -- Oil falls to $30/b, rig count collapses
- *Nov 2016* -- OPEC declares victory, returns as swing producer
- *Jun 2017* -- Oil falls back to $45 per barrel
- *Nov 2017* -- OPEC comes back, prices stick with help from Russians and others
- *Oct 2018* --Oil prices averaged $71/b

FRED, St. Louis Fed, Bloomberg Through Sep 2018

Global Growth Slows from High Levels: Still a Solid Base for Oil Demand Optimism

(% GDP Growth)

	2016	2017	2018	2019
World	3.3	3.7	3.7	3.4
U.S.	1.7	2.3	2.4	2.1
Euro Area	1.6	2.2	2.9	2.5
Japan	1.0	1.7	1.1	0.9
	---	---		
China	6.7	6.9	6.6	6.2
India	7.1	6.7	7.3	7.4
Brazil	-3.5	1.0	1.4	2.4

- Strong economic reports continue in 2018. Global growth remains strong, even after being revised down 0.2 percent for 2018 and 2019
- Late-cycle stimulus has seen the U.S. accelerate beyond expectations, but the IMF expects tariffs and trade measures to now trim expectations for US growth
- Slower activity in the Euro area is led by France, Germany, and Italy has an ongoing political/financial crisis. Japan sees less domestic consumption and investment
- Emerging markets have come under pressure from a strong dollar, higher oil prices, higher U.S. interest rates and capital outflows, and tariff tensions

Source: IMF *World Economic Outlook*: Oct 2018 Update

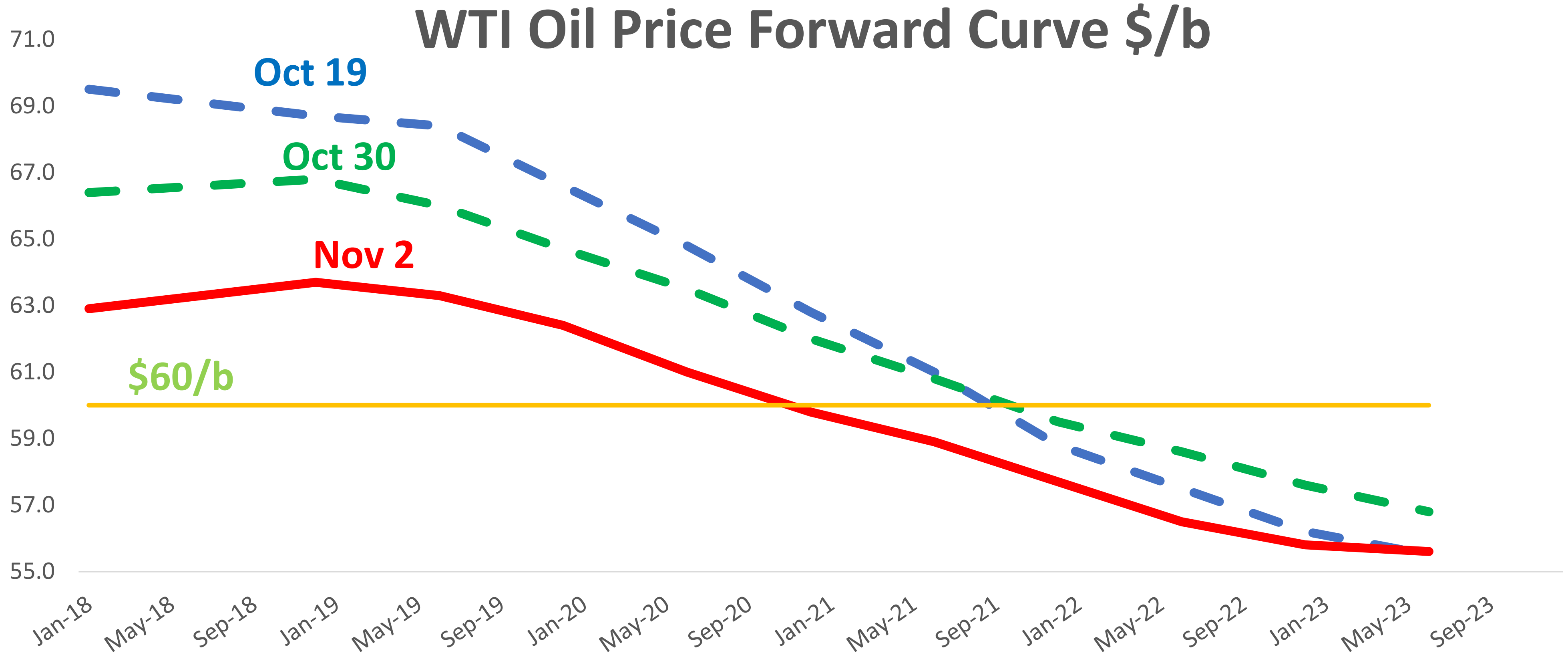
Political Risk/Disruptions Come Back in 2018 Giving Oil Price Upside Risk Again

- Supporting oil prices:
  - Global growth has slowed recently, but remains strong
  - OPEC compliance remains very strong
  - Political risk puts the Middle East back in play: Kurds and Turks in Iraq, the U.S. and Russians tied up in Syria, the Saudis in Yemen, etc.
  - Venezuelan oil production follows the course of its economy – both are in freefall
  - More on re-imposition of Iran sanctions below
- The current upside boost to oil prices from political risk or disruptions is about $5-$10/barrel

Trump and New Iranian Sanctions: Much Ado About Very Little?

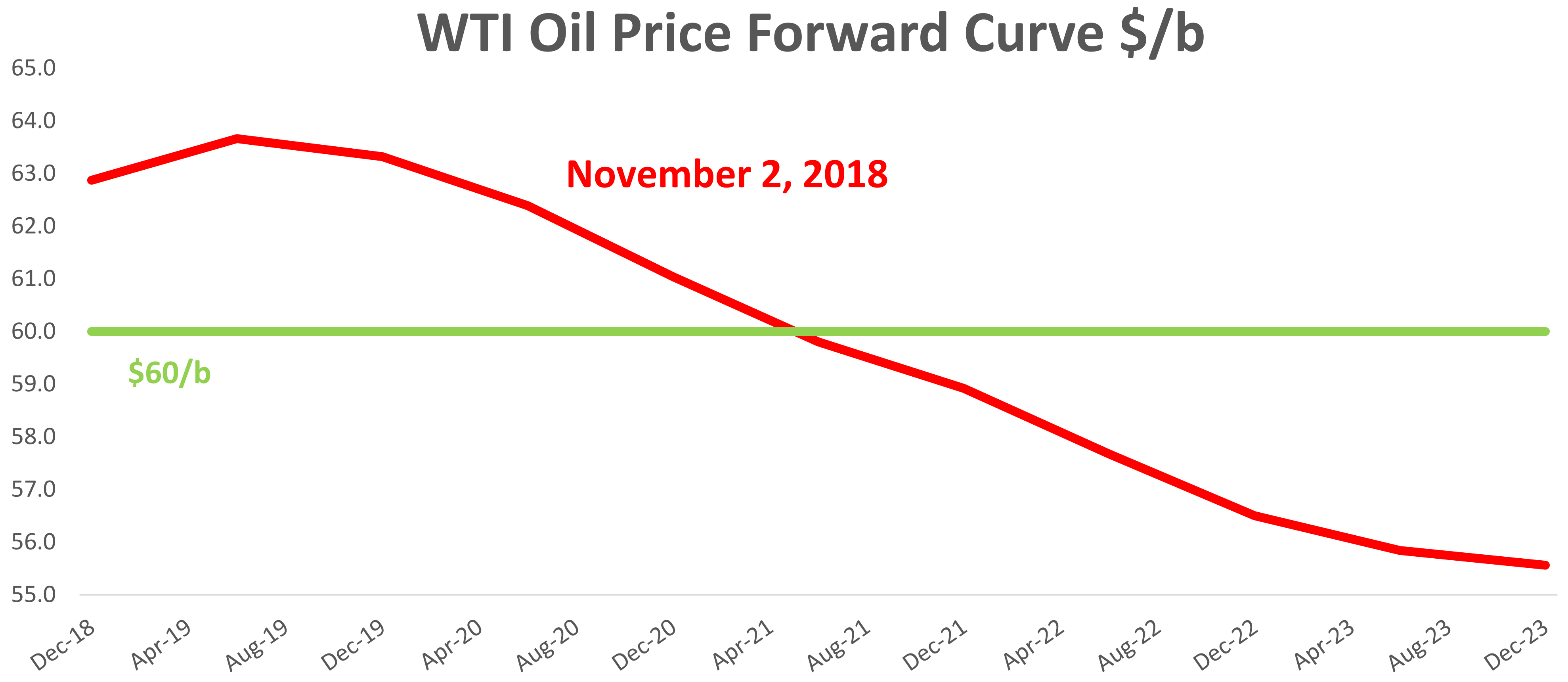
- On May 9, Donald Trump restored all prior economic sanctions on Iran. This could potentially disrupt 2.7 million barrels per day of Iranian oil exports. The current treaty has a 6-month grace period before any reduction in oil sales by Iran is required by global buyers, and the deadline is November 4
- Initially thought that sanctions would have no significant impact on Iran exports. France, the UK, Germany, China, and the U.N. vigorously oppose new sanctions. Russia, Turkey, and India were probably not going along anyway. In the event some Iranian oil production was lost, oil producers are already lining up to take Iran's place as suppliers.
- But U.S. took a very tough approach, threatening shippers, airlines, oil companies, banks, and others. Europe is finding it hard to keep their companies in line
- As of September, the Chicago Mercantile Exchange says Iranian production had fallen from 3.87 million barrels per day to 3.8 million. Others claim much bigger declines
- After the killing of an American-based journalist, Saudis say they will replace any Iranian oil shortfall that arises

Look What Can Happen When Political Risk Gets Squeezed Out of the Market



CME Group

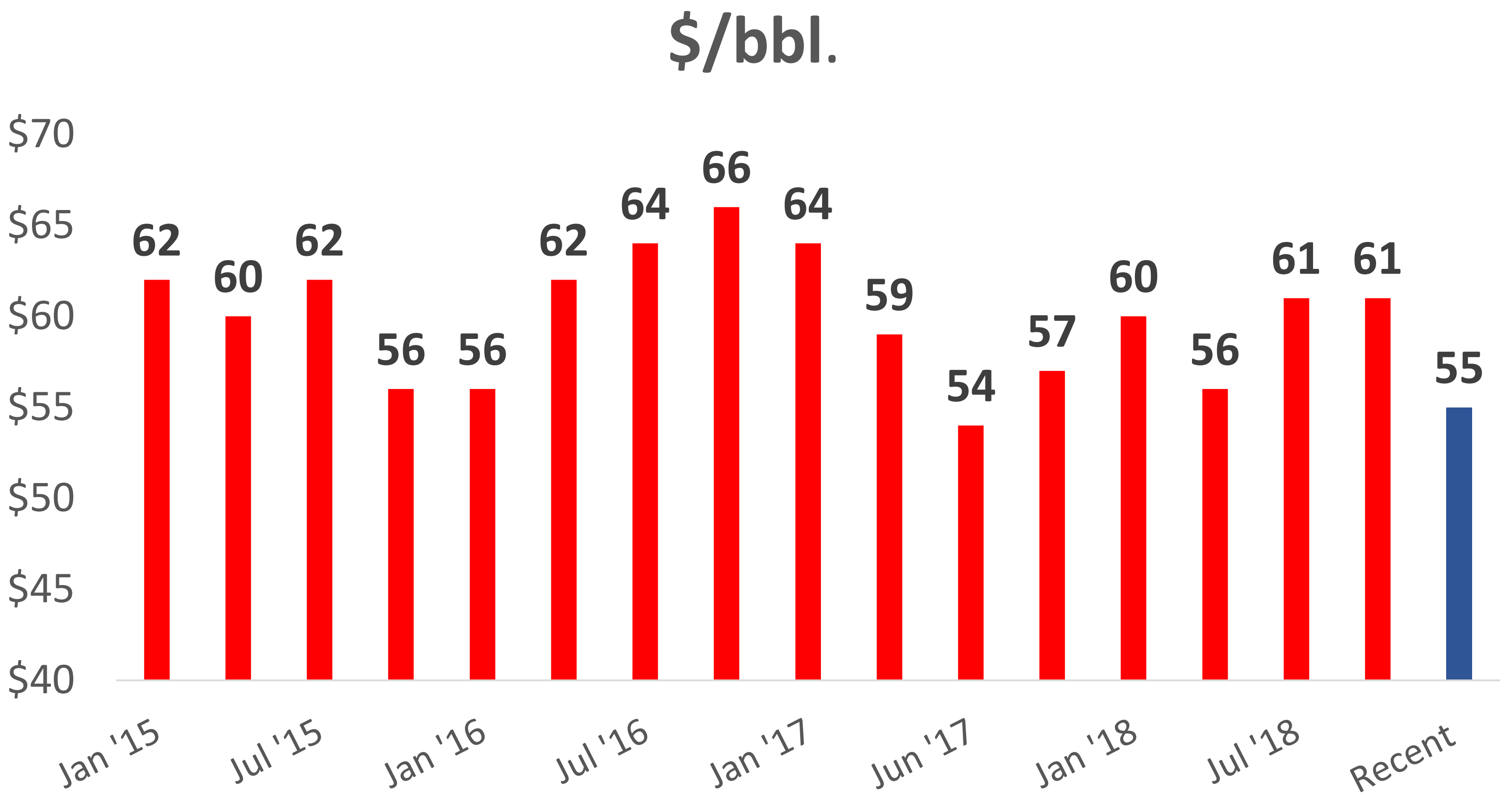
Current Oil Market Has Recovered But with Clear Signs of Political Risk



CME Group

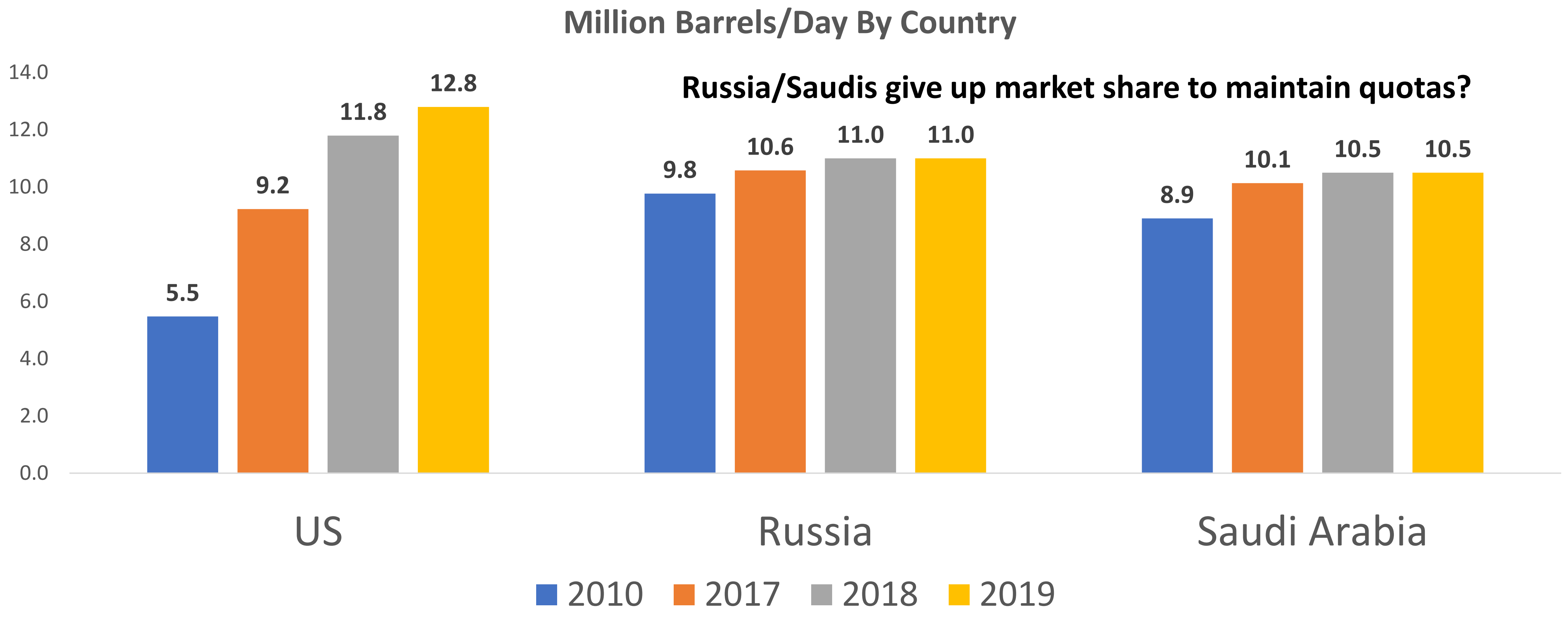
Let’s Put Aside Political Turmoil For Now: What Is the U.S. Role in Oil Production?

What Is the Right Price of WTI?
Oil Price Implied by the Stock of 40 Oil Producers



Goldman Sachs Research, at first week of each quarter

At $60, U.S. Fracking Can Easily Move Oil Production to 12.5 million Barrels per Day by 2019



Fracking Has Fundamentally Changed American Oil Production

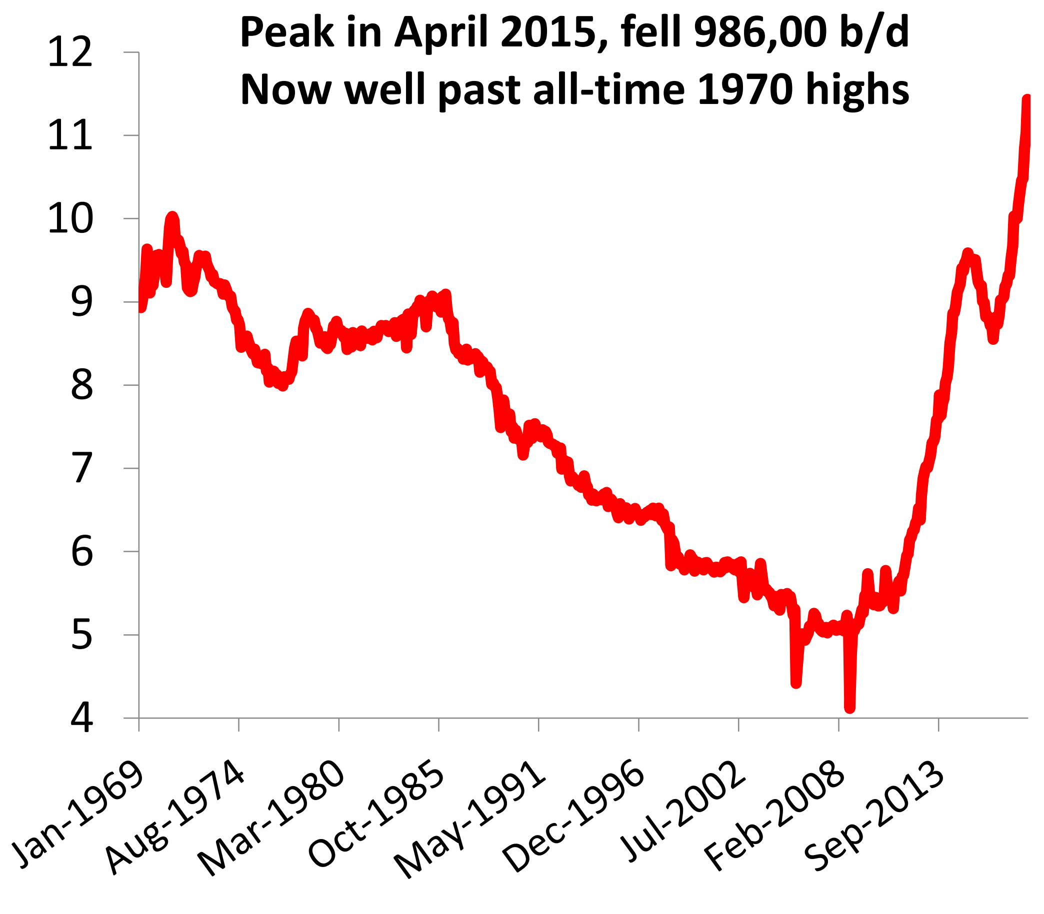
High Cost Oil at Low risk

- Looks more like a competitive industry
- Low barriers to entry for new producers, i.e., capital, some geology, leases, and a hire a service company
- Traditional exploration risk is gone, the oil is there
- Get a quick and certain rise or fall in oil production in response to changing oil price incentives

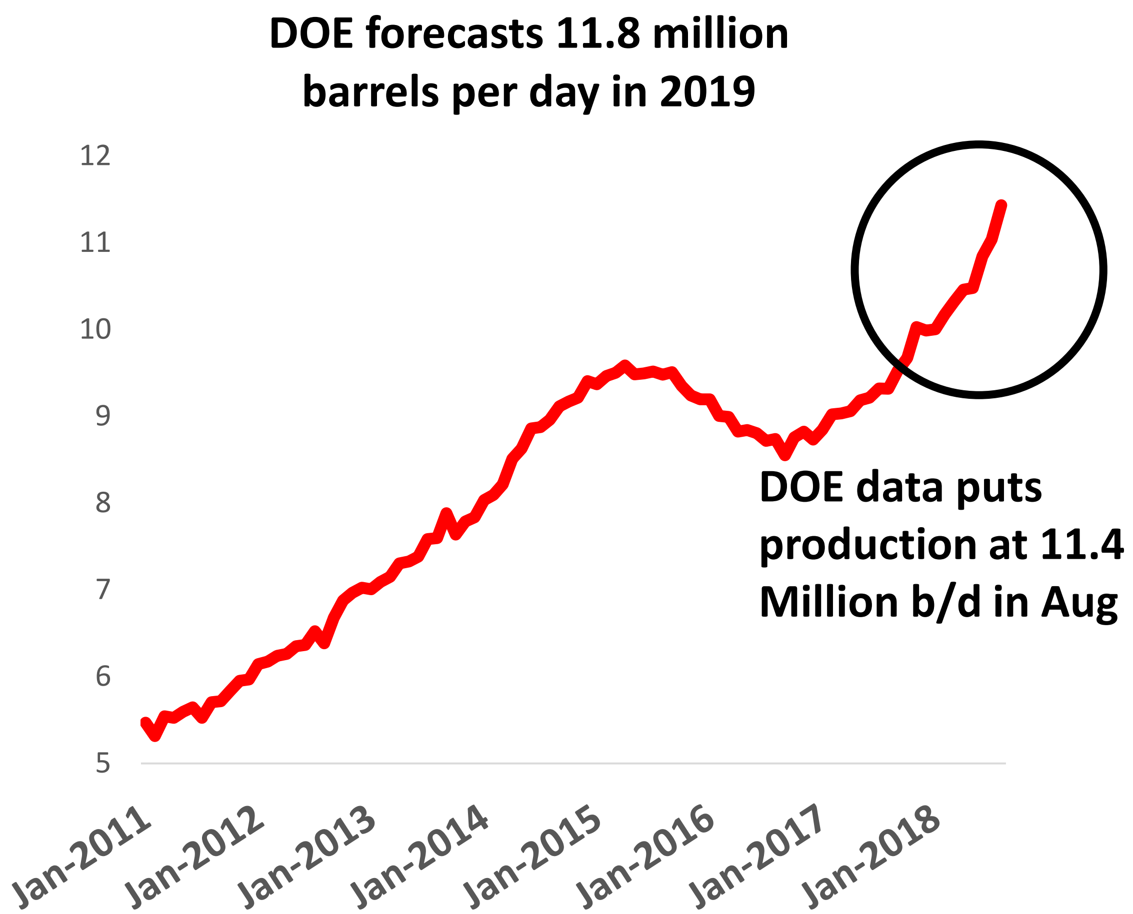
Past Bad Behavior

- In 2016-17, U.S. fracking responded to OPEC's return with rapid production increases
- Facilitated by private equity and high-yield markets, providing "unbridled abundance of capital"
- Price fell back to $45 in 2017, and large public companies have since promised discipline in 2018
- But ease of entry allows many less disciplined, small private companies to enter the market

U.S. Shale Oil Production Continues to Soar
(million barrels/day, s.a.)



DOE/EIA, Seasonally adjusted by IRF

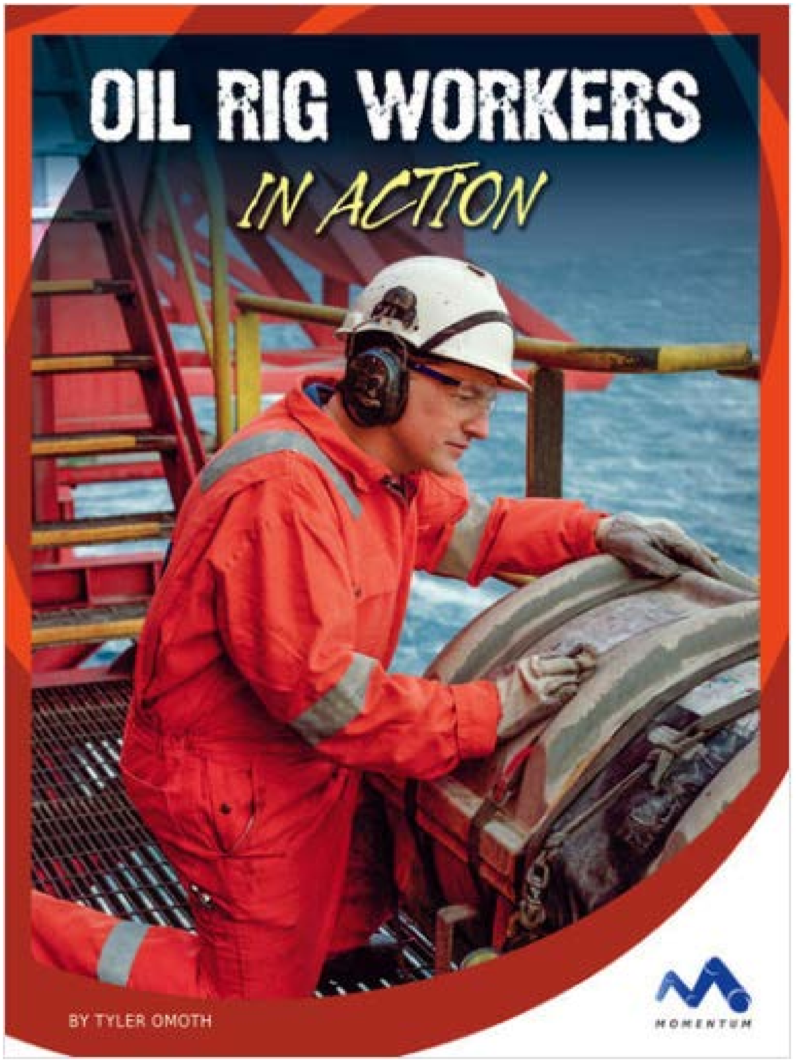


When Are Oil Prices Headed? Nothing Inevitable About It … It Depends

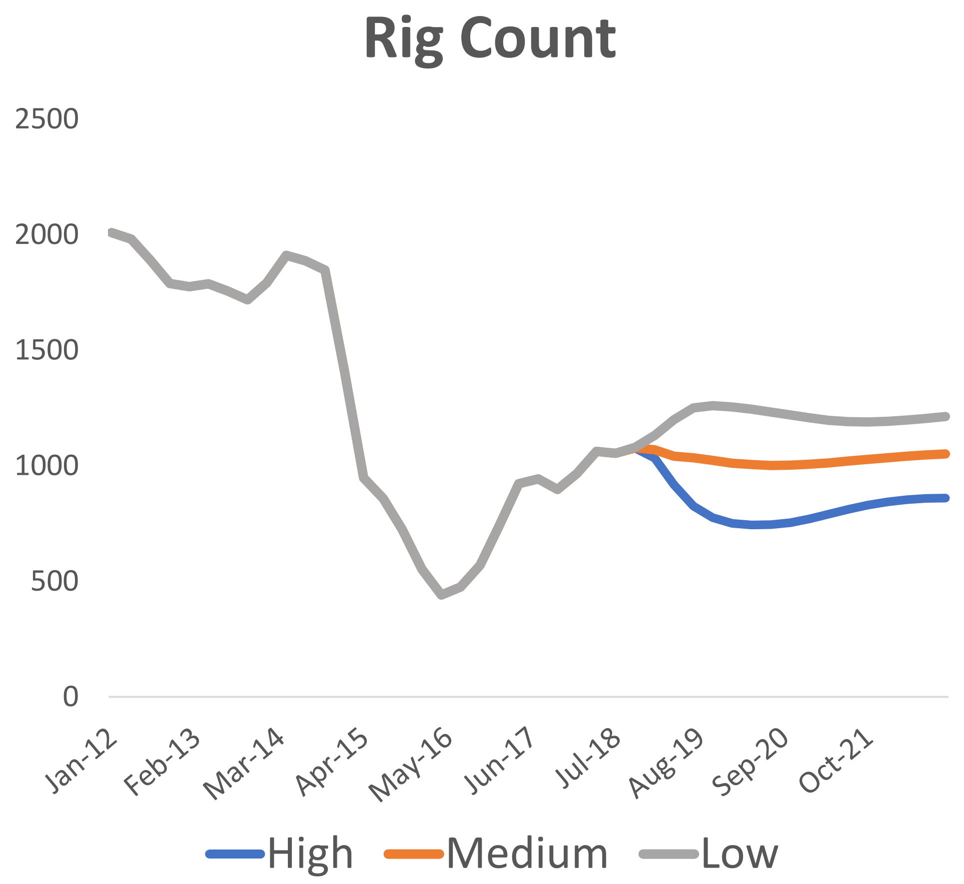
- Oil markets are tight now
  - OPEC has played its role as swing producer, stringently complying with quotas and adding oil to the market to ease shortages
  - The collapse of the Venezuelan economy has removed a million barrels per day from the market, and may remove more
  - If Iranian sanctions hold to any extent, OPEC/Saudi production will be strained to replace it
- Looking forward?
  - Production problems in Venezuela are fixable with moderate repair and maintenance. Longer term problems in Mexico, Libya and Nigeria are also fixable and in the hands of those countries
  - U.S. fracking production continues to climb. Pipeline constraints disappear in a matter of months. Capital spending continues to rise
  - When does rising U.S. production set up a clash with OPEC/Saudi/Russian market share?

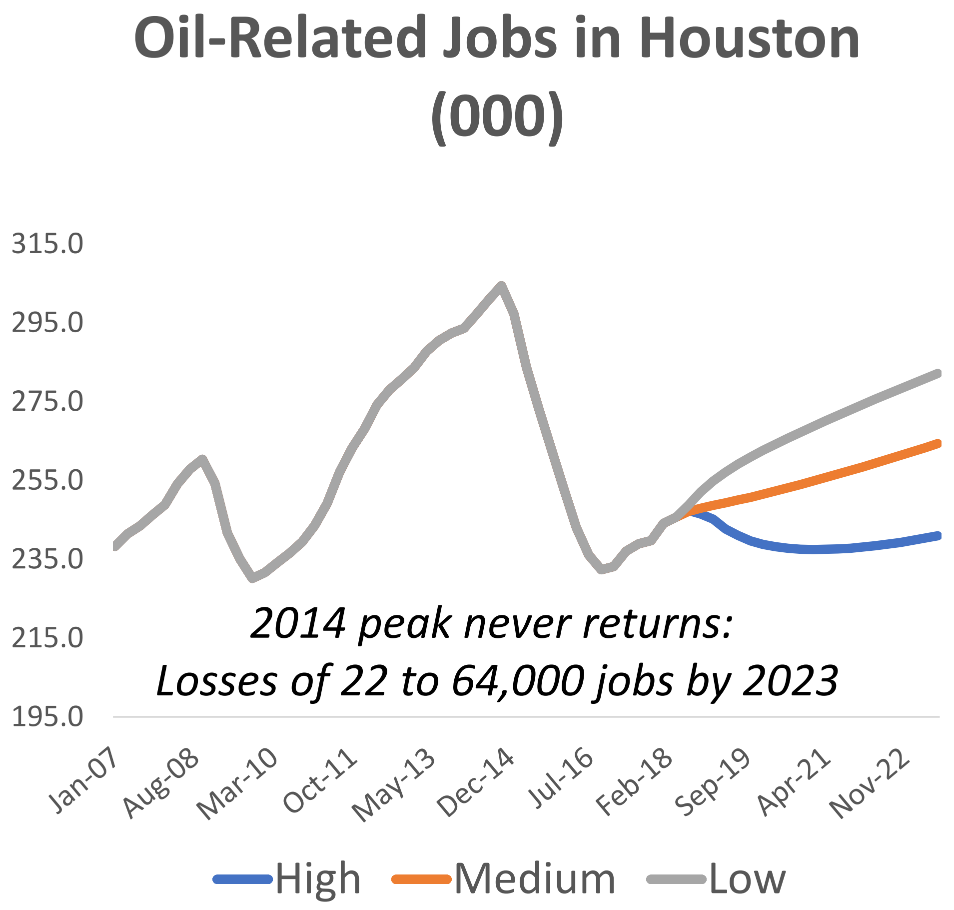
Three Scenarios for a Drilling Recovery

- **Oil price and rig count:**
  - *High Scenario*: It takes a supply disruption to move oil price over $80 for a number of months
  - *Medium Scenario*: Oil price stays near the current $60-$65
  - *Low Scenario: OPEC withdraws as swing producer again – with oil price near $40*
- **Innovation caps rig count at lower levels than in the past:**
  - *High Scenario*: 1220
  - *Medium Scenario*: 1030
  - *Low Scenario*: 754
- **Return of Drilling Jobs in Houston**
  - *High* brings 9,100 oil jobs back in 2018; 7,100 in 2019
  - *Medium* 7,500 oil jobs in 2018, but only 2,100 in 2019
  - *Low* in 2018 is 7,400 and 2019 is -5,500 as oil prices fall again.



Rig Count Scenarios: No Return of Local Oil Employment to Prior 2014 Peak





All oil-related jobs: oil producers, oil services, machinery, fabricated metal, refining, petrochemicals, plastics, pipelines, and selected jobs in wholesale trade and professional services.

The U.S. Economy Is Still Doing Fine:
The Biggest Threat Is Too Much Strength

The U.S. Economy Is Performing Well

- The U.S. economy remains strong. We know this from virtually every economic measure, and from surveys of professional forecasters, consumers, purchasing managers, and small business
- The probability of recession remains near zero, and the economy has strengthened significantly in recent months
- Any problems ahead for the national economy are tied to emerging strength, not to potential weakness
- Our forecast assumes that the U.S. economy remains as an important source of strength for Houston in 2018 and beyond

There Are Other Opinions: Paul Krugman and the Smorgasbord Recession

- Krugman says recession is not from an economic shock to the U.S., but death by a 1000 cuts. The risks are not at home, but mostly abroad, and will drag the U.S. down
- *A messy Brexit* poses a shock to the UK and to Europe, affecting the U.S. through financial ties and trade
- *A strong U.S. dollar* weakens emerging markets with large dollar-denominated debt, slowing the U.S. economy
- *The oil market* could bring a big positive shock at any time, and push the U.S. into recession
- *The trade war* has had marginal impacts so far, but we have seen China's economy slow and the currency weaken
- *The Federal Reserve* gets carried away with interest rate policy, and causes the next recession by raising rates too far and too fast

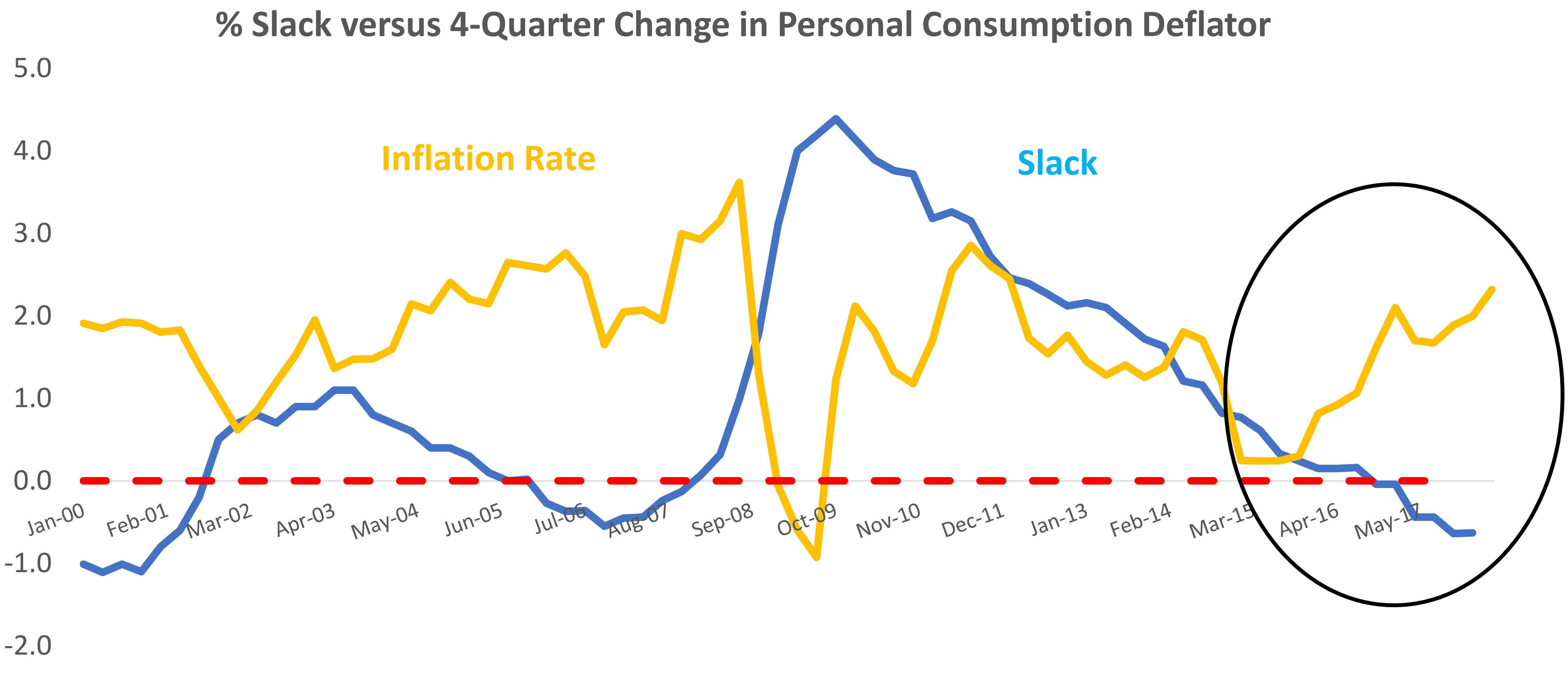
Fed Policy Has Moved to Center Stage

- The current U.S. expansion began in 2009, began very slowly. About 2012 it moved to moderate and steady growth, with few speculative excesses. In July it became the second longest U.S. expansion
- The Fed undertook unprecedented policy measures in the financial crisis, including zero interest rates and doubling its balance sheet. In the last 18 months, the Fed has moved to normalize these measures
- Through much of the recovery, the Fed repeatedly asked Congress to help speed the recovery with fiscal policy, e.g., tax cuts or infrastructure spending, but to no avail
- We have recently seen inflation measures pick up, and move back to the Fed's two percent target. We have seen this before in the recovery, only to see prices fall back. Will this be different with full employment and high levels of capacity utilization?

Tax Cuts and Jobs Act of 2017

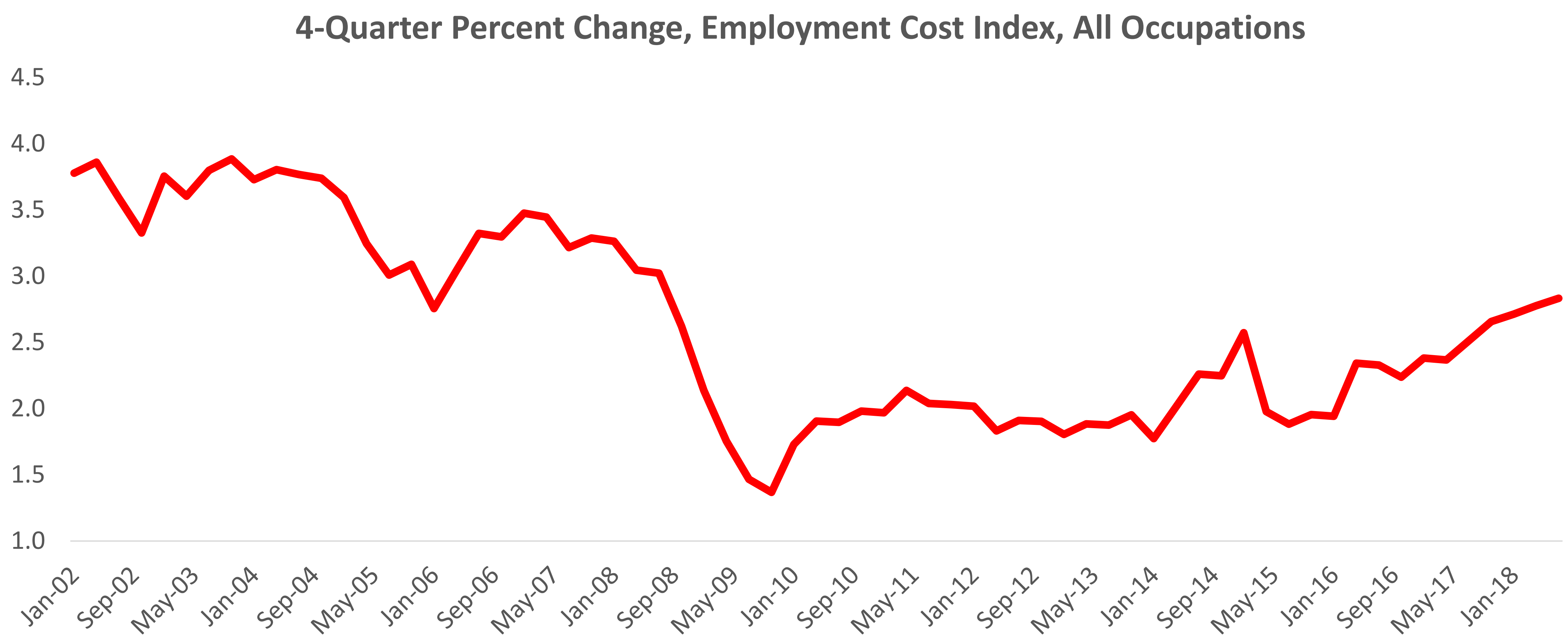
- In December, Congress passed the Tax Cuts and Jobs Act that enacted much needed tax reform and lowered taxes for corporations and individuals. It did not raise taxes elsewhere or cut spending leaving a $1.5 trillion dollar deficit over 10 years
- The administration argues the tax reforms unleash growth and will pay for themselves; the nonpartisan Urban Institute says additional growth will pay 13 percent of the deficit. This is what the Fed wanted … five years ago
- Economists are revising growth figures for GDP upward, but only in the near-term and not nearly as much as the administration
- Faster growth is likely capped by three specific factors:
  - We are already close to full employment and industrial capacity
  - Faster growth puts fiscal and monetary policy at cross purposes. If the labor market continues to tighten, the Fed accelerates its rate increases
  - If large fiscal deficits materialize, other legislation is in place to require spending cuts, including cuts to entitlements

When Slack Disappears, Inflation Picks Up



Congressional Budget Office, Bureau of Economic Analysis

Wages, Salaries and Employer-Paid Benefits Have Recently Begun to Rise Again



Bureau of Labor Statistics

Fed's Heavy Lifting Is About Over: All Up to the Economy Now

Only three rate increases in 2018-19

Meeting Date	Range b.p.	Prob. of Increase	Change
8 Nov	200-225	5.2%	--
19 Dec	225-250	73.8%	+
30 Jan	225-250	6.8%	--
20 Mar	250-275	50.7%	+
1 May	250-275	48.2%	--
19 Jun	250-275	67.3%	--
31 Jul	250-275	29.6%	--
19 Sep	275-300	38.7%	--
30 Oct	275-300	40.4%	--
11 Dec	300-325	51.4	+

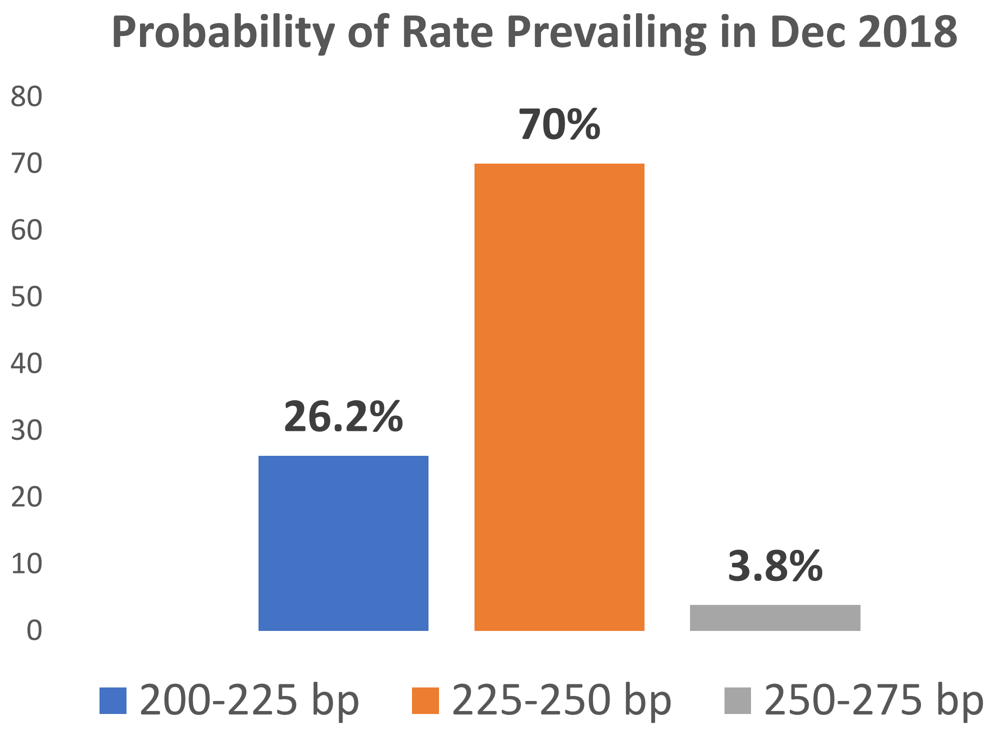
Which way for policy? Now a waiting game

- Fed has remained on a very measured track for rate increases, with little change in policy after the TCJA
- Two more rate increases will take the policy rate near a neutral stance, eliminating past Financial Crisis rate stimulus and perhaps offering restraint on the current economy with another increase
- Expectations moved up regularly and steadily through 2018 with the Fed showing the way, but futures market participants begin to be widely split on rates – up, down, or no change -- in early 2019 as neutral stance is reached

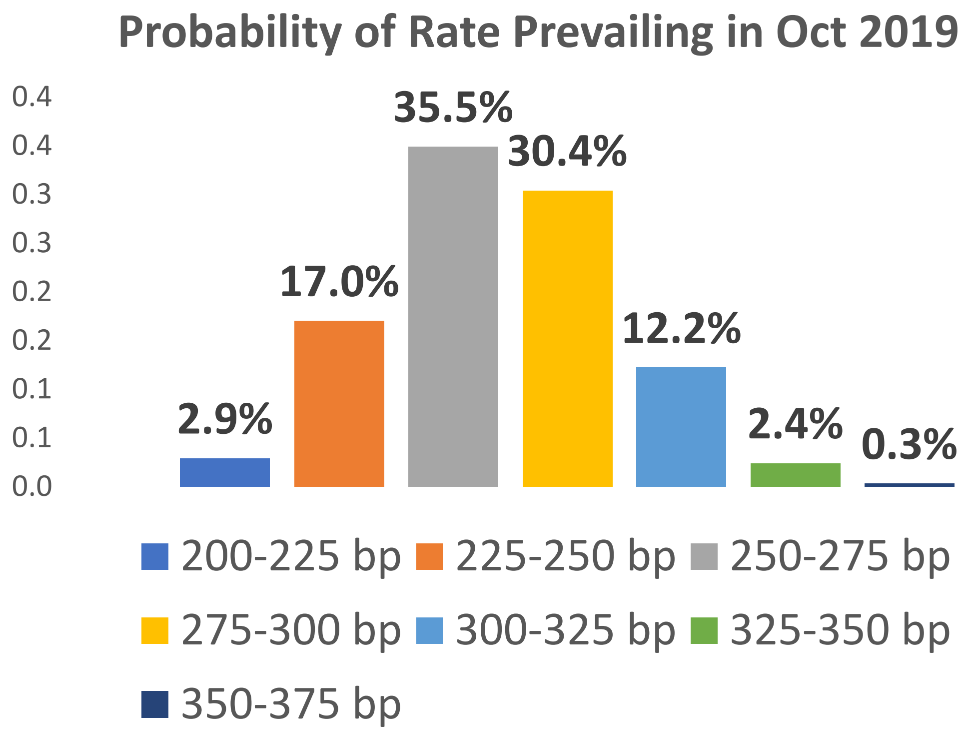
Source: Fed Funds futures, CME Group, 10/26/2018. Table assumes as soon as probability of a rate increase passes 50% a 25 basis point increase is triggered.

Fed Leadership Disappears Once Neutral Rate Reached in Mid-2019

Fed Is Giving Firm Directions on a December 2018 Rate Increase



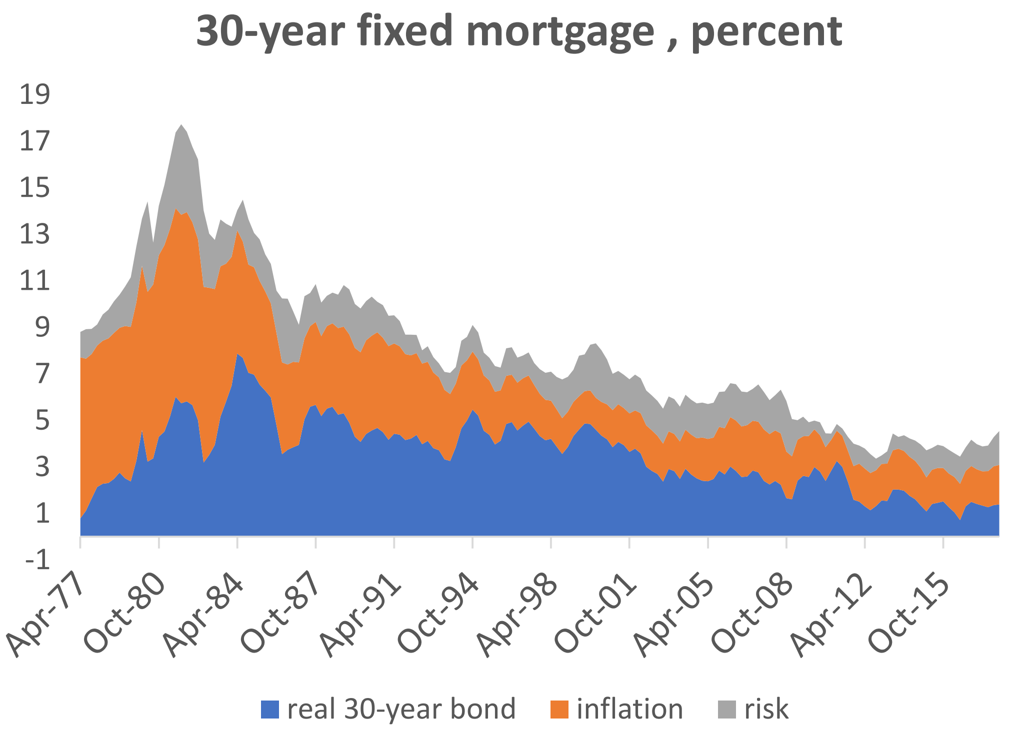
Once the Neutral Rate Is Reached This Direction Becomes Widely Split



Source: Fed Funds futures, CME Group, 10/30/2018.

The 30-Year Fixed Rate Mortgage: Current Forecasts Assume Best of All Worlds

Rates have varies from 3.4% to 17.7%, now near 4.6% for 30-year fixed



Where now?

Outlook for the 30-year fixed rate

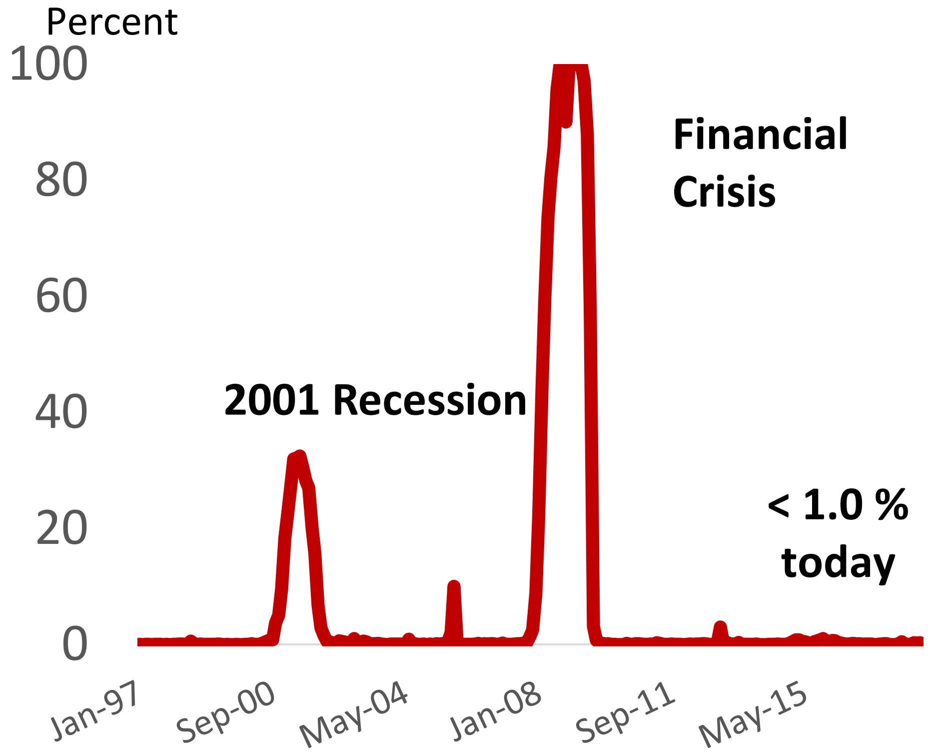
Period:	30-Year Fixed	Real Risk Free	Inflation	Risk Premium
Last 40 years	8.1%	3.5%	3.1%	1.4%
The 1980s	12.7%	5.1%	5.4%	2.1%
Since 2008	4.2%	1.8%	1.6%	0.8%
Looking forward:				
2018	4.7%	1.2%	2.0%	1.5%
2019	5.3%	1.7%	2.1%	1.5%
2020	5.5%	1.9%	2.1%	1.5%

Note: Outlook assumes stable inflation, risk free rate of 1.5 percent, and three rate Increases by the Federal Reserve in late 2018 and 2019.

Various sources from FRED, St. Louis Fed, and IRF calculations

Moderate U.S. Recovery Continues

Chance of Recession About One Percent Today



Consensus Forecast Is Still Strong: But Not Too Hot, Not Too Cool

	Real GDP (%)	Unempl Rate (%)	Payroll Jobs ('000/mo)
Quarterly Data:			
2018Q2	3.0	3.9	181.0
2018q3	3.0	3.9	175.0
2018q4	2.8	3.8	160.4
2019Q1	2.4	3.8	160.9
2019Q2	2.6	3.7	151.7
Annual Average:			
2018	2.8	3.9	185.9
2019	2.7	3.7	160.8
2020	1.9	3.9	NA
2021	2.0	4.0	NA

Source: Chauvet and Piger smoothed recession probabilities, FRED, St. Louis Fed; Philadelphia Fed, *Survey of Professional Forecasters*, Second Quarter 2018.

Pull It All Together?

- Three oil scenarios: high, medium, or low. High is based on $80 oil and political disruption to oil markets; medium sees 2018 $65 oil and drilling capped by producer discipline or over-production; low is OPEC again pulling out as swing producer and $40 oil price
- Continued U.S. expansion at moderate or better rates
- Continued drag from the end of the East Side petrochemical construction
- Momentum from the fracking boom years is gone
- Harvey jobs slowly disappear

Forecast Job Growth Is Moderate As Oil Prices Stabilize or Improve

(000 New Jobs, Q4/Q4)

	By Scenario			
Year	High	Medium	Low	20/60/20
2014	112.3	112.3	112.3	112.3
2015	8.9	8.9	8.9	8.9
2016	-2.6	-2.6	-2.6	-2.6
2017	27.9*	27.9*	27.9*	27.9*
2018	65.1	62.4	53.2	61.1
2019	78.4	67.4	62.6	68.6
2020	72.9	54.8	40.2	55.5
2021	75.3	67.1	48.6	65.0
2022	85.3	66.1	50.6	66.9
2023	89.1	68.5	53.8	69.7

*Excludes 27,800 temporary jobs in 2017Q4 driven by Hurricane Harvey.
Calculations of IRF, based on drilling scenarios above. Figures are Q4/Q4. The 2016 calculations include benchmark revisions of March 2018.

This Forecast Compared to May Outlook

(000 New Jobs, Q4/Q4)

By Scenario

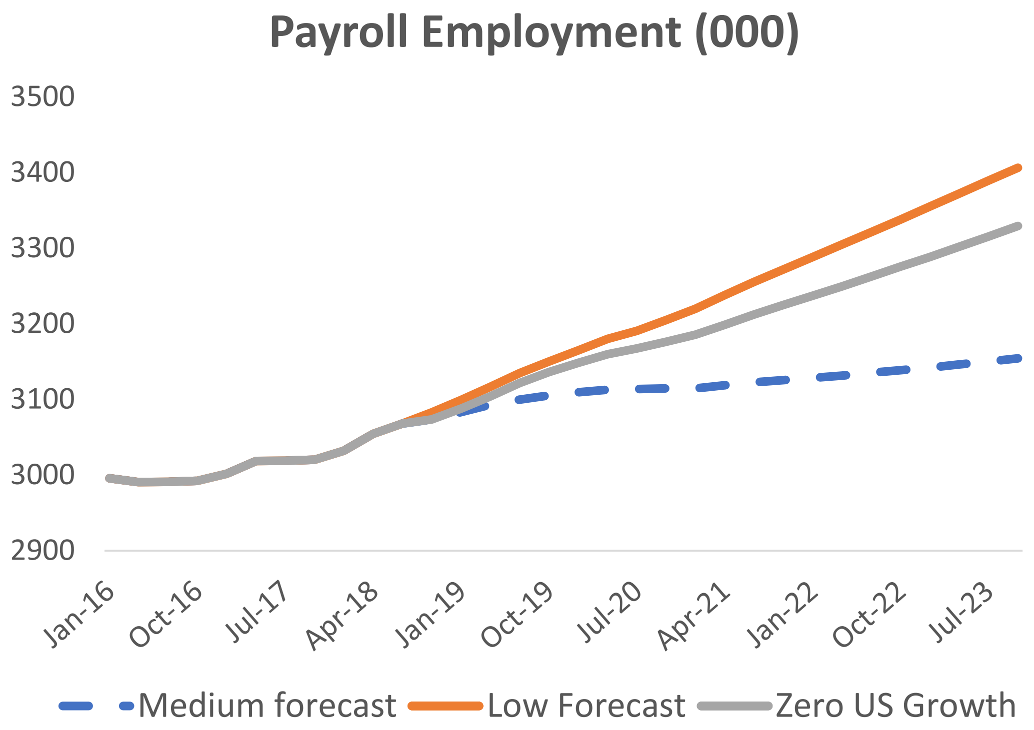
Year	This forecast Medium	May 2018 Medium	November 2017 Medium
2014	112.3	112.7	112.7
2015	8.9	11.0	11.0
2016	-2.6	10.8	-1.5
2017	27.9*	35.2	41.1
2018	62.4	52.6	42.1
2019	67.4	68.0	56.0
2020	54.8	74.1	64.5
2021	67.1	78.8	73.2
2018-2021	251.7	273.5	235.8

*Hurricane Harvey jobs removed from 2017

Note: Calculations of IRF, based on drilling scenarios above. Figures are Q4/Q4. This forecast (*) in 2017Q4 excludes 27,800 one-time jobs from Hurricane Harvey. May forecast did not foresee Harvey, November forecast underestimated Harvey impacts. The 2018 estimate adjusted down for likely over-estimates of payroll data

U.S. Economy Is Crucial to Houston's Growth: At $40 Oil No U.S. Growth Means No Little Growth

Three Forecasts: Medium, Low, and Low with Zero U.S. Growth



Medium Is U.S. Growth *and* $65 Oil, Low Cuts Oil to $40, Lower Removes U.S. Growth

Three Forecasts of Houston Job Growth

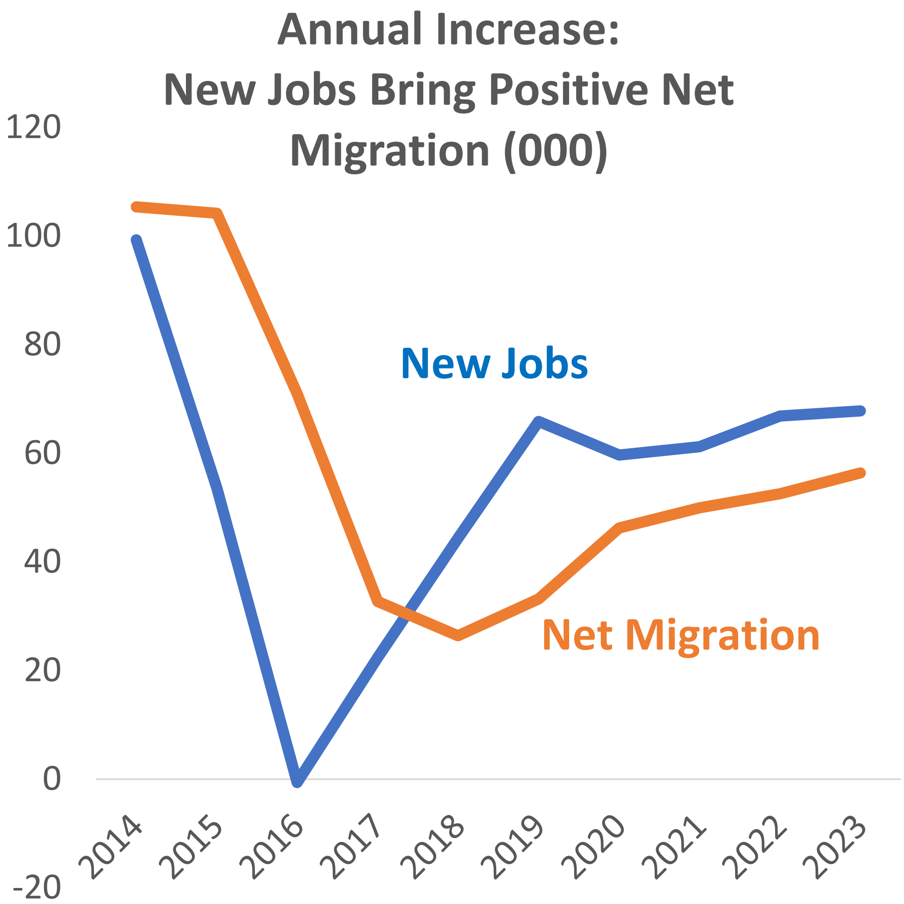
Net New Payroll Jobs (000)

	Medium	Low	Lower
2016	-2.3	-2.3	**-2.3**
2017	27.9*	27.9*	**27.9***
2018	62.3	53.2	**53.2**
2019	67.4	62.6	**31.8**
2020	54.8	40.2	**9.2**
2021	67.1	48.6	**11.3**
2022	66.1	50.6	**12.8**
2023	68.5	53.8	**15.6**

*Excludes Harvey-related jobs in late 2017 which are unrelated to business conditions at the time

Net Migration Lags Job Growth: Bottoms Out in 2018 in Houston

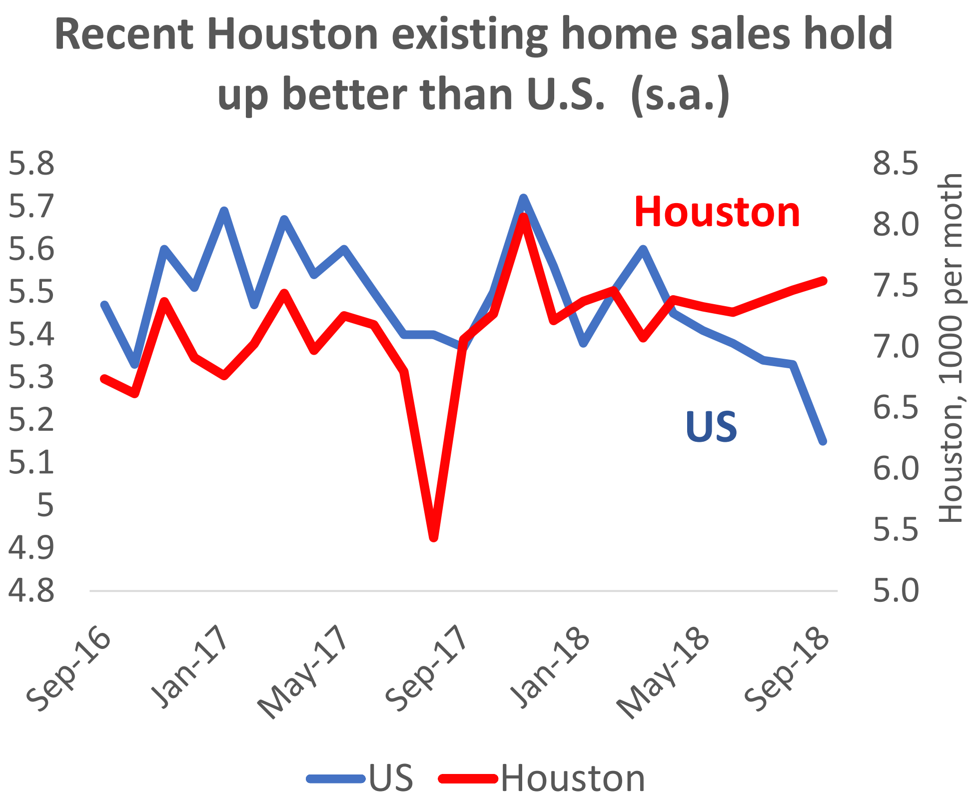
- 2017 local population increase of 94,417 was smallest since 2010, third smallest since 1997
- Weak net migration of 33,000 was the chief reason, with domestic migration turning negative at -10,000
- Net migration is strongly related to job growth, lagging a year
- Data at right matches medium employment forecast, sees a 2018/19 trough with 25/30,000 net in-migrants
- Improves to over plus-50,000 net migrants by 2023



Houston Housing: Harvey Is Gone, But Rising Rates and Affordability Move to the Forefront

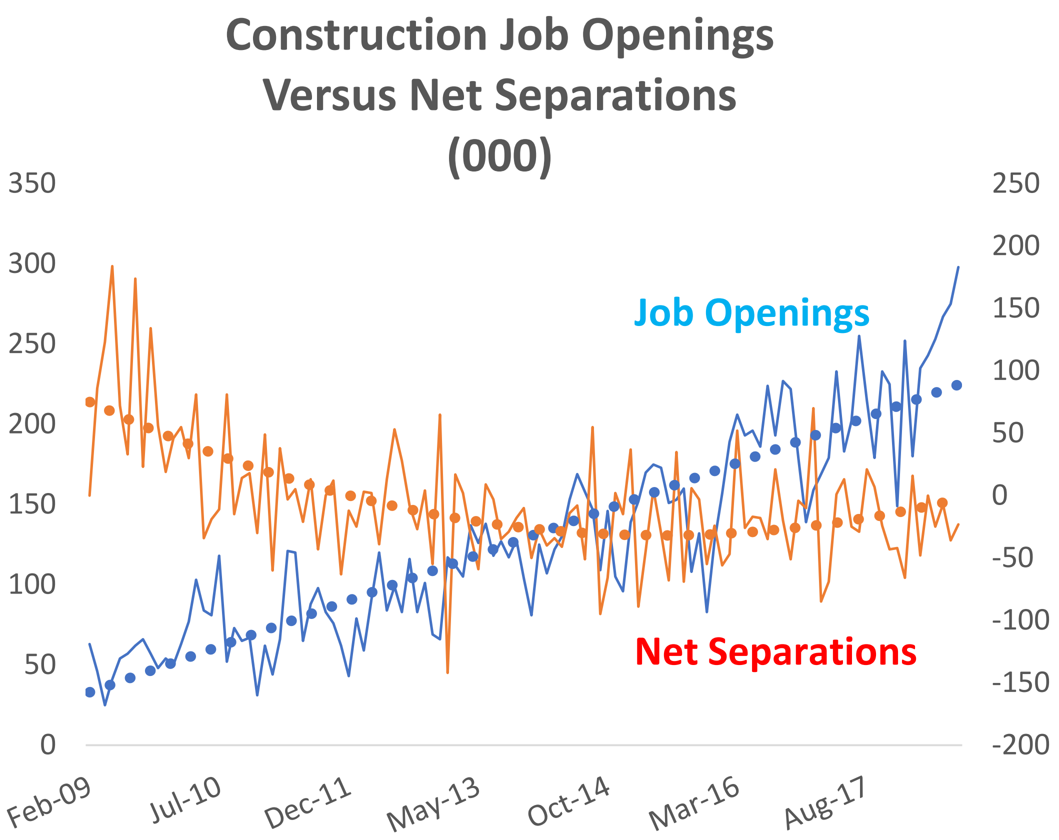
National Housing Market Summarized By Recent Wells Fargo Reports

- Early in this cycle, sales were held back by lot, labor and material shortages. These have receded as rising mortgage rates and affordability have become the key issue in home sales
- Both existing and new home sales continue to tumble – for the last six and four months respectively.
- Virtually every national indicator of housing activity demand has been cooling or trending lower for several months, with inventories rising and price turning flat



Rising Mortgage Rates and Building Costs Have Slowed Sales Nationwide

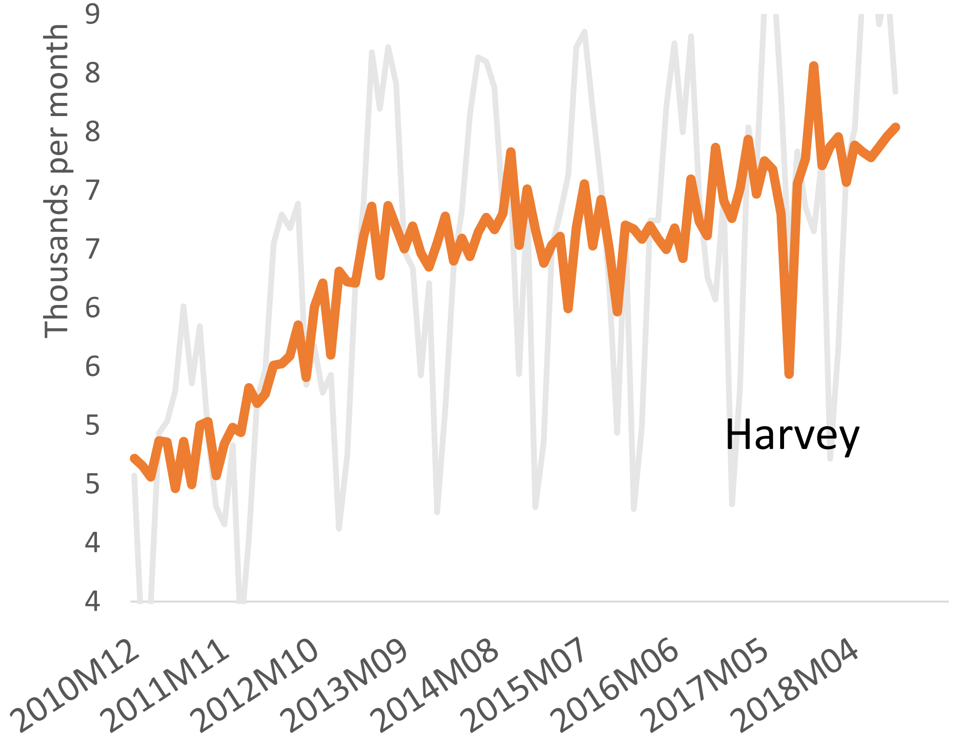
- The Producer Price Index says inputs to the construction industry rose 6.2 percent September to September
- Led by energy including diesel and asphalt, and by tariffs on steel, aluminum and lumber
- Strong demand for workers combine with immigration restrictions to bring growing labor shortages
- *Rising mortgage rates have now moved to the forefront as the major affordability issue for potential buyers*



BLS, JOLTS, net separations are total separations minus hires

Local Existing Home Sales Rose In Recent Months in Early 2018, Flat Since Then

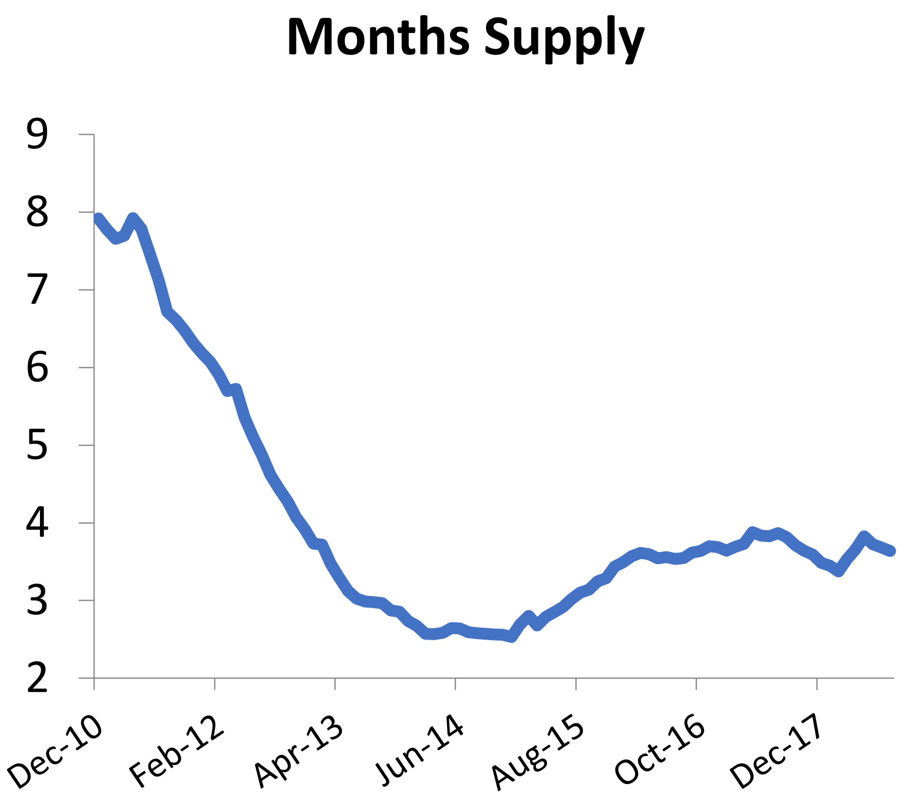
(sales, s.a.)

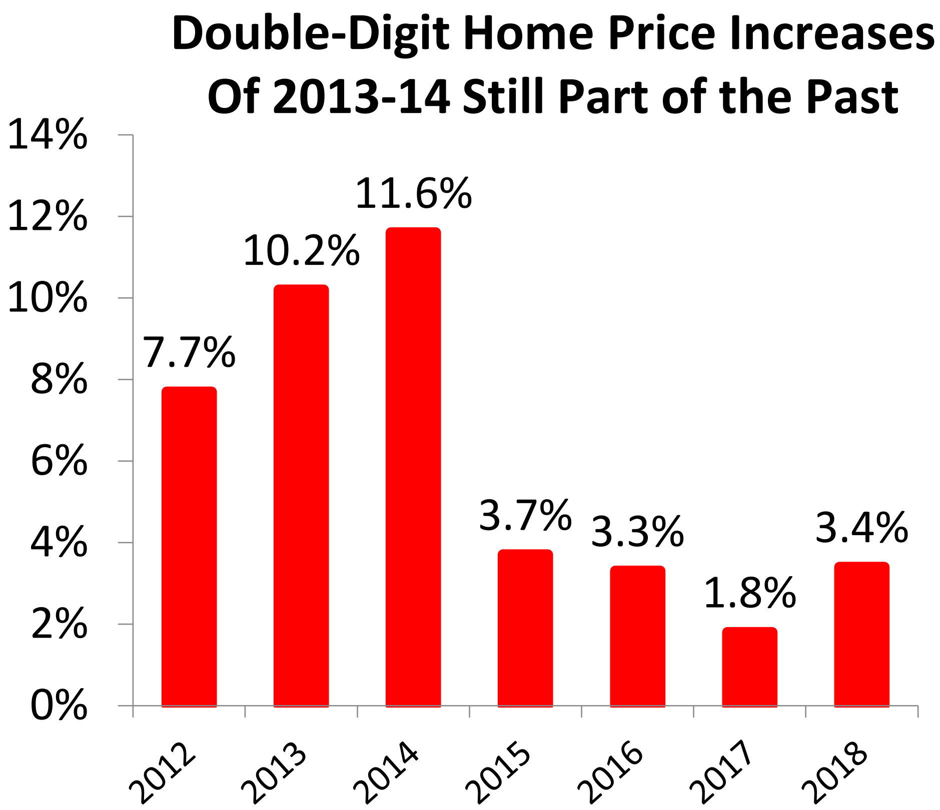


Source: Texas A&M Real Estate Center

- Harvey had a short-lived impact on home sales, first as we waited out the storm, and a brief burst of sales in November 2017
- In 2018 sales picked up modestly early in 2018 to levels that reflect the improved oil prices we have seen in 2017-18. They then turned flat
- There is nothing in the 2018 sales numbers that indicates a return to the boom-time conditions of before 2014 – not in the sales, price or inventory numbers

Post-Harvey the Existing Home Market Should Continue to Slowly Loosen Up

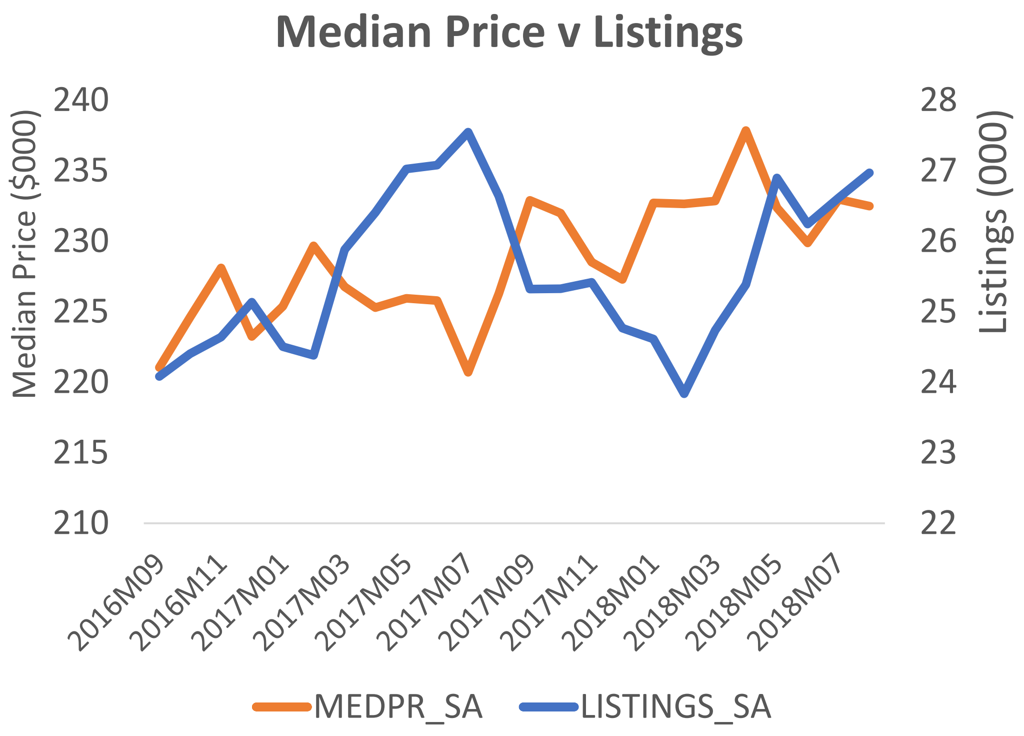




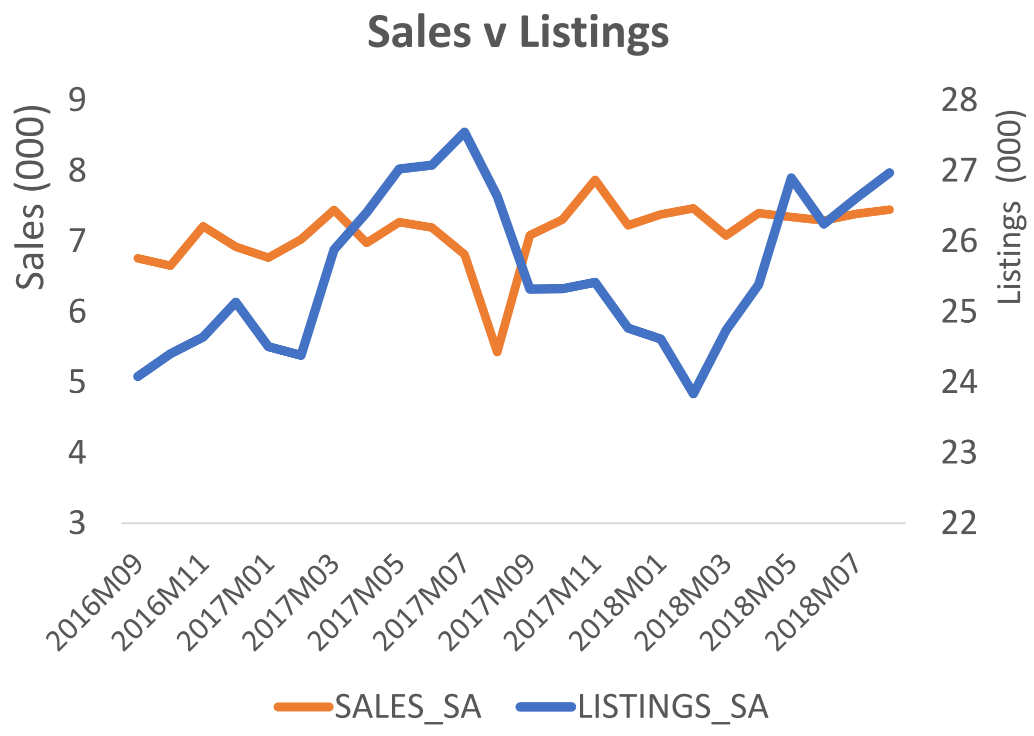
Source: Texas A&M Real Estate Center, seasonal adjustment by IRF

Main Harvey Impact Was a Fall in Listings And Price That Corrected Over the Summer

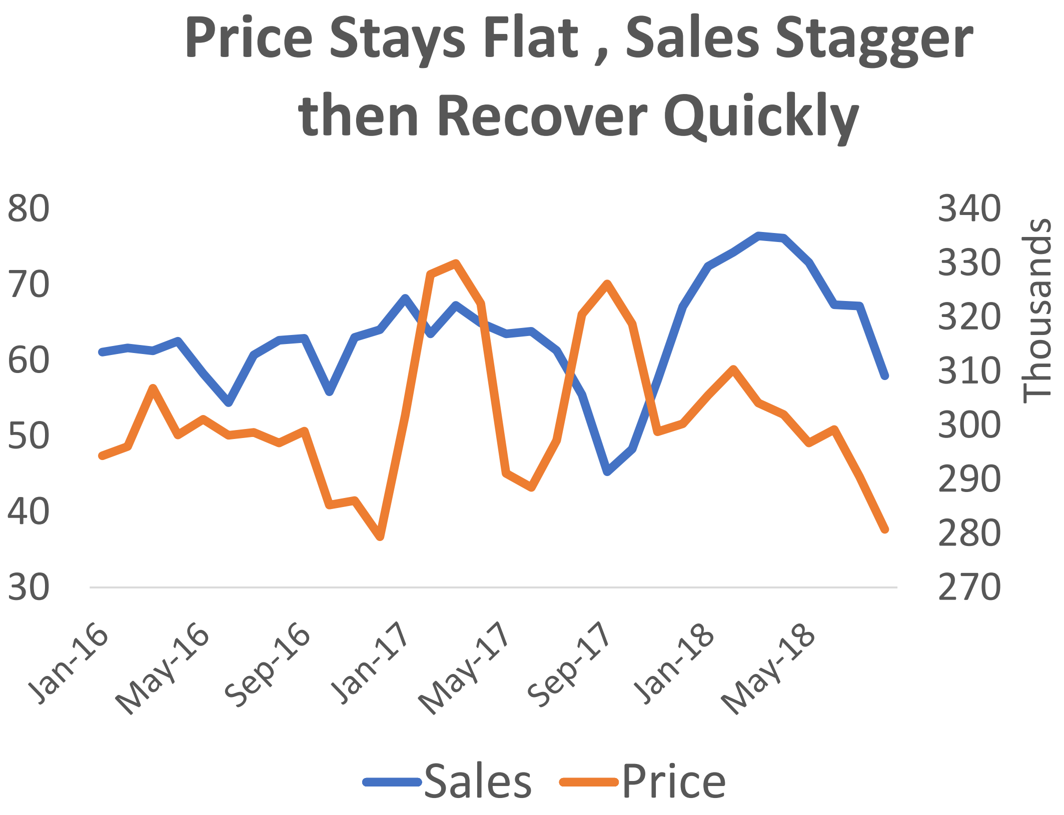
Median Price Surged After Harvey as Listings Fell, Then Both Stabilized

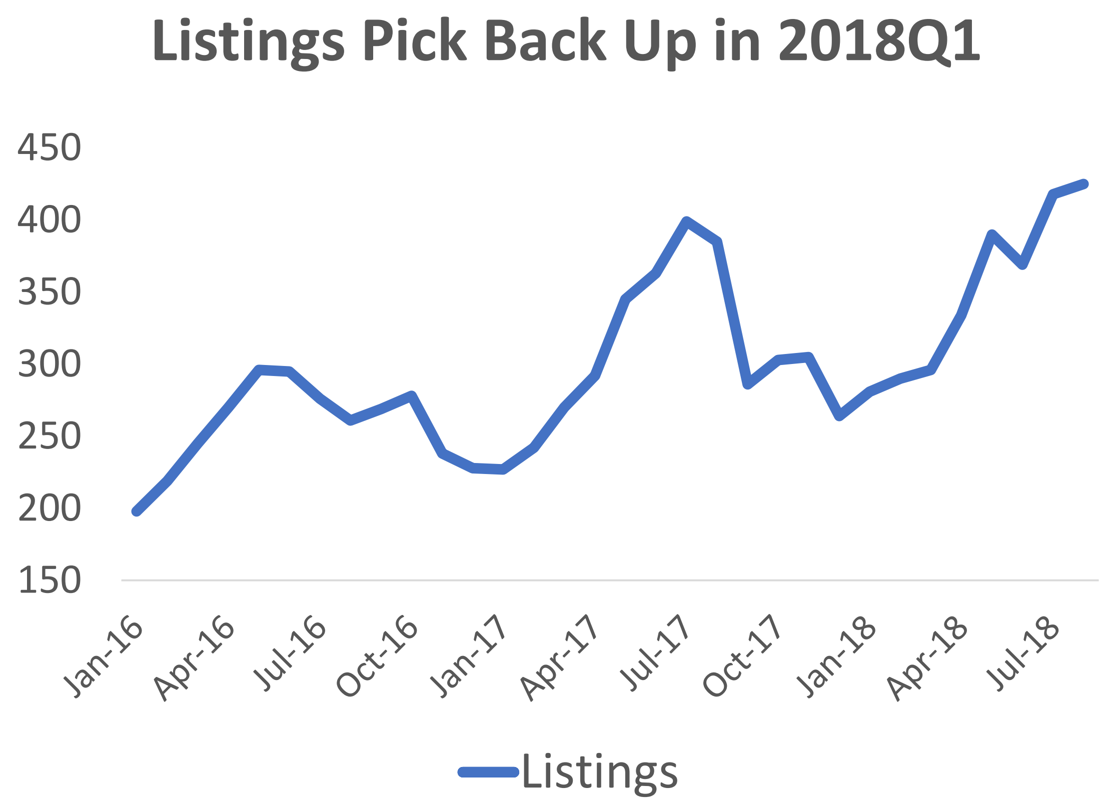


Sales Show Little Harvey Impact After the Storm, Despite a Fall in Listings



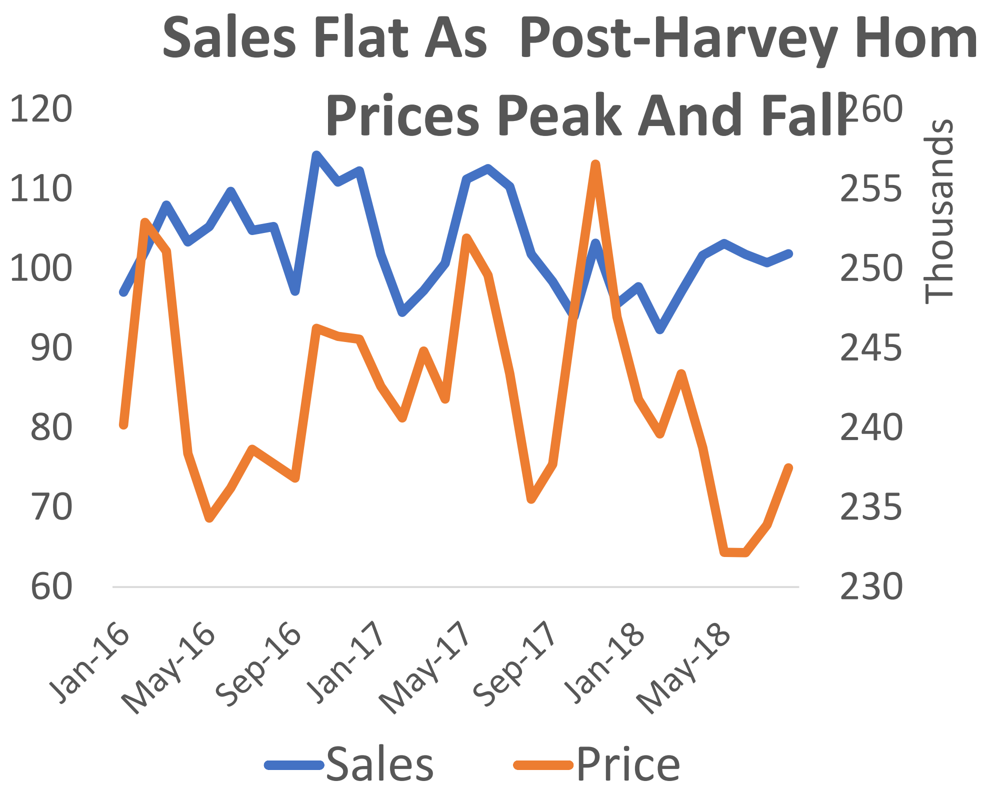
Energy Corridor During Harvey and After

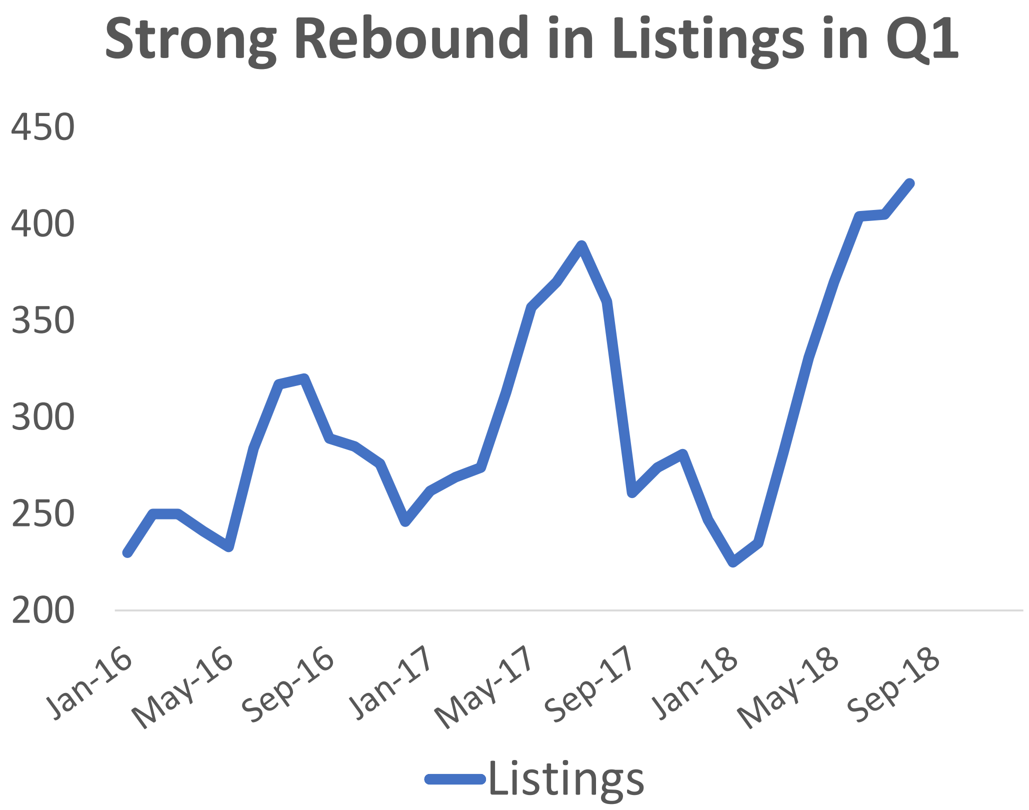




Source: Texas A&M Real Estate Center, calculations of IRF

Kingwood See Prices Fall Back in 18Q1, Listings Rebound

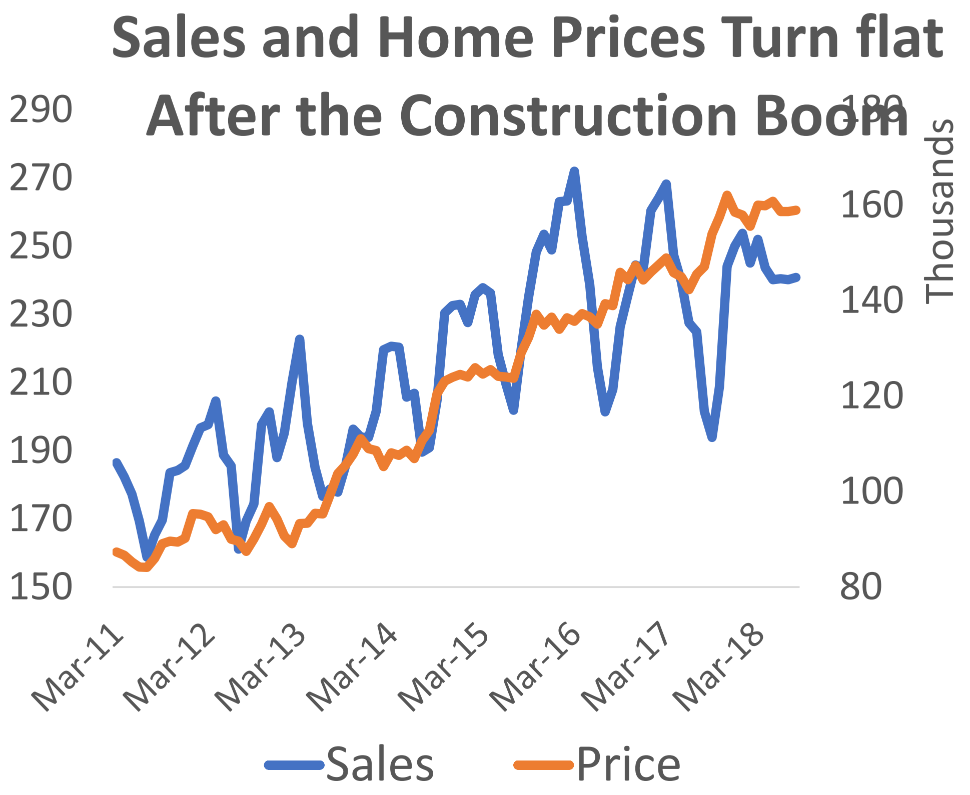


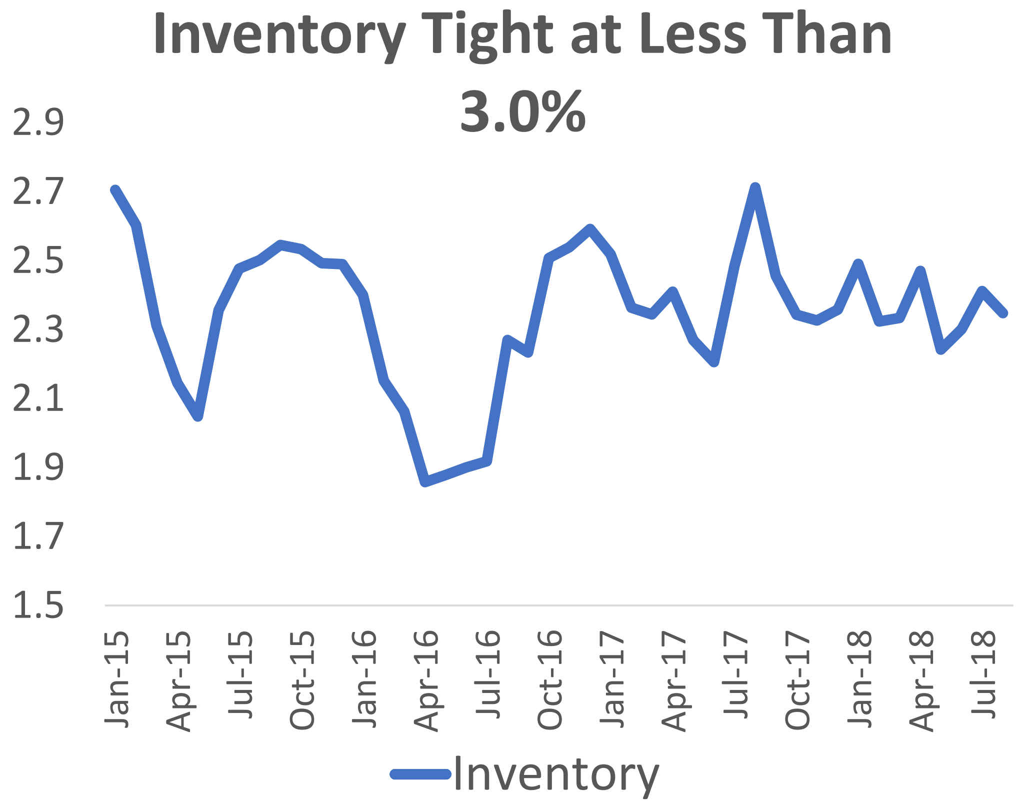


Source: Texas A&M Real Estate Center, calculations of IRF

Ship Channel Cities

Baytown, Channelview, Pasadena

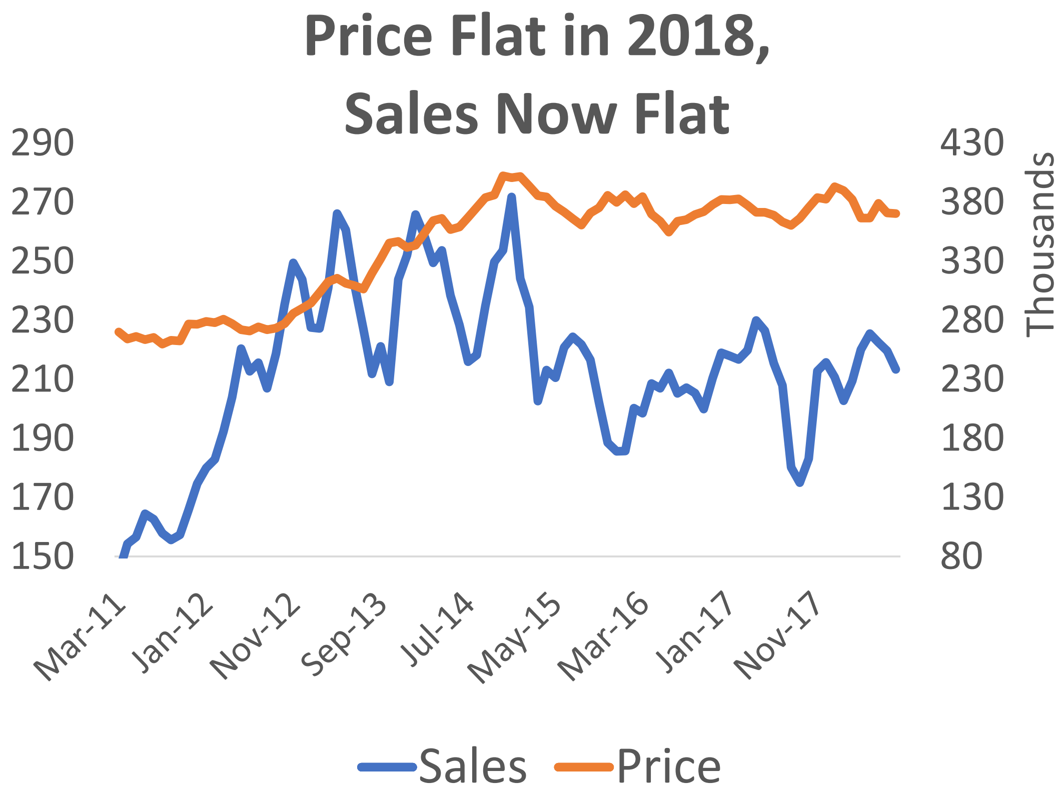


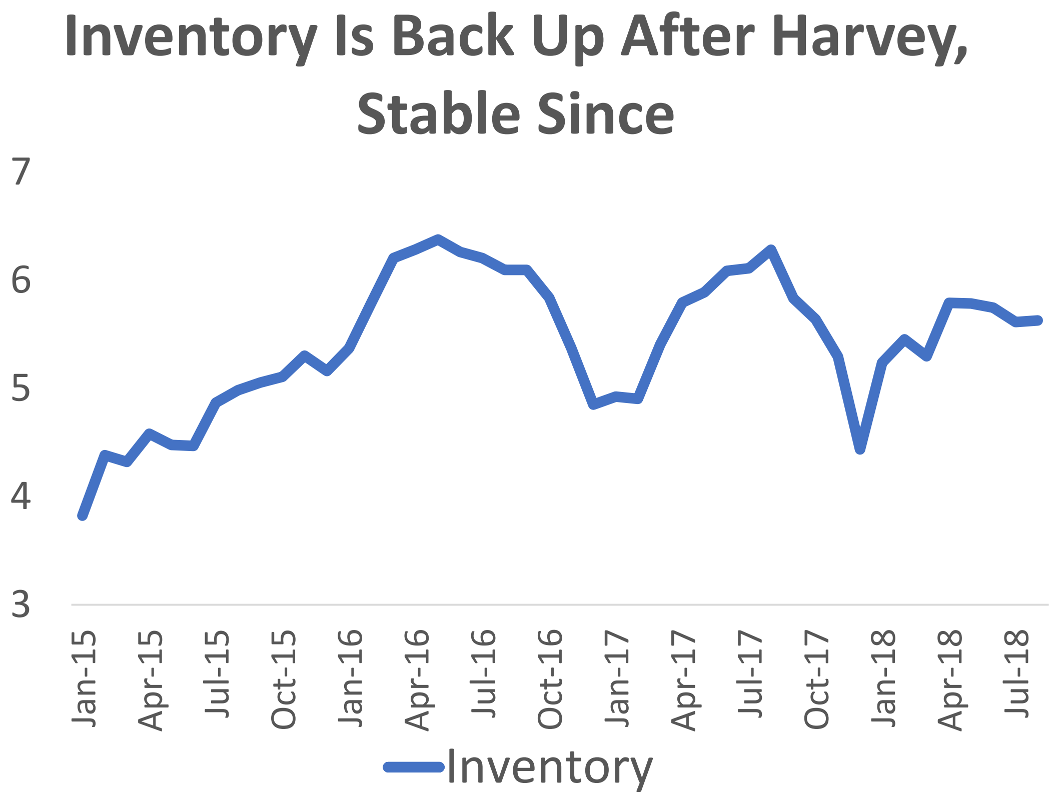


Source: Texas A&M Real Estate Center, calculations of IRF

Close-In and Upscale

Rice Military, Heights, Galleria

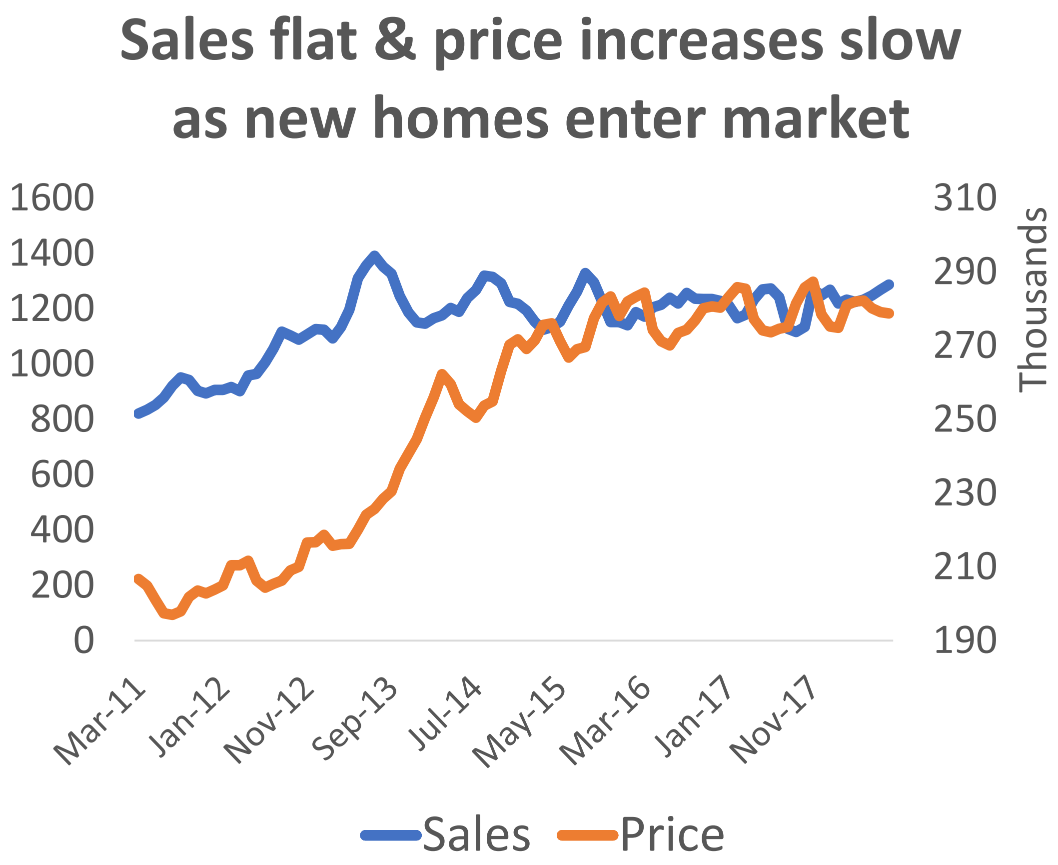


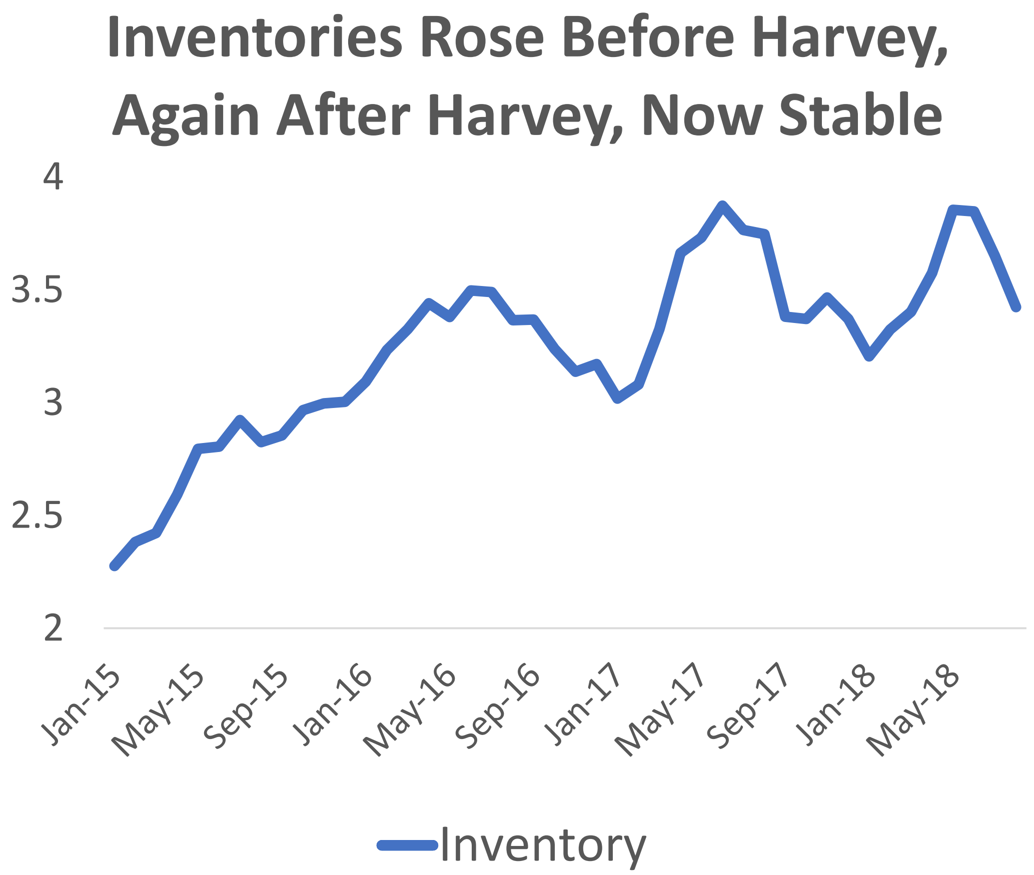


Source: Texas A&M Real Estate Center, calculations of IRF

Distant Suburbs

Pearland, Sugar Land, Kingwood, Katy





Source: Texas A&M Real Estate Center, calculations of IRF

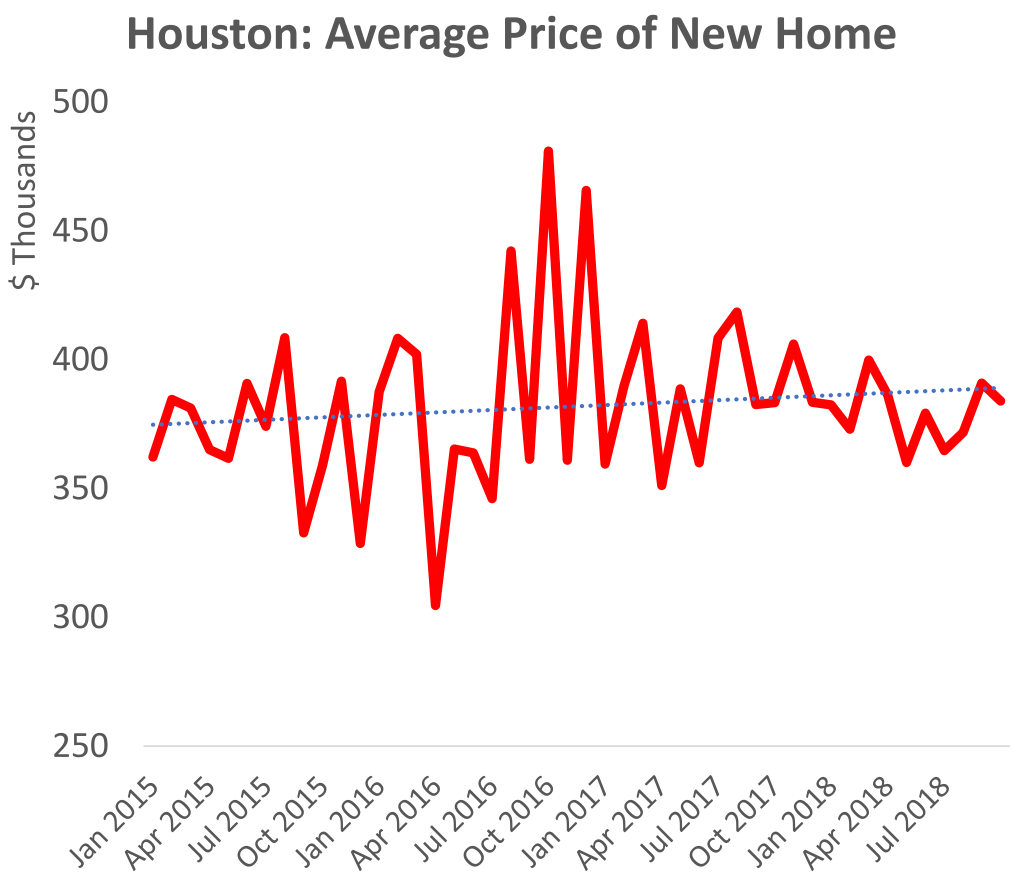
New Home Sales: A 2018 Boost from Harvey and Higher Oil Prices Wore Off By Summer

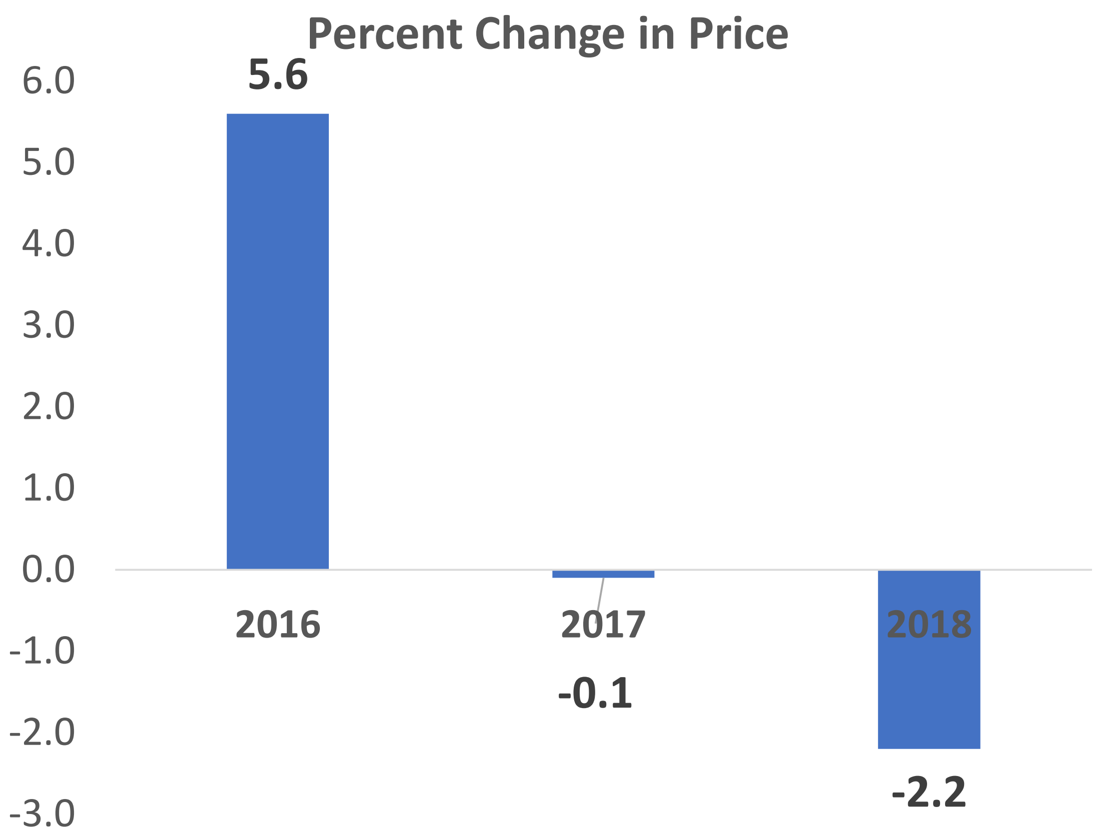
Meyers Research

Traditional Entry-level Houses Are Still In the Driver's Seat for New Home Sales

- A long history of missteps on lot development
  - By 2012, the fracking boom generated strong demand for large homes for high-end engineers/executives
    - Existing home supply was quickly exhausted, and there were no lots on the ground to build large homes. Pressure grew on existing homes
    - Low inventories and sharply rising home prices slowly squeezed 100,000+ families out of the housing market
  - By 2015, the large lot supply caught up – just in time for the drilling bust to abruptly end the demand for upscale housing
- The last three years have paid off in lot development for low- to moderately-priced homes with 45-60 foot frontages. The sweet spot today lots of 50-54 foot frontages and homes priced at $300,000
- Lot development is still heavily oriented to smaller frontages, while rising construction costs squeeze the lower price points

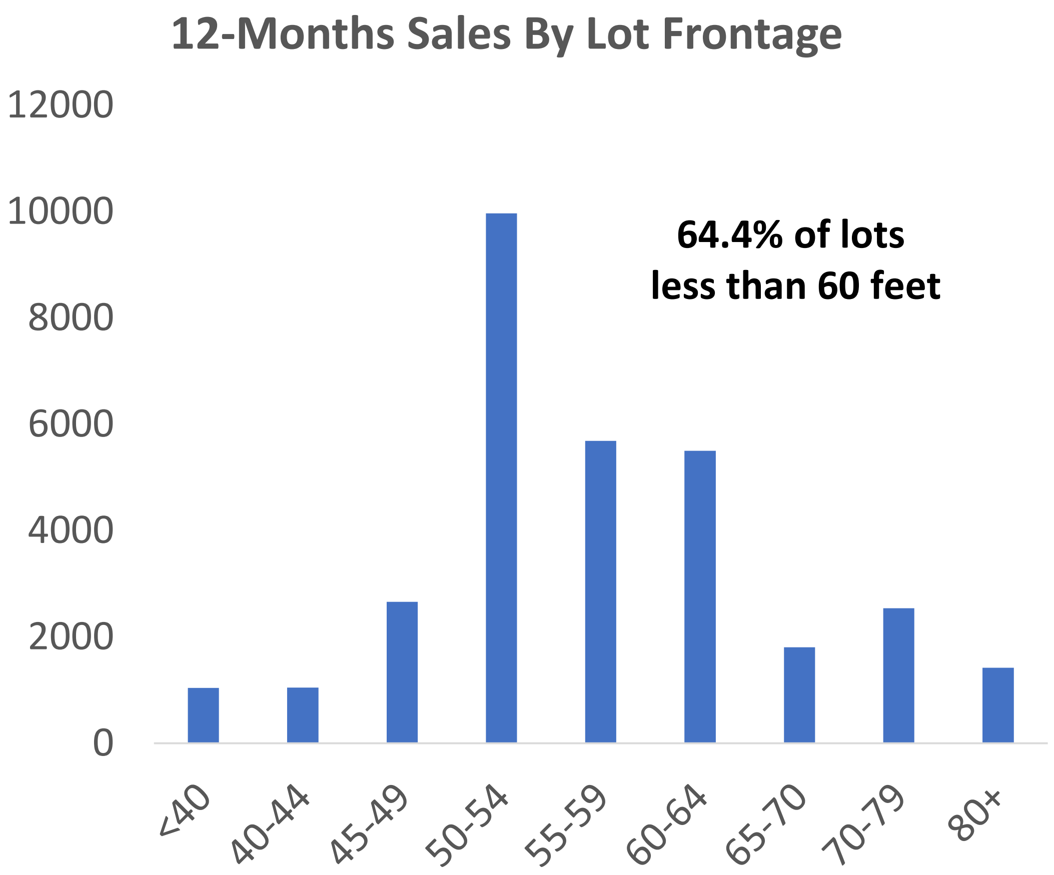
Change of Sales Mix to Smaller Homes Has Cut the Average Price of a New Home





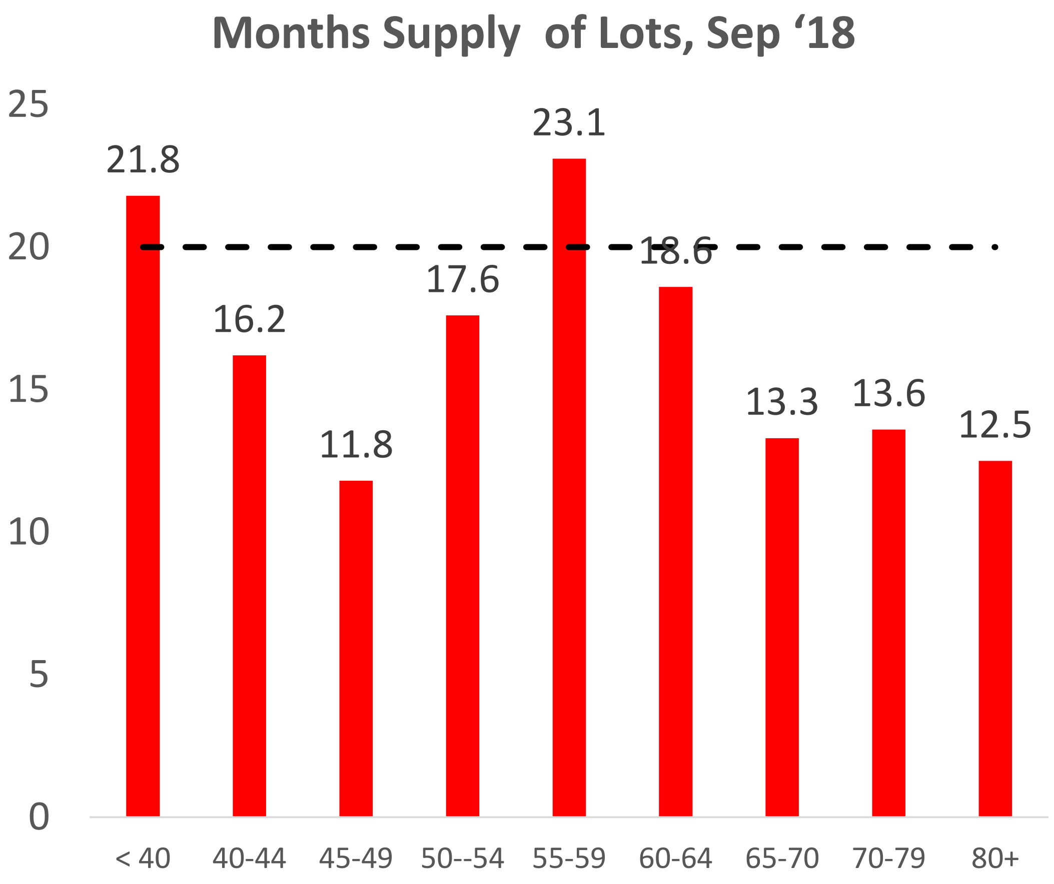
Meyers Research

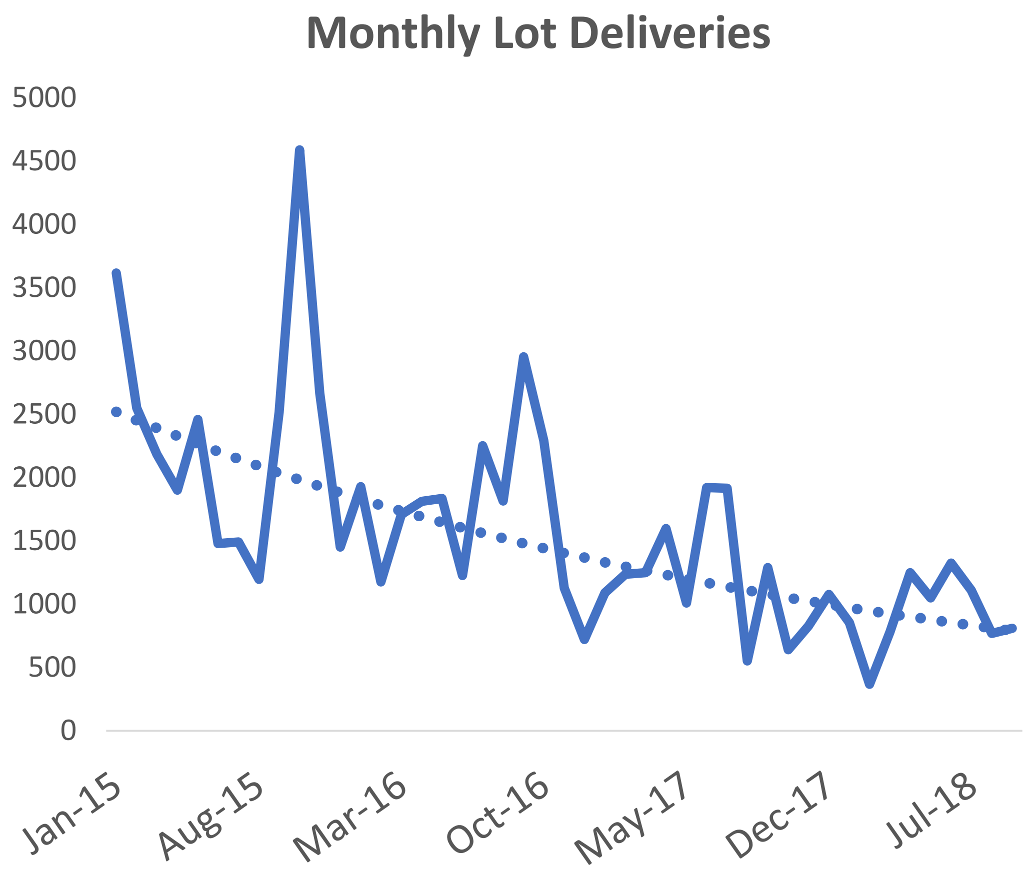
Lot Development and New Home Sales Still Squarely Focused on Entry-Level Homes



Zonda by Meyers Research

New Home Lot Supply Tightens Again, But Slowing Sales and Good Pipeline Are the Cure





Zonda by Meyers Research

Apartment Market Looks for a New Equilibrium After Harvey and Oil Recovery

Harvey Effects Are Gone Now: The Economy Is Back in Charge

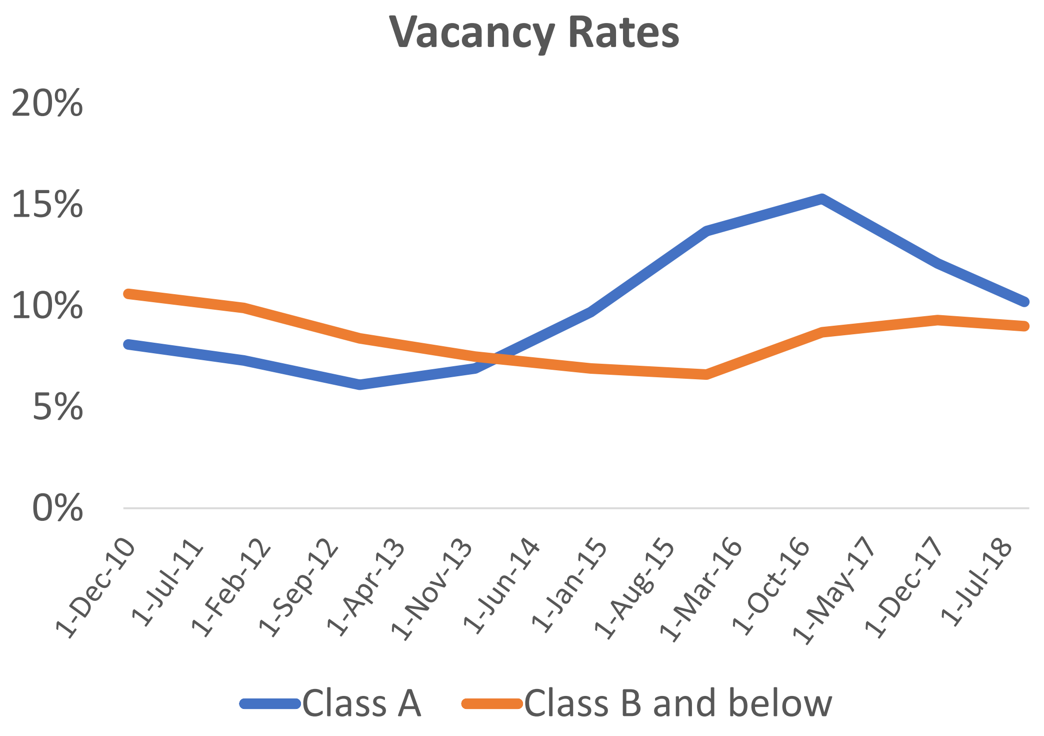
Class A Rents and Occupancy After Harvey			
	Stable	In Lease Up	All Class A
No. of Units	131,540	14,829	149,239
Monthly Rent	$1,494	$1,602	$1,540
Occupancy	91.7%	61.4%	85.%

Apartment Data Services through September

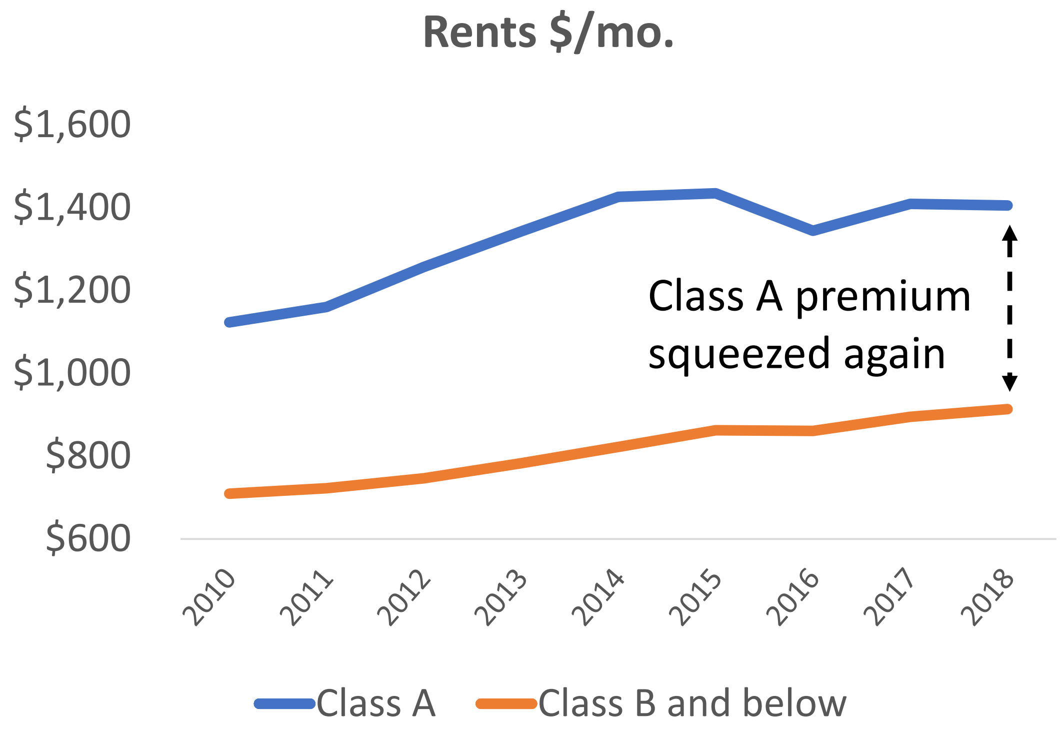
- With Harvey-damaged units removed, Harvey-driven absorption over, and renewed economic growth, occupancy is back at 92% for Class A, 90% overall
- Overall occupancy bottomed out at 88.1% in March 2017, and surged to 89.5% through March 2018
- A final echo is being felt in Q3 of this year, as 12-month Harvey leases roll over. Occupancy has been flat since May and near 90%
- There are still plenty of buildings with incentives, but more than a month is rare except for high-rise buildings

Feeling the Last Echo of Harvey as 2018 Ends

Class A Vacancy Falls to 10.2% in 2018, Class B stays at 9.0%

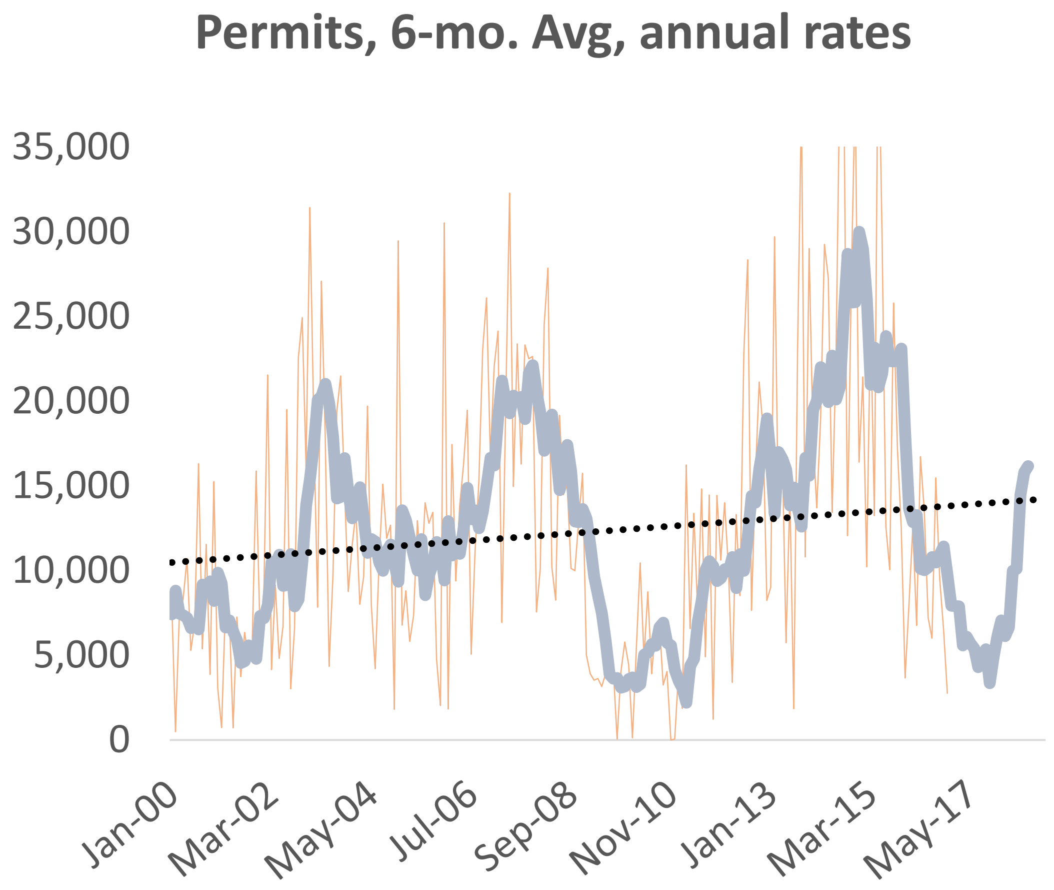


Class A Rents Down from 2014 Peak, After Accounting for Harvey and Economy



CoStar vacancy and rents to September

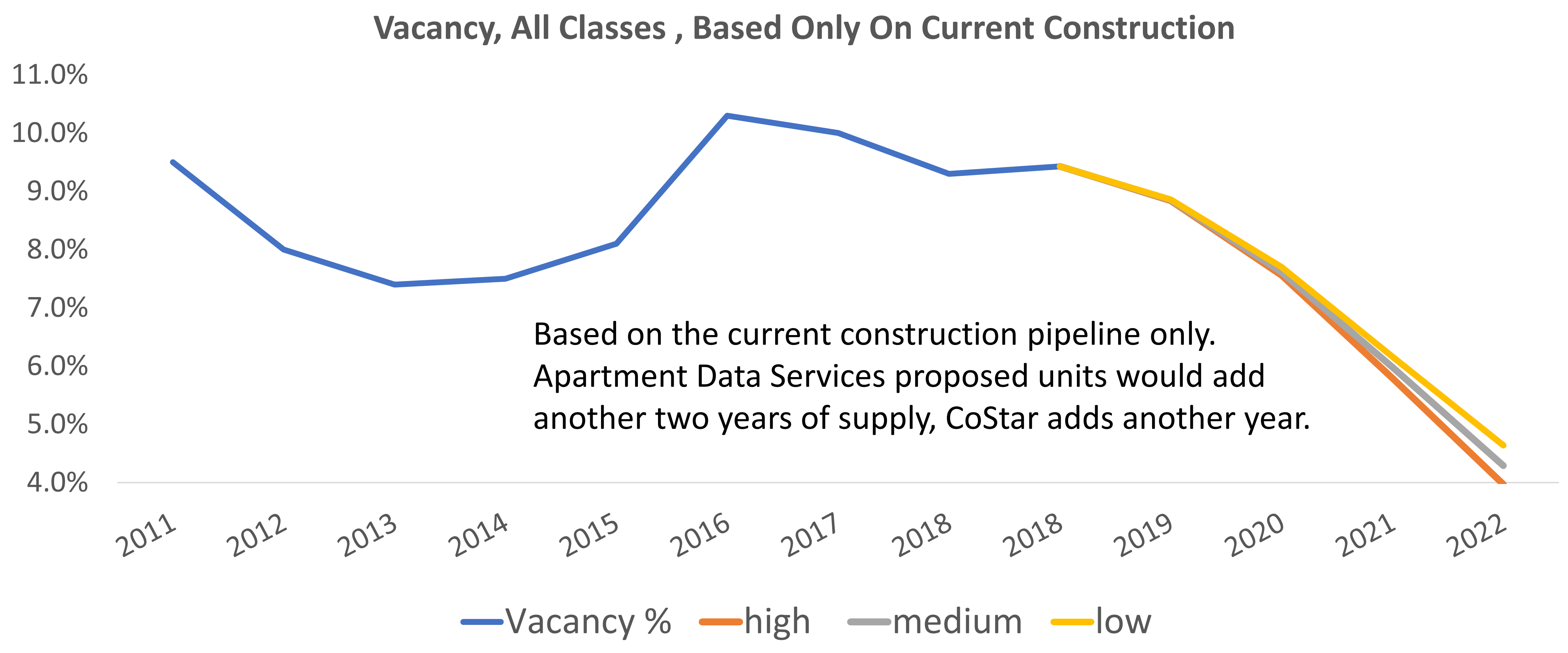
The Apartment Construction Cycle Starts Again



TAMU Real Estate Center

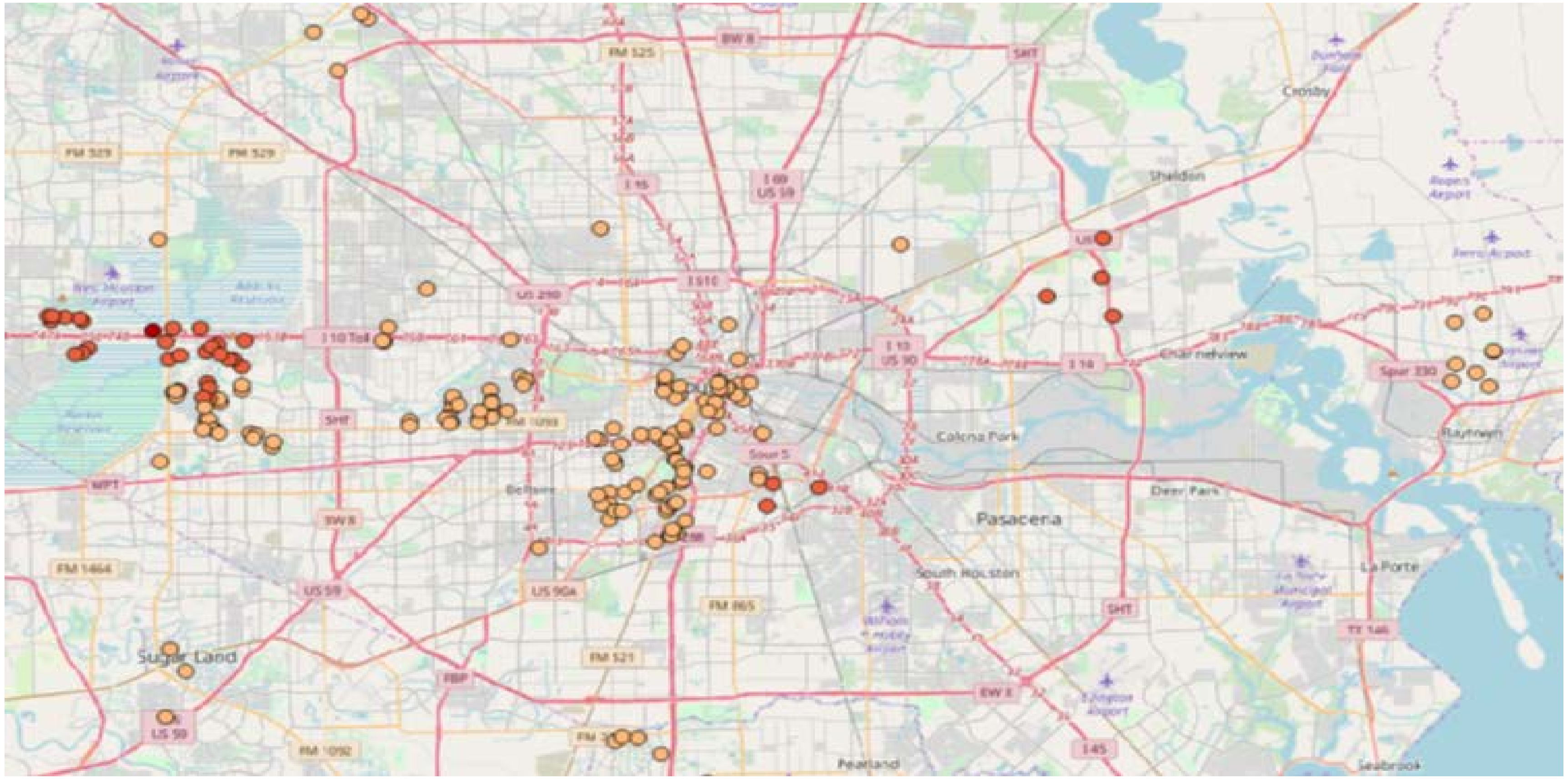
- The building cycle starts again. The number of units absorbed each year in our medium forecast should be about 12,000. We never seem to find that equilibrium
- Permitting over the past 6 months is at 16,000 units at annual rates
- Apartment Data Services says 47,000 units that will need to be filled in the future: 9,000 units recently opened, 11,000 under construction, and 26,000 proposed. CoStar has about half the number proposed units

Renewed Economic Growth and the Current Construction Pipeline Would Bring Rapid Gains



CoStar and calculations of IRF

Class A Multi-Family Markets with Late 2018 Vacancy Rates Greater than 10 Percent



Light Dot = Property located in 2-mile radius market area with 10%+ vacancy
Dark Dot = Same but > 20%+

CoStar and calculations of IRF

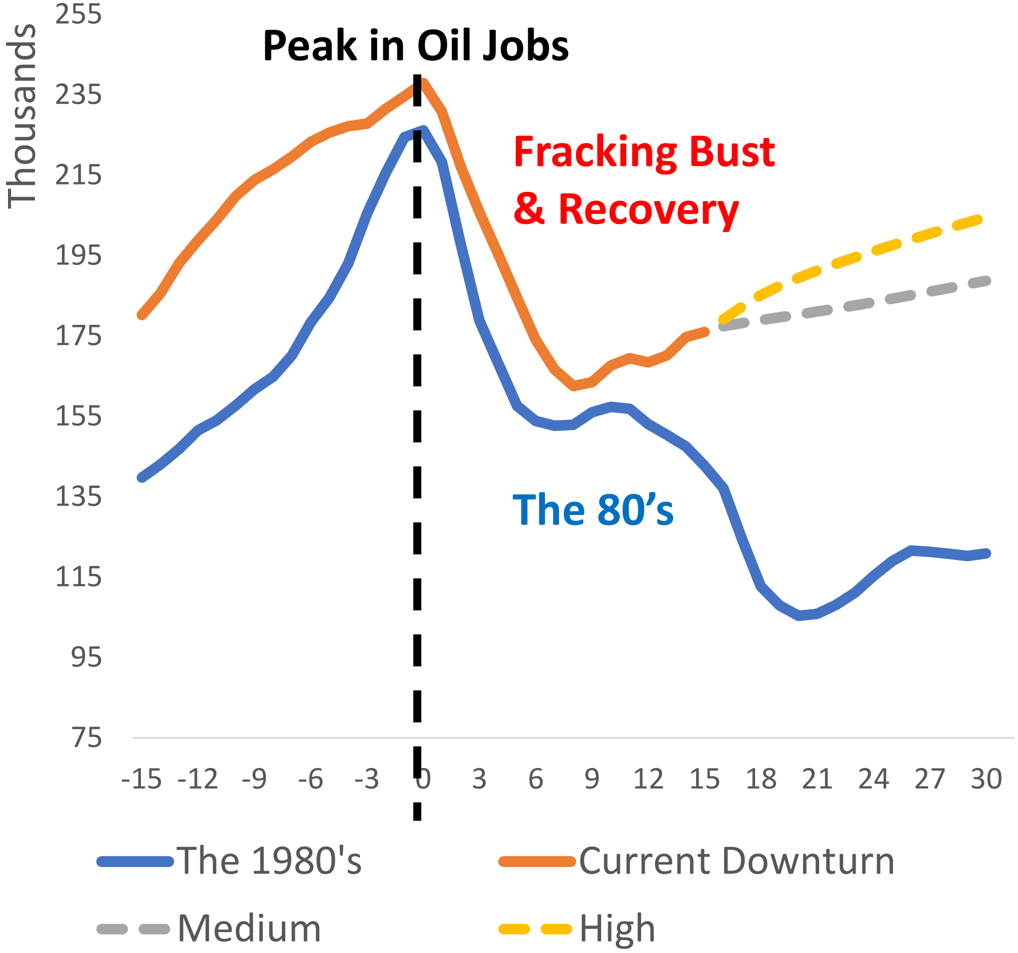
Recovery Begins in the Office Market …
But a Long Way to Go

A Tepid Recovery in Local Oil-Related Jobs Leaves the Office Market Treading Water

Largest 2018 Leases Fail Impress as Group

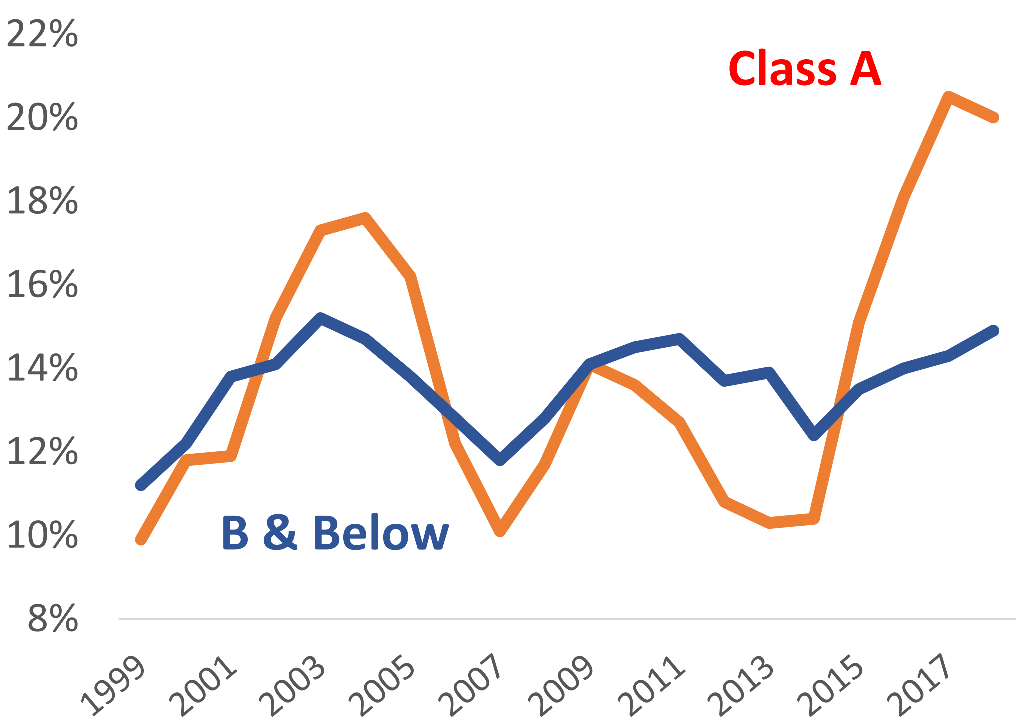
Tenant	(000) ft-sq.	Terms
Apache	515	Extension
Transocean	300	New
Schlumberger	226	Renewal/Expansion
Vinson & Elkins	212	Prelease
Hines	155	Prelease
EY	121	Relocation
Harris County	118	New
Gulf Interstate	115	Renewal
Sable Permian	98	New
Constellation/Exelon	94	Sublease
BP Lower 48	91	New
Alta Mesa	89	Renewal
Asurion	86	New
Energy XXI	85	Renewal
Acclara Solutions	83	Relocation/Expansion

Houston Business Journal, October 2018



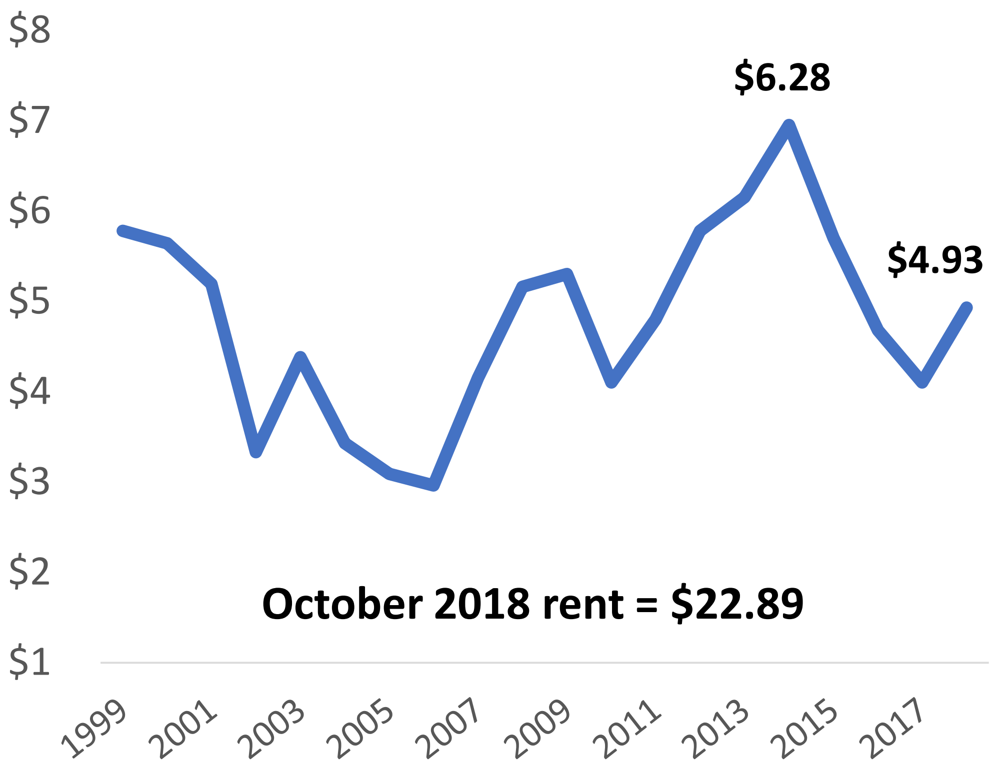
Improvements Are Real in 2018: Just Not Very Big

Class A Vacancy Rates Nearly Double, Move Down From Highs in 2018



CoStar

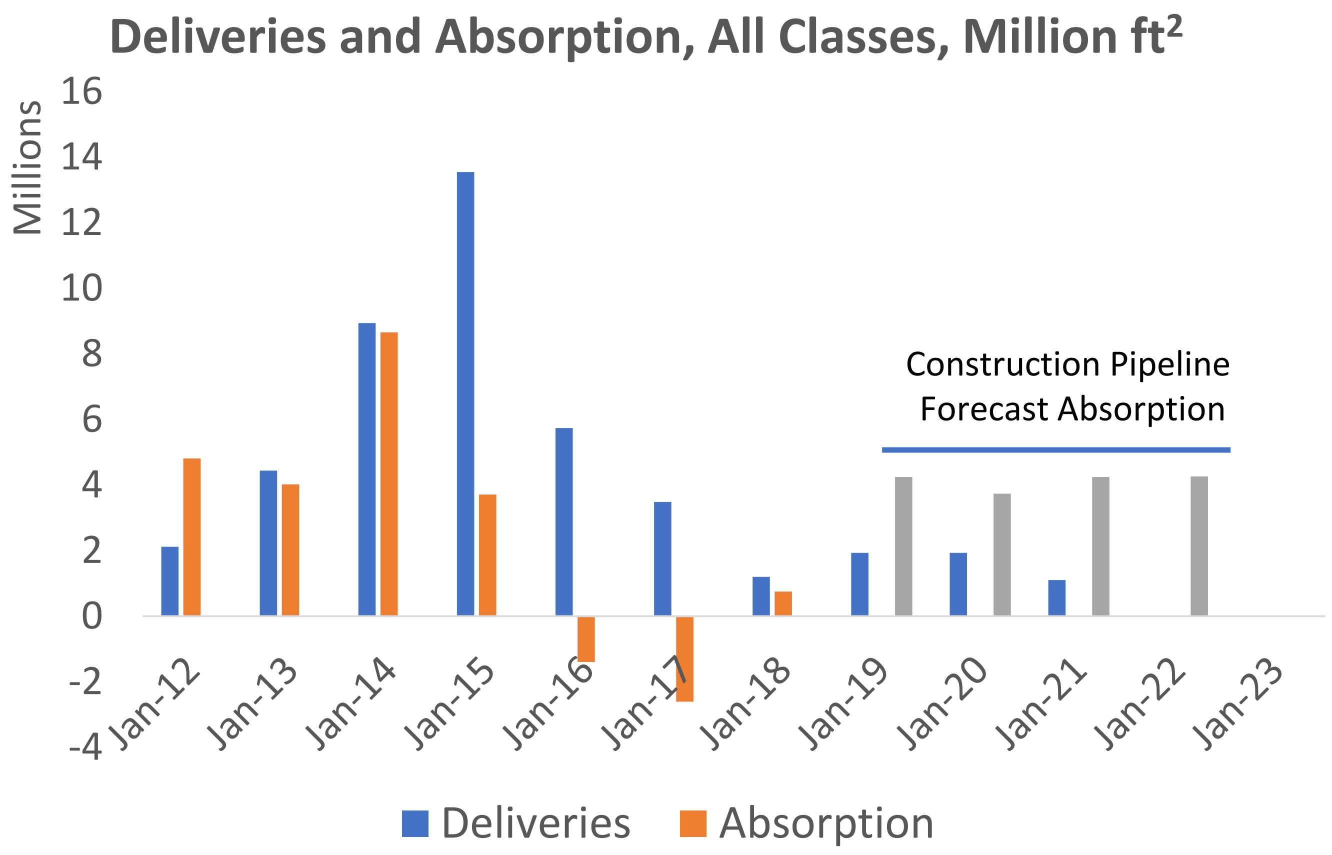
Class A Rent Premium Still Cut by 20% between 2014 and 2018



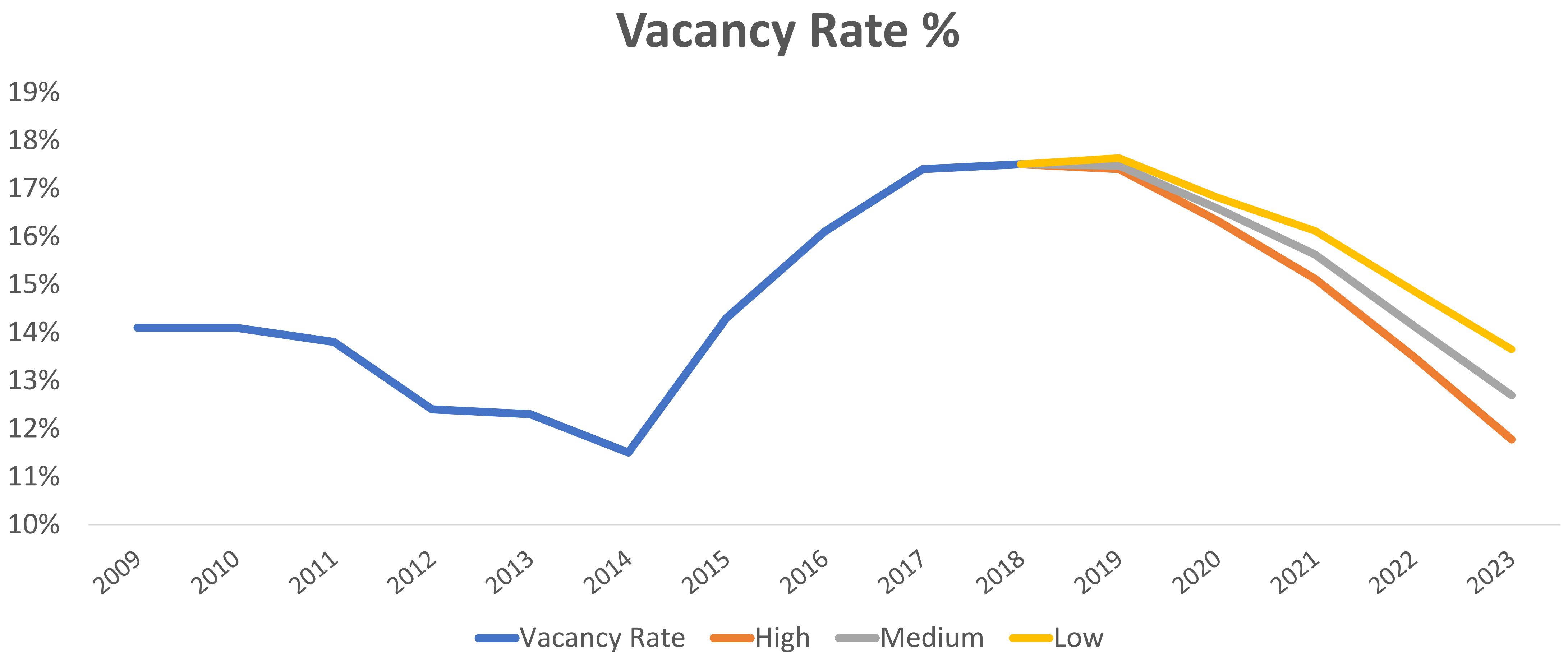
Limited Deliveries and Annual Absorption of About 4 million Ft^2 Slowly Brings Vacancy Rates Down

Absorption Stumbled in 2015
(Million ft^2)

	Deliveries	Absorption
2012	2.1	4.8
2013	4.4	4.0
2014	8.9	8.7
2015	13.5	3.7
2016	5.7	-1.4
2017	3.5	-2.6
2018	1.2	0.8
2019	1.9	4.2
2020	1.9	3.7
2021	1.1	4.3
2022	0.0	4.3

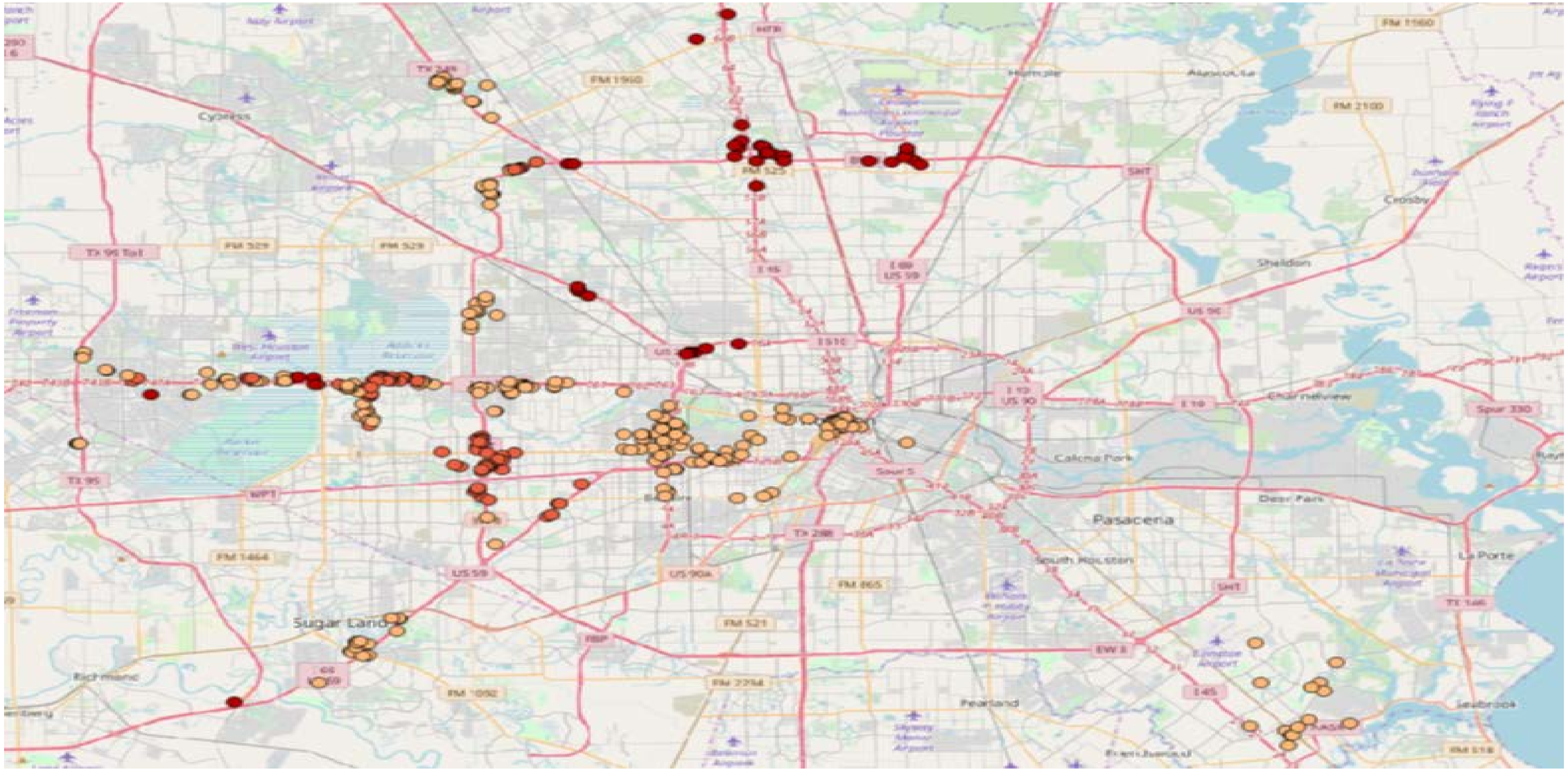


Office Vacancies Have Probably Peaked: But a Long Way to Go for a Healthy Market



CoStar, Calculations of IRF

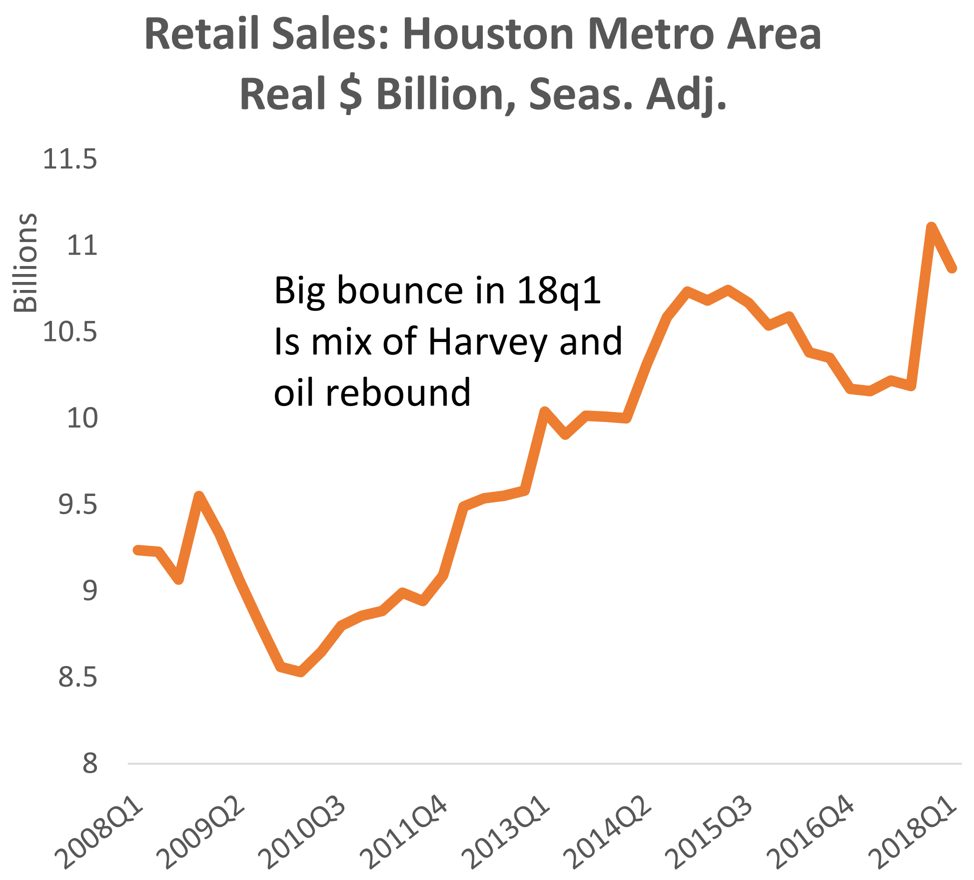
Vacancy Greater than 20 Percent: Energy Corridor, Westchase, and Greenspoint

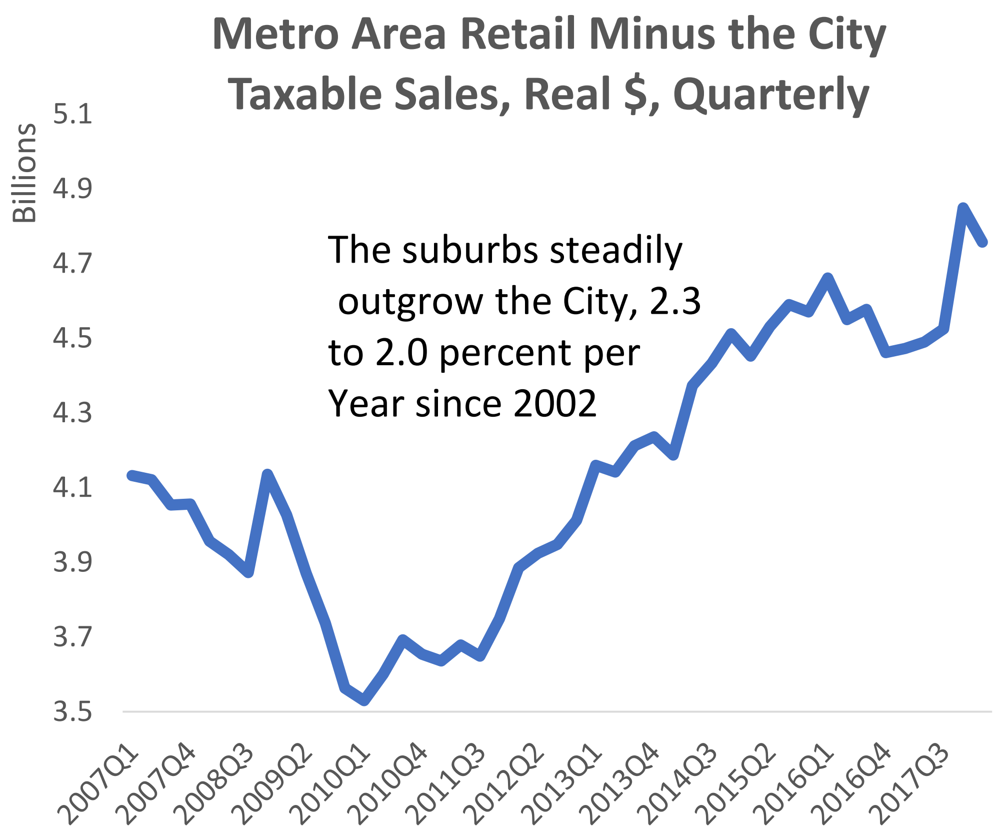


Light Dot = Building located in 2-mile radius market area with 10%+ vacancy
Dark Dot = Same but 20%+ vacancy

Retail Market Continues to Tighten

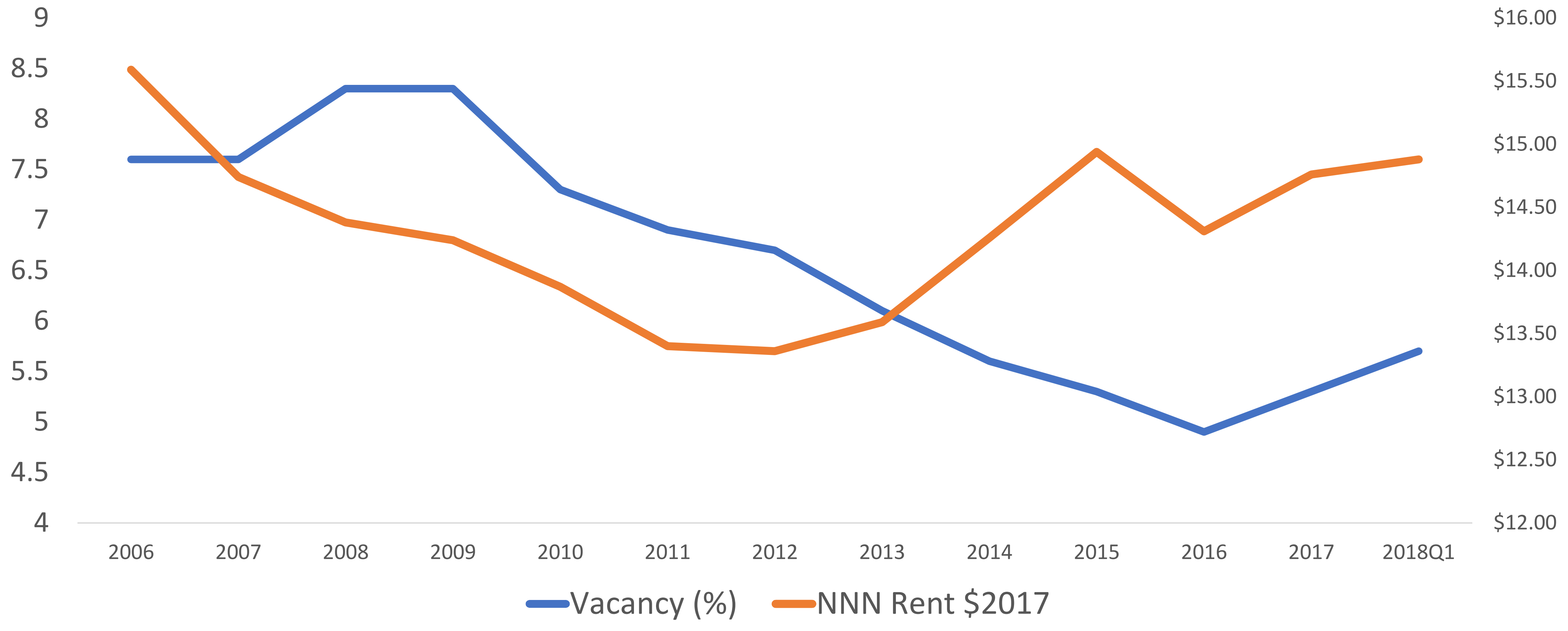
Harvey and Rising Oil Prices Generate a Big Retail Bounce in 2018



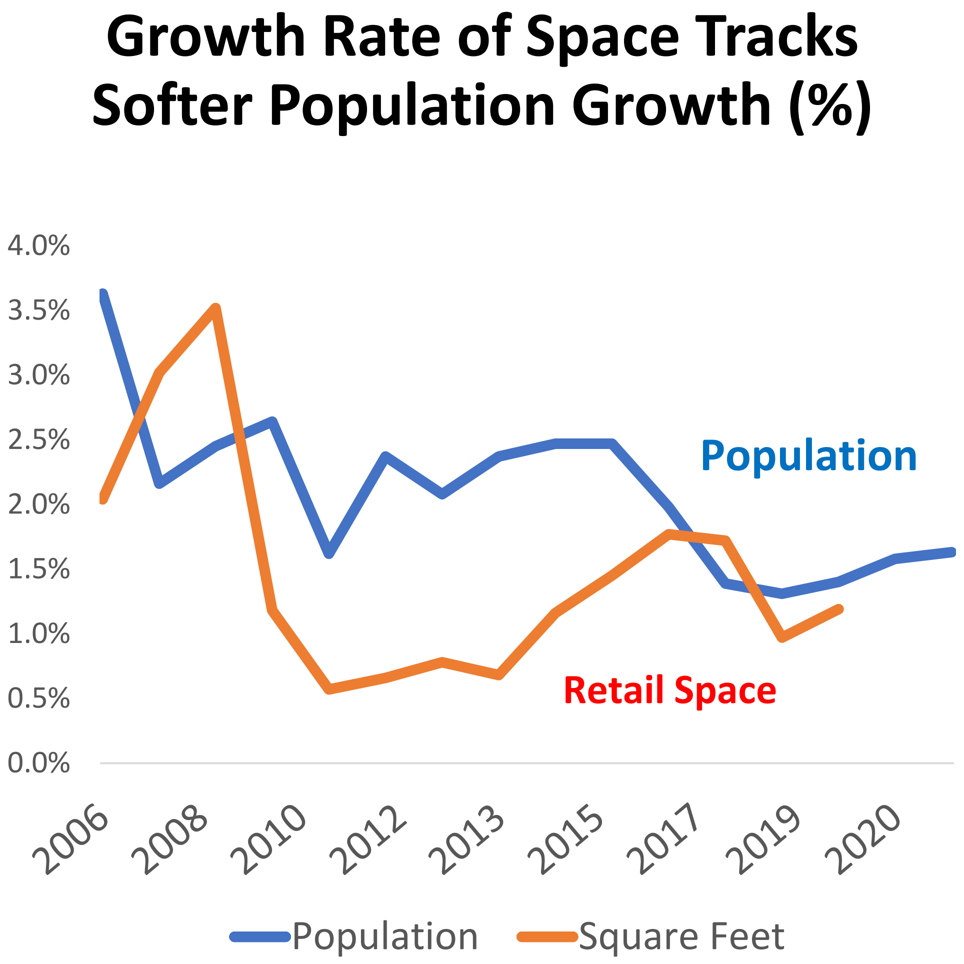


Texas Comptroller

Rising Rents, Low Vacancy Continue in Houston's Retail Sector

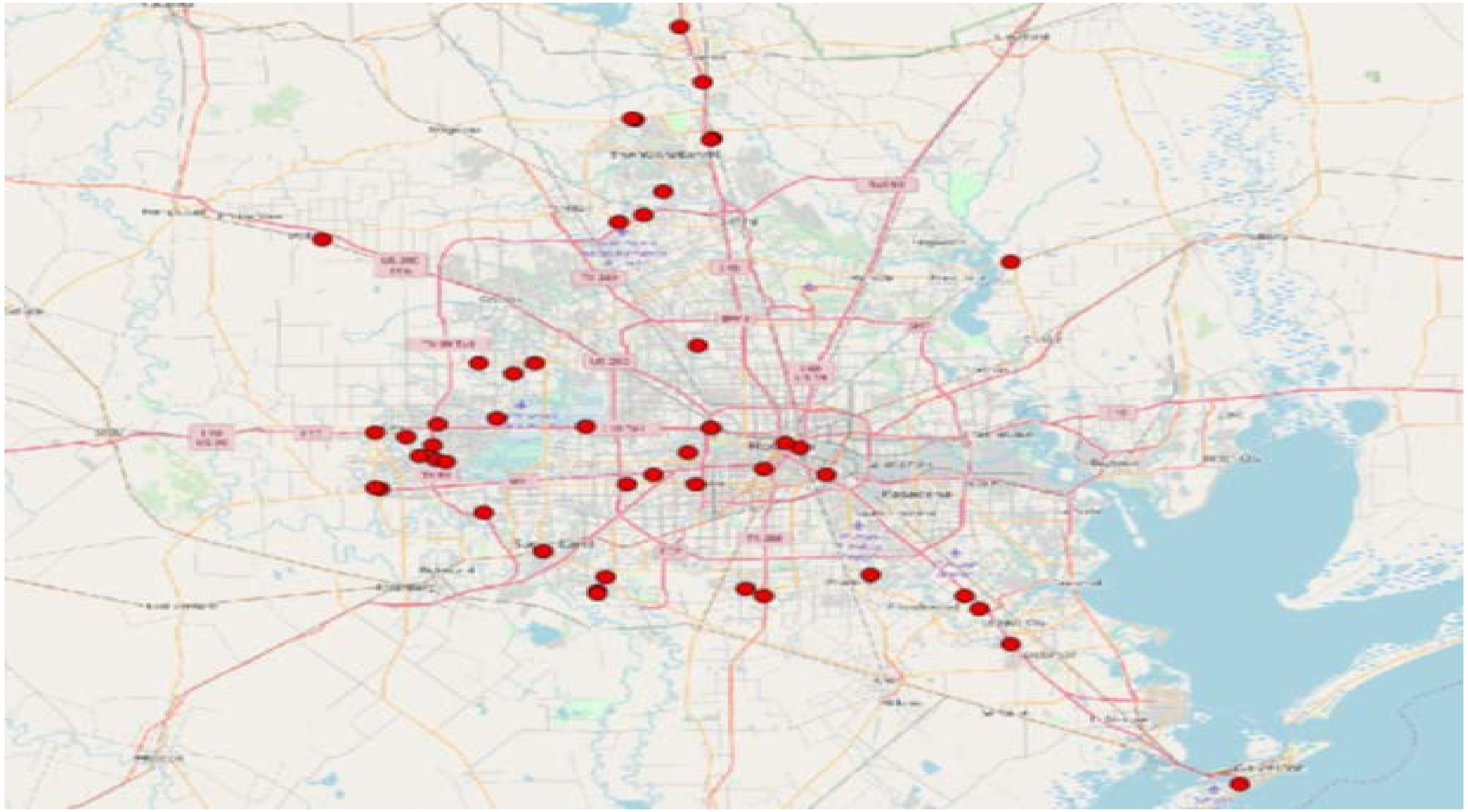


Retail Pipeline Shows Healthy Growth, In-Line with Population



CoStar 2018Q3, deliveries and retail growth stated at annual rates

Suburbs Rule Retail Construction: Only 10 Large Projects Inside Belt 8



CoStar

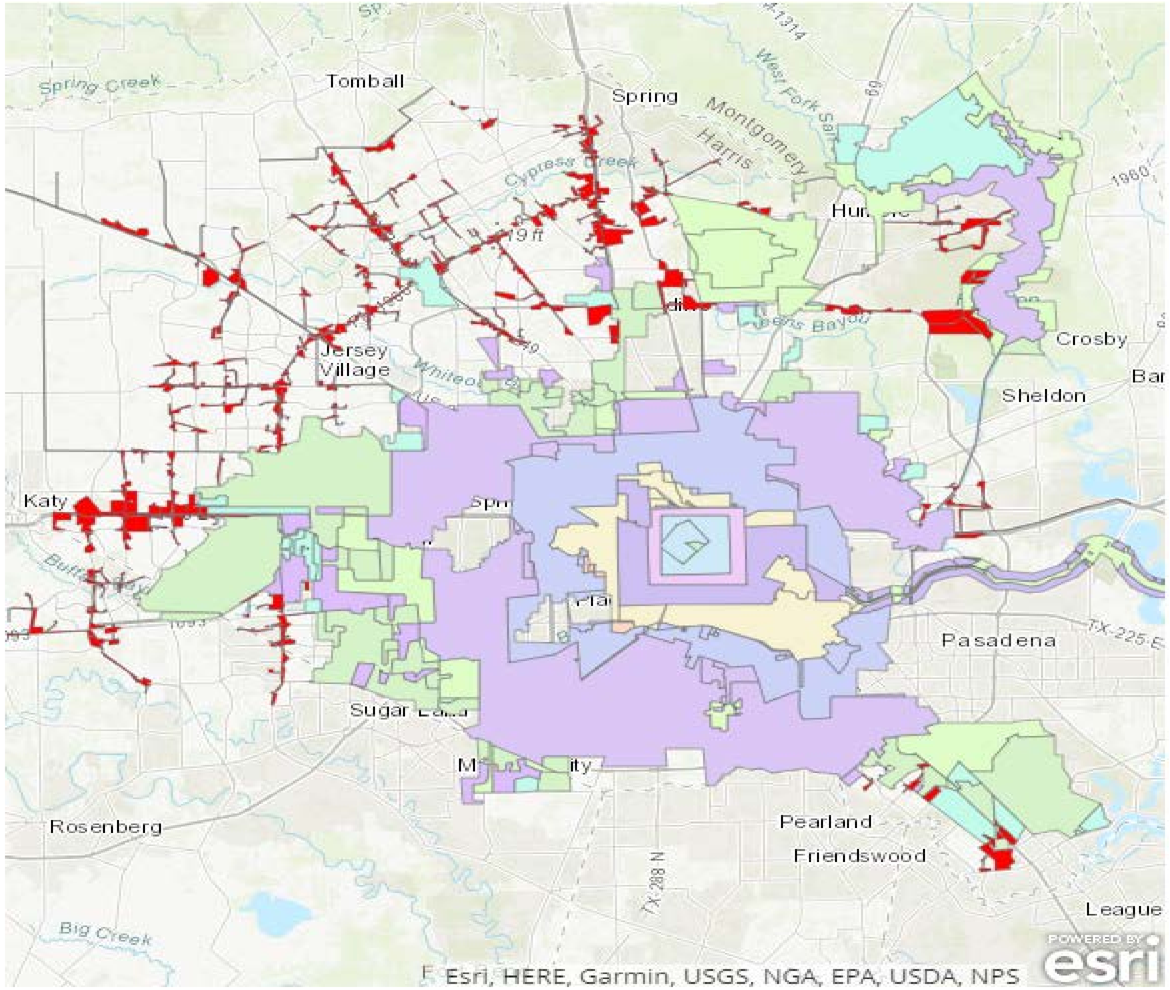
Quill and *Wayfair* Decisions: Will They Even the Playing Field for Brick and Mortar?

- In 1992, in *Quill Corp. v. North Dakota* the U.S. Supreme Court ruled that sales taxes had to be paid on an item only of the seller had a physical presence in the state
- *South Dakota v. Wayfair, Inc.* saw South Dakota fight back, passing their own "no physical presence" law, requiring online retailers to pay state sales taxes. More than 20 states followed their lead.
- On June 21, the Supreme Court changed directions, and ruled the physical presence rule was unsound and incorrect in the age of internet services
  - The Court said that the states, brick-and-mortar stores, and interstate commerce were being harmed by the physical presence rule
  - The nature of the internet redefined the "physical presence" landscape
  - It is no longer a burden on vendors to apply the correct sales tax

Texas Comptroller's Draft Guidance

- The Texas State Comptroller issued draft guidance on *Wayfair* in September that makes remote sellers liable for sales and use tax in Texas
- *Most large online retailers already comply*, and the guidance provides a safe harbor for remote sellers with less than $500,000 in revenue over the prior 12 months. Permitting and collection obligations for other sellers begin October 2019
- The main question that remains unanswered is compliance with the many local jurisdictions in Texas – those jurisdictions that piggyback with a penny on the state's six cent.
- The *Wayfair* decision says to assign tax liability at the location of the buyer. This is easy for the state – we all live in Texas. It complicates quickly if the vendor must decide from which municipality, MTA, fire, crime or hospital district to collect
- The size of the safe harbor exemption, the date of compliance, and the fate of local taxes all seem likely to wind up in the hands of the legislature in early 2019

How Many of the Smallest E-Commerce Vendors Can Reasonably Be Expected to Comply?

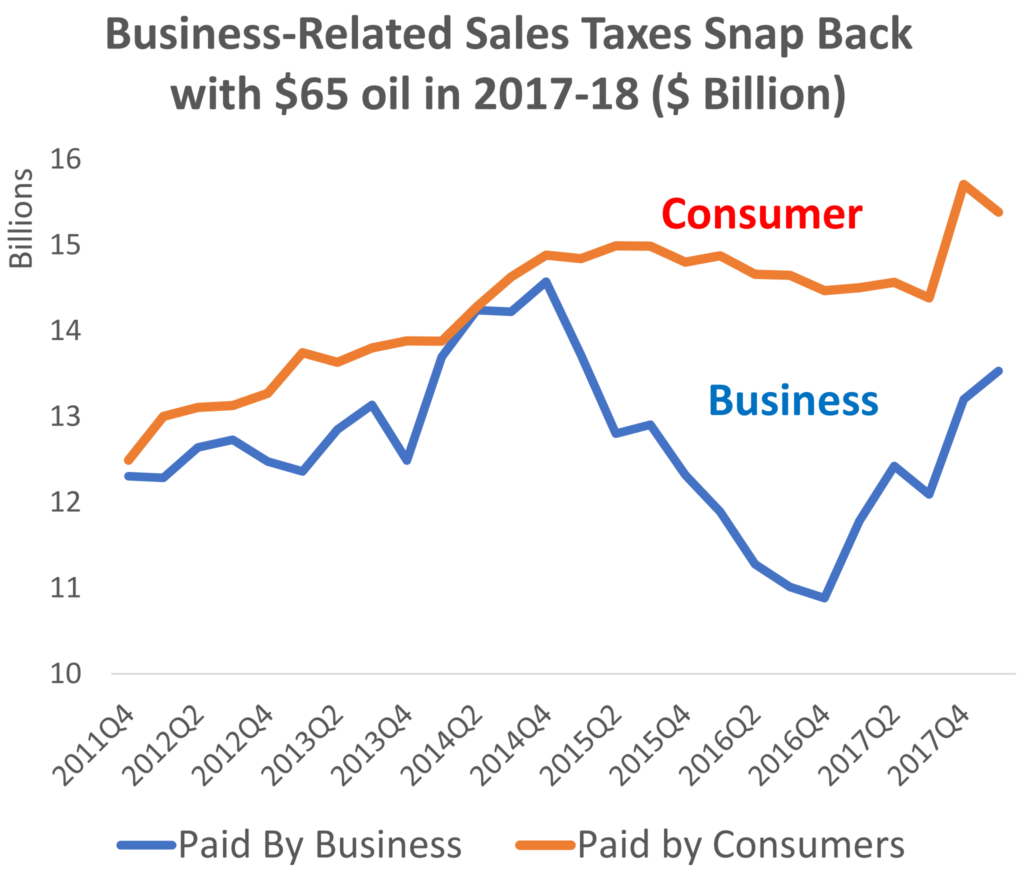


- *Local* taxes can vary from house to house, block to block, and across a metro area. Look at the City of Houston's crazy-quilt of limited purpose annexations. (The web in red)
- For Texas vendors, the Comptroller assigns a physical address to the seller, and assesses local tax liability based on that address
- But if the vendor is out-of-state, the *Wayfair* decision says to assign tax liability at the location of the buyer. Do they live in the City or county? Ride the MTA? Pay sales tax for emergency services?

Industrial Real Estate Well in the Lead as Economic Growth Resumes

Houston Industrial Hits On All Cylinders: Upstream, Downstream, and E-Commerce

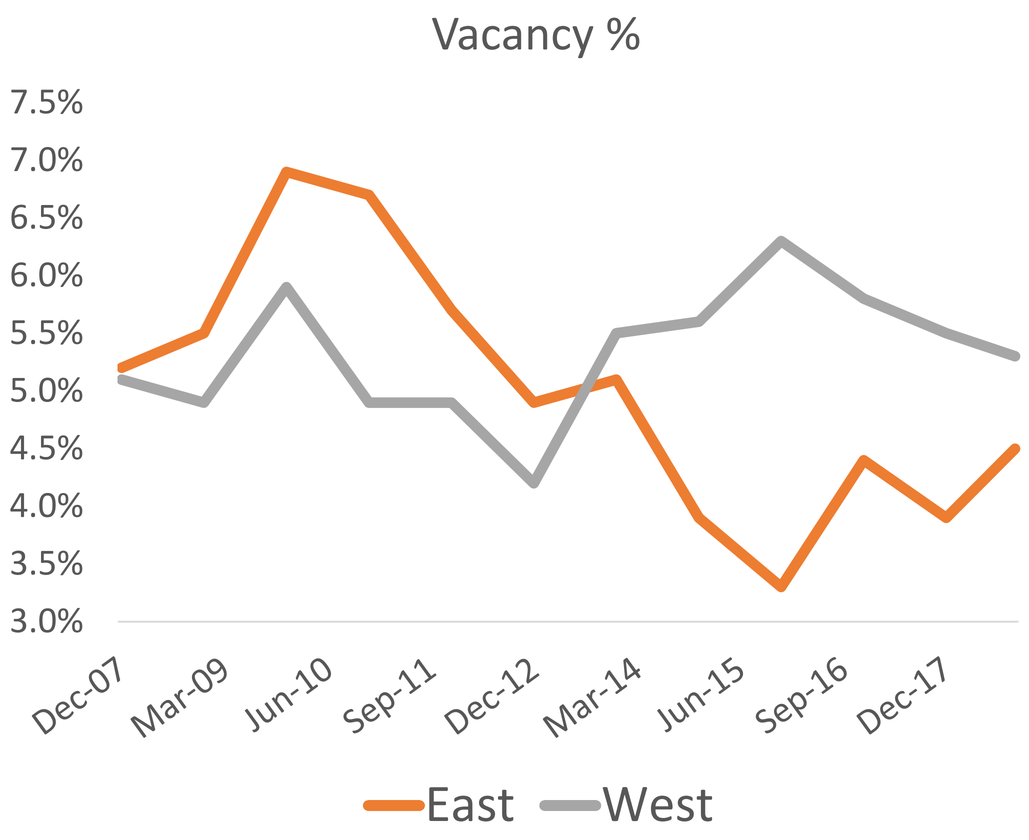
- Eastside/Downstream
  - General container traffic through the port continues to grow, but with a big push from plastic pellets as petrochemicals finish up
  - Oil and oil product exports open new avenues for growth
  - Fear of labor strife in LA/Long Beach pushes contingency warehouses into Houston, Mobile, and other Gulf Coast ports
- Westside/Upstream
  - Industrial and warehousing activity has bounced back with $65 oil
  - “Last mile” warehouse/distribution from e-commerce helps the west/northwest



Business sales include those by manufacturing, construction, wholesale trade, transportation and warehousing, Professional and technical services, and others. Consumer sales are retail, food and drink, entertainment, etc.

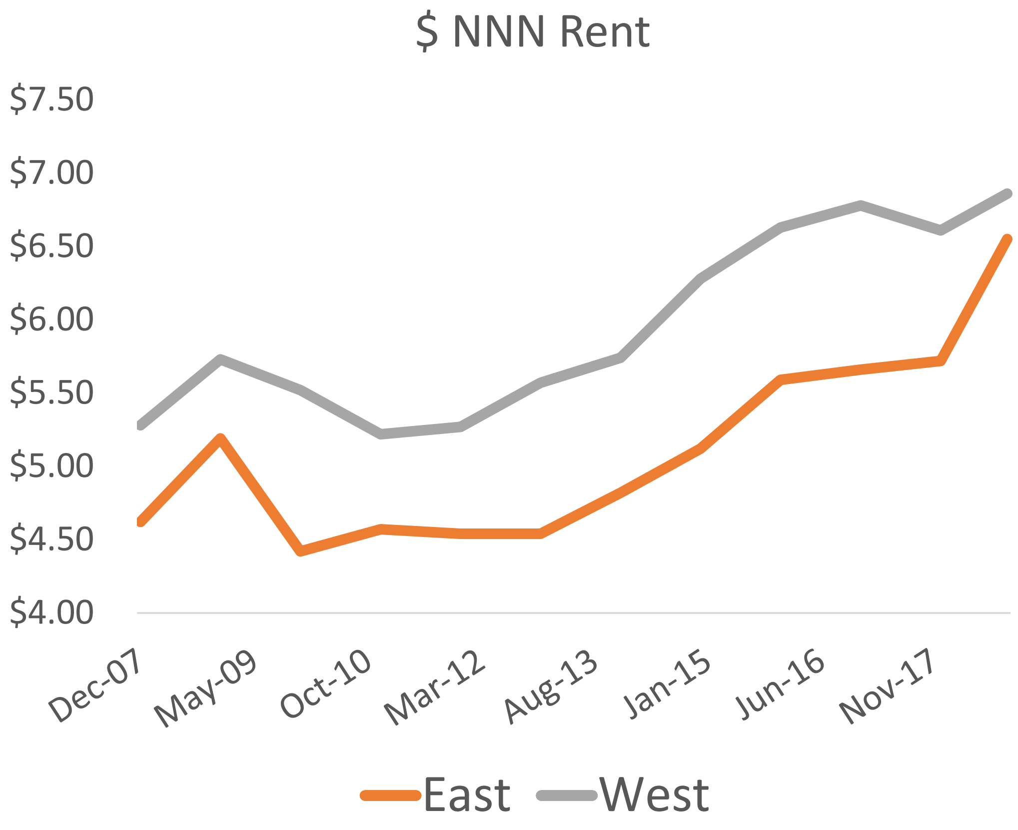
Eastside/Westside, Downstream/Upstream

Westside Vacancy Falls As Price of Oil Rises in 2018



Rents Rising Quickly

On Both Sides of Town



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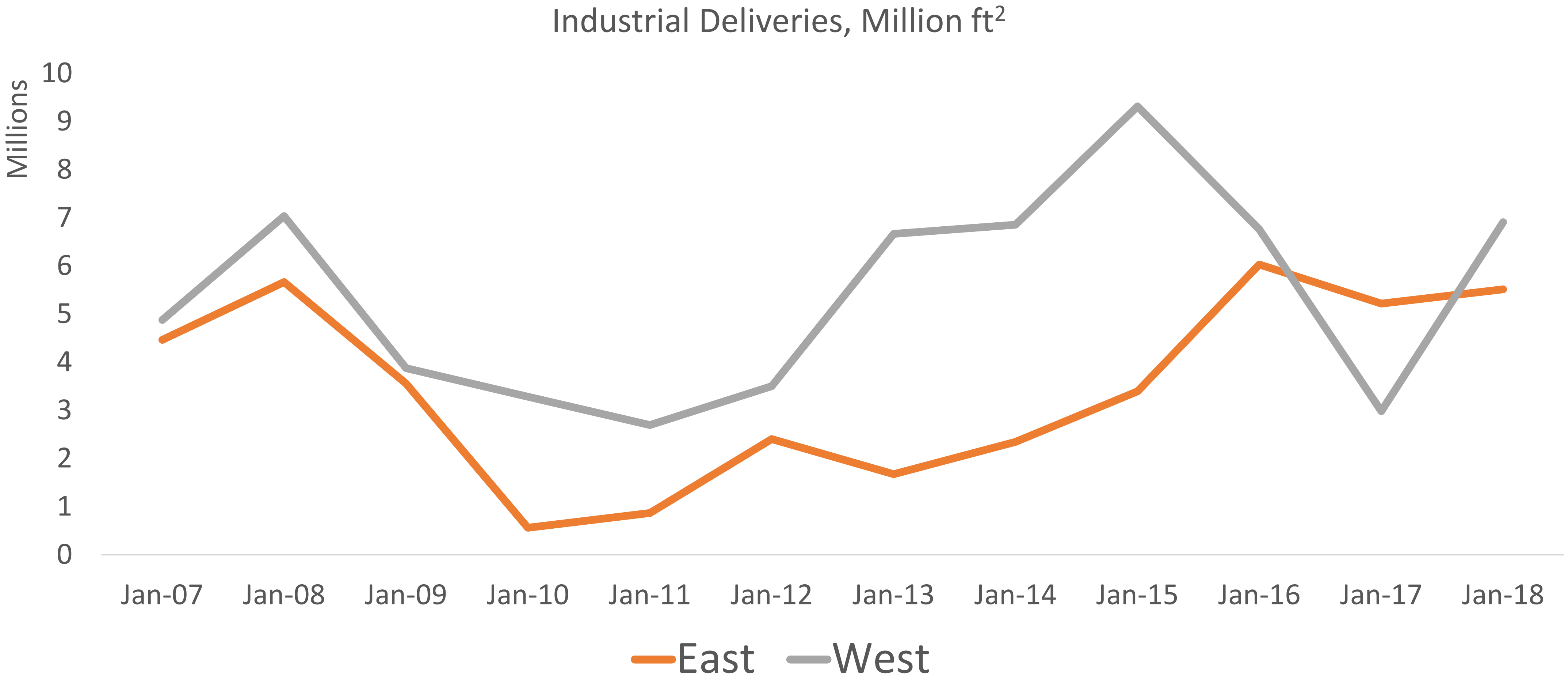
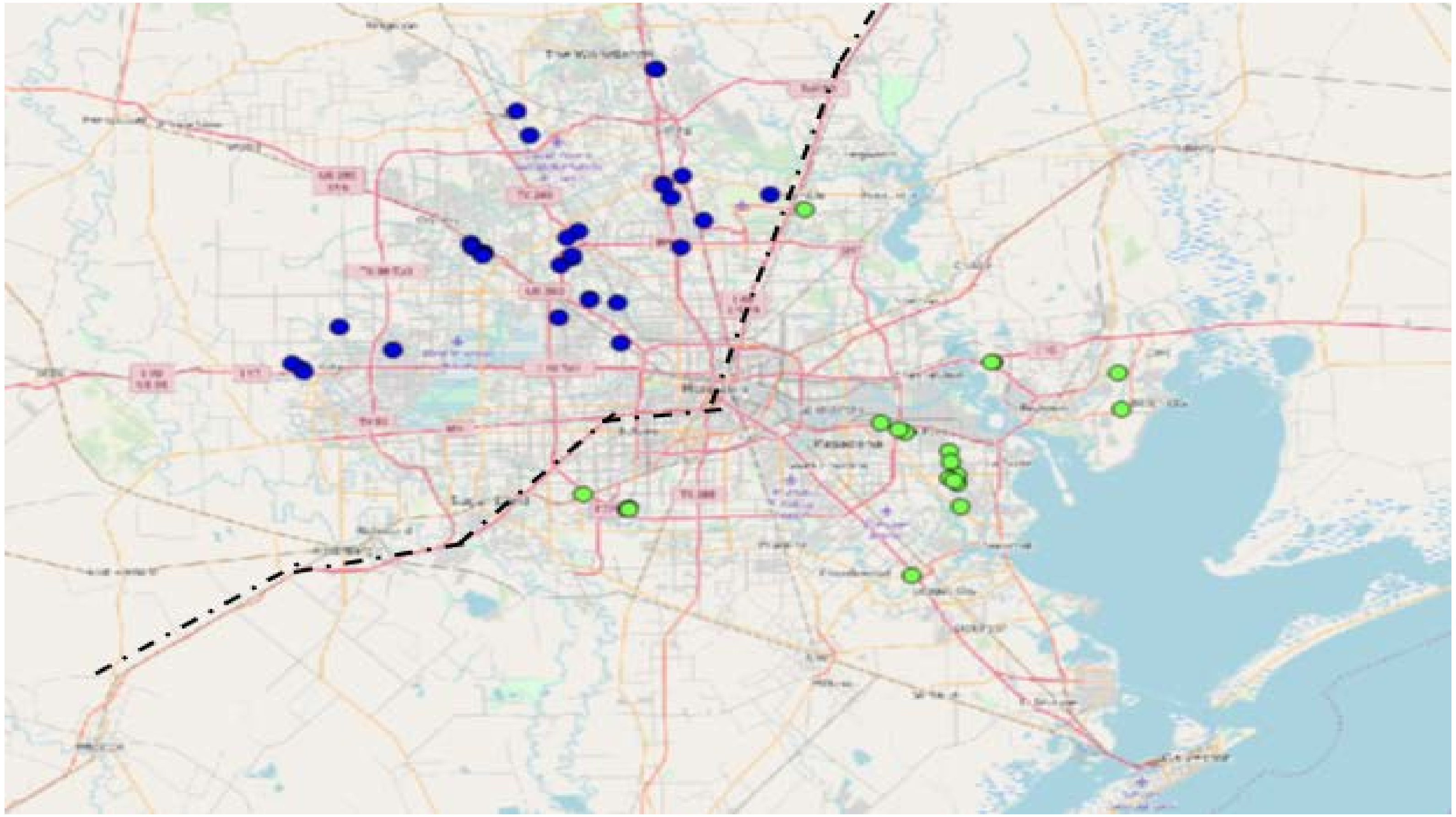
Westside Deliveries Snap Back With Help from Oil and Logistics, East Side Carries On



East/West Split
In Industrial/Warehouse Construction



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Our next symposium will be in May 2019 – date to be determined