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

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C.T. Bauer College of Business
November 6, 2018
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

Down 1.6% in Oct 2016 from Jan 2015 peak

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

Oil recovery is here in 2017-18. But no big bounce in oil jobs so far

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

3-month growth rate, annualized

New Jobs Added in Recovery: December 2016 to Present

- 8,659 retail trade
- 8,526 health care
- 6,897 finance
- 6,556 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

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.

### Houston Employment Estimates Based on Preliminary Sample

Meaningful Revisions Continue for Up to Two years

<table>
<thead>
<tr>
<th>Year</th>
<th>Sample Year (000 jobs, Dec-Dec)</th>
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<tr>
<td>12</td>
<td>118.5</td>
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<tr>
<td>13</td>
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<td>18</td>
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</tr>
</tbody>
</table>

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

- = sample data for year
- = first benchmark
- = second benchmark

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

Harvey and Possible Over-Estimates Removed as Economic Drivers

Likely Revisions Make Current Growth Look More Moderate

Two views on 2018 job growth:
- 4-quarters through 18Q3: TWC 114.1, Adjusted Dallas Fed & IRF 50,100*
- Y-t-d to Q3 SA & annualized: TWC 122.3, Adjusted Dallas Fed & IRF 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%
Percent unemployed, Houston vs. US

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

Oil workers look for work again after long layoffs
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.)

Local Energy Sectors Begin to Turn in Dec 2016 (000, s.a.)

Lost 74,300 jobs in the energy base by Dec 2016. Added back only 14,500 through September 2018

<table>
<thead>
<tr>
<th>Sector</th>
<th>Change in Job Number (000)</th>
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<tr>
<td></td>
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<tr>
<td>Upstream</td>
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<tr>
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<tr>
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<td>Chemicals</td>
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<td>Energy Base</td>
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*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?

<table>
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<th>Oil Price ($/b)</th>
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**Working Rigs After Four Quarters Of Stable Prices**

- Only 1439 rigs predicted with $100 oil.
- Average 2018 oil price is $66.
- 2018 rig count to Sept was 1021.

Graph showing the relationship between oil price and working rigs.
### Given the Price of Oil: How Many Houston Oil Jobs in Our Future?

Even with fewer rigs at $100, Houston oil jobs down less than 10%.

Average 2018 oil price is $66 and local oil jobs below expectations at 245,000.

#### Working Rigs After Four Quarters of Stable Prices

<table>
<thead>
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<th>Oil Price ($/b)</th>
<th>Working Rigs (Rigs)</th>
<th>Oil Jobs (000)</th>
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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)

<table>
<thead>
<tr>
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<th>2016</th>
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<th>2018</th>
<th>2019</th>
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<tr>
<td>Brazil</td>
<td>-3.5</td>
<td>1.0</td>
<td>1.4</td>
<td>2.4</td>
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- 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

WTI Oil Price Forward Curve $/b

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

WTI Oil Price Forward Curve $/b

November 2, 2018

$60/b

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

$/bbl.

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

Million Barrels/Day By Country

Russia/Saudis give up market share to maintain quotas?

US  Russia  Saudi Arabia

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<thead>
<tr>
<th>Year</th>
<th>US</th>
<th>Russia</th>
<th>Saudi Arabia</th>
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<td>5.5</td>
<td>9.8</td>
<td>8.9</td>
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<td>9.2</td>
<td>10.6</td>
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<td>11.8</td>
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<tr>
<td>2019</td>
<td>12.8</td>
<td>11.0</td>
<td>10.5</td>
</tr>
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</table>
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 forecasts 11.8 million barrels per day in 2019

DOE data puts production at 11.4 Million b/d in Aug

Peak in April 2015, fell 986,00 b/d
Now well past all-time 1970 highs

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

Rig Count

Oil-Related Jobs in Houston (000)

2014 peak never returns: Losses of 22 to 64,000 jobs by 2023

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

% Slack versus 4-Quarter Change in Personal Consumption Deflator

Congressional Budget Office, Bureau of Economic Analysis
Wages, Salaries and Employer-Paid Benefits Have Recently Begun to Rise Again

4-Quarter Percent Change, Employment Cost Index, All Occupations

Bureau of Labor Statistics
Fed’s Heavy Lifting Is About Over: All Up to the Economy Now

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<tr>
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<td>+</td>
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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

Probability of Rate Prevailing in Dec 2018

Once the Neutral Rate Is Reached This Direction Becomes Widely Split

Probability of Rate Prevailing in Oct 2019

Source: Fed Funds futures, CME Group, 10/30/2018.
The 30-Year Fixed Rate Mortgage: Current Forecasts Assume Best of All Worlds

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

Where now?
Outlook for the 30-year fixed rate

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

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

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

Financial Crisis

2001 Recession

< 1.0 % today

Percent

Quarterly Data:
- 2018Q2: 3.0% GDP, 3.9% Unemployment, 181.0k Jobs
- 2018Q3: 3.0% GDP, 3.9% Unemployment, 175.0k Jobs
- 2018Q4: 2.8% GDP, 3.8% Unemployment, 160.4k Jobs
- 2019Q1: 2.4% GDP, 3.8% Unemployment, 160.9k Jobs
- 2019Q2: 2.6% GDP, 3.7% Unemployment, 151.7k Jobs

Annual Average:
- 2018: 2.8% GDP, 3.9% Unemployment, 185.9k Jobs
- 2019: 2.7% GDP, 3.7% Unemployment, 160.8k Jobs
- 2020: 1.9% GDP, 3.9% Unemployment, NA
- 2021: 2.0% GDP, 4.0% Unemployment, NA

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)

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

*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

<table>
<thead>
<tr>
<th>Year</th>
<th>This forecast</th>
<th>May 2018</th>
<th>November 2017</th>
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<tbody>
<tr>
<td></td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
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<tr>
<td>2014</td>
<td>112.3</td>
<td>112.7</td>
<td>112.7</td>
</tr>
<tr>
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<td>2016</td>
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<tr>
<td>2017</td>
<td>27.9*</td>
<td>35.2</td>
<td>41.1</td>
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<tr>
<td>2018</td>
<td>62.4</td>
<td>52.6</td>
<td>42.1</td>
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<tr>
<td>2021</td>
<td>67.1</td>
<td>78.8</td>
<td>73.2</td>
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<tr>
<td>2018-2021</td>
<td>251.7</td>
<td>273.5</td>
<td>235.8</td>
</tr>
</tbody>
</table>

*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

Payroll Employment (000)

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

Three Forecasts of Houston Job Growth

<table>
<thead>
<tr>
<th>Year</th>
<th>Medium</th>
<th>Low</th>
<th>Lower</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>-2.3</td>
<td>-2.3</td>
<td>-2.3</td>
</tr>
<tr>
<td>2017</td>
<td>27.9*</td>
<td>27.9*</td>
<td>27.9*</td>
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<tr>
<td>2018</td>
<td>62.3</td>
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<td>53.2</td>
</tr>
<tr>
<td>2019</td>
<td>67.4</td>
<td>62.6</td>
<td>31.8</td>
</tr>
<tr>
<td>2020</td>
<td>54.8</td>
<td>40.2</td>
<td>9.2</td>
</tr>
<tr>
<td>2021</td>
<td>67.1</td>
<td>48.6</td>
<td>11.3</td>
</tr>
<tr>
<td>2022</td>
<td>66.1</td>
<td>50.6</td>
<td>12.8</td>
</tr>
<tr>
<td>2023</td>
<td>68.5</td>
<td>53.8</td>
<td>15.6</td>
</tr>
</tbody>
</table>

*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.)

- 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.

Source: Texas A&M Real Estate Center
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

Price Stays Flat, Sales Stagger then Recover Quickly

Listings Pick Back Up in 2018Q1

Source: Texas A&M Real Estate Center, calculations of IRF
Kingwood See Prices Fall Back in 18Q1, Listings Rebound

Sales Flat As Post-Harvey Home Prices Peak And Fall

Strong Rebound in Listings in Q1

Source: Texas A&M Real Estate Center, calculations of IRF
Ship Channel Cities
Baytown, Channelview, Pasadena

Sales and Home Prices Turn flat After the Construction Boom

Inventory Tight at Less Than 3.0%

Source: Texas A&M Real Estate Center, calculations of IRF
Close-In and Upscale
Rice Military, Heights, Galleria

Price Flat in 2018, Sales Now Flat

Inventory Is Back Up After Harvey, Stable Since

Source: Texas A&M Real Estate Center, calculations of IRF
Distant Suburbs
Pearland, Sugar Land, Kingwood, Katy

Sales flat & price increases slow as new homes enter market

Inventories Rose Before Harvey, Again After Harvey, Now Stable

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

Houston: Average Price of New Home

Percent Change in Price

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

*12-Months Sales By Lot Frontage*

- 64.4% of lots less than 60 feet

*12-Months Sales By Price Range*

- 81.4% of sales less than $400K

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

Months Supply of Lots, Sep ‘18

- < 40: 21.8
- 40-44: 16.2
- 45-49: 11.8
- 50-54: 17.6
- 55-59: 23.1
- 60-64: 18.6
- 65-70: 13.3
- 70-79: 13.6
- 80+: 12.5

Monthly Lot Deliveries

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

<table>
<thead>
<tr>
<th></th>
<th>Stable</th>
<th>In Lease Up</th>
<th>All Class A</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Units</td>
<td>131,540</td>
<td>14,829</td>
<td>149,239</td>
</tr>
<tr>
<td>Monthly Rent</td>
<td>$1,494</td>
<td>$1,602</td>
<td>$1,540</td>
</tr>
<tr>
<td>Occupancy</td>
<td>91.7%</td>
<td>61.4%</td>
<td>85.0%</td>
</tr>
</tbody>
</table>

- 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.

Apartment Data Services through September
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

- 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

Vacancy, All Classes, Based Only On Current Construction

Based on the current construction pipeline only. Apartment Data Services proposed units would add another two years of supply, CoStar adds another year.

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

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

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

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

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

### Deliveries and Absorption, All Classes, Million ft\(^2\)

<table>
<thead>
<tr>
<th>Year</th>
<th>Deliveries</th>
<th>Absorption</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>2.1</td>
<td>4.8</td>
</tr>
<tr>
<td>2013</td>
<td>4.4</td>
<td>4.0</td>
</tr>
<tr>
<td>2014</td>
<td>8.9</td>
<td>8.7</td>
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<tr>
<td>2015</td>
<td>13.5</td>
<td>3.7</td>
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<tr>
<td>2016</td>
<td>5.7</td>
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<td>2017</td>
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<td>2018</td>
<td>1.2</td>
<td>0.8</td>
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<td>2021</td>
<td>1.1</td>
<td>4.3</td>
</tr>
<tr>
<td>2022</td>
<td>0.0</td>
<td>4.3</td>
</tr>
</tbody>
</table>
Office Vacancies Have Probably Peaked: But a Long Way to Go for a Healthy Market

Vacancy Rate %

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

Retail Sales: Houston Metro Area
Real $ Billion, Seas. Adj.

Metro Area Retail Minus the City
Taxable Sales, Real $, Quarterly

Big bounce in 18q1
Is mix of Harvey and oil rebound

The suburbs steadily outgrow the City, 2.3 to 2.0 percent per Year since 2002

Texas Comptroller
Rising Rents, Low Vacancy Continue in Houston’s Retail Sector

![Graph showing rising rents and low vacancy in Houston’s retail sector from 2006 to 2018Q1.](image-url)
Retail Pipeline Shows Healthy Growth, In-Line with Population Growth Rate of Space Tracks Softer Population Growth (%)

<table>
<thead>
<tr>
<th>Population Growth (%)</th>
<th>0.0%</th>
<th>0.5%</th>
<th>1.0%</th>
<th>1.5%</th>
<th>2.0%</th>
<th>2.5%</th>
<th>3.0%</th>
<th>3.5%</th>
<th>4.0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retail Deliveries in 2018 (000 Ft^2)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

CoStar 2018Q3, deliveries and retail growth stated at annual rates
Suburbs Rule Retail Construction: Only 10 Large Projects Inside Belt 8
**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 if 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.
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

Vacancy %

<table>
<thead>
<tr>
<th>Month</th>
<th>East</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec-07</td>
<td>5.0%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Mar-09</td>
<td>6.0%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Jun-10</td>
<td>7.0%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Sep-11</td>
<td>8.0%</td>
<td>7.5%</td>
</tr>
<tr>
<td>Dec-12</td>
<td>9.0%</td>
<td>8.5%</td>
</tr>
<tr>
<td>Mar-14</td>
<td>10.0%</td>
<td>9.7%</td>
</tr>
<tr>
<td>Jun-15</td>
<td>11.0%</td>
<td>10.5%</td>
</tr>
<tr>
<td>Sep-16</td>
<td>12.0%</td>
<td>11.7%</td>
</tr>
<tr>
<td>Dec-17</td>
<td>13.0%</td>
<td>12.5%</td>
</tr>
</tbody>
</table>

$ NNN Rent

<table>
<thead>
<tr>
<th>Month</th>
<th>East</th>
<th>West</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dec-07</td>
<td>$4.00</td>
<td>$3.50</td>
</tr>
<tr>
<td>May-09</td>
<td>$4.50</td>
<td>$4.00</td>
</tr>
<tr>
<td>Oct-10</td>
<td>$5.00</td>
<td>$4.50</td>
</tr>
<tr>
<td>Mar-12</td>
<td>$5.50</td>
<td>$5.00</td>
</tr>
<tr>
<td>Aug-13</td>
<td>$6.00</td>
<td>$5.50</td>
</tr>
<tr>
<td>Jan-15</td>
<td>$6.50</td>
<td>$6.00</td>
</tr>
<tr>
<td>Jun-16</td>
<td>$7.00</td>
<td>$6.50</td>
</tr>
<tr>
<td>Nov-17</td>
<td>$7.50</td>
<td>$7.00</td>
</tr>
</tbody>
</table>

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

Industrial Deliveries, Million ft²
East/West Split
In Industrial/Warehouse Construction
Please give us your current address and email to be added to our distribution list for future events. Our next symposium will be in May 2019 – date to be determined.