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Houston and COVID-19:
Are We Nearing the End-Game?

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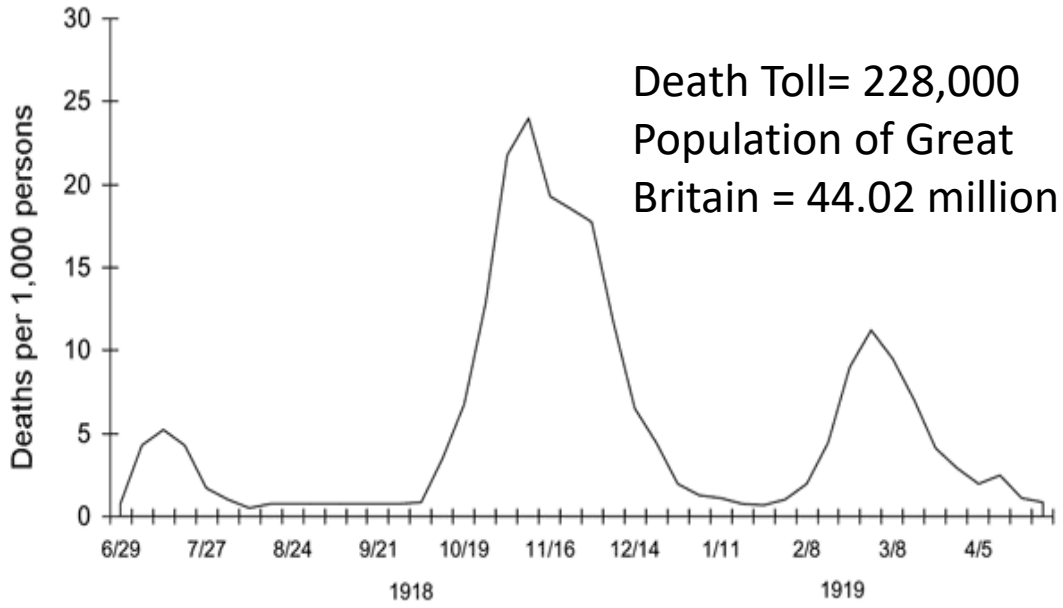
Overview of Today's Discussion

- All about COVID-19 as a disease and how pandemics affect the economy
- Employment and income/spending effects of COVID on the U.S. and Houston economic outlook
- With many mixed messages on the economy, but how bad is this downturn?
- Houston's oil and gas sector is working on a streak of six tough years
- Brief thoughts on COVID and the global economy
- The outlook for Houston as the virus is controlled and the economy heals
- *A consumer warning:* The virus is in charge, and the economy is just along for the ride. The forward-looking projections offered here serve as thoughtful planning scenarios. No one can offer a meaningful or working economic forecast right now

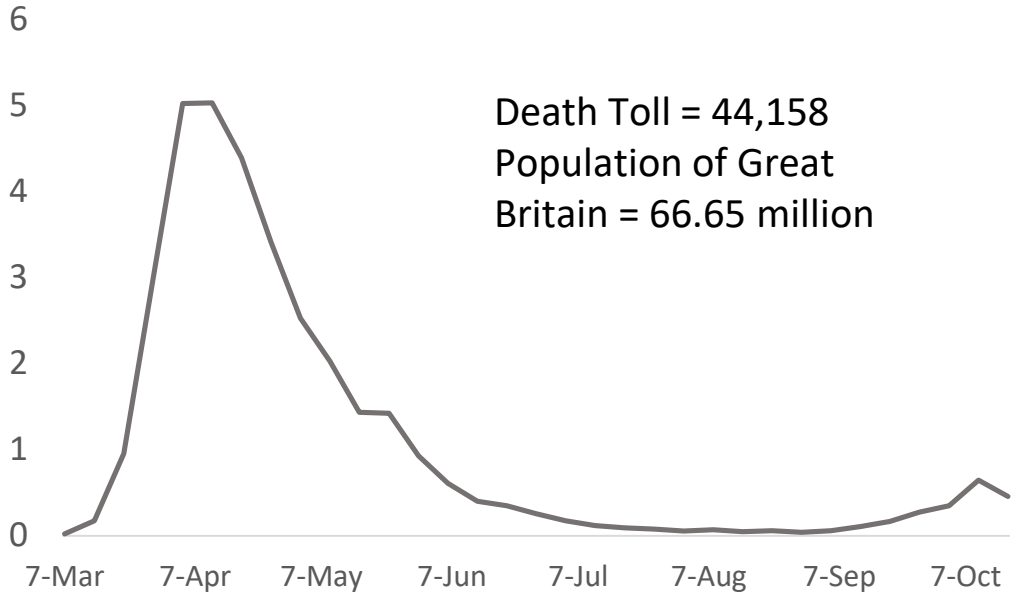
Perspective on COVID-19, the Pandemic, and Its Economic Impacts

Pandemic Waves of the 1918-20 Spanish Flu And COVID-19 Great Britain

Three Waves of the Spanish Flu in 1918-20 (Death/000)



In 2020 a Milder Disease with Public Health Interventions (Death/000)



E. Jordan, Epidemic *Influenza: A Survey*, Chicago, Ill. American Medical Association, 1927; WHO Coronavirus Dashboard data to 10/23/2020. Mortality rates are per thousand and at annual rates

COVID-19: Spread and Mortality Rate Compared to Other Diseases and Pandemics

COVID-19 Basic Reproduction Rate

	R_0
Measles	12 to 18
Mumps	10 to 12
Chicken pox	10 to 12
Polio	5 to 7
Whooping Cough	5.5
COVID-19	**2.5 to 4.0**
Common Cold	2 to 3
Influenza (1918)	1.4 to 2.8
Ebola	1.5 to 2.5
Influenza (2009)	.9 to 2.1

COVID-19 Case Mortality Rate

	Percent
2016 Ebola	66
2014 Ebola	40
2012 MERS	34
1918 Spanish Flu	> 2.5
COVID-19	**0.65**
1968 Influenza	< 0 .5
2009 Swine Flu	0.1 to 0.5
2002 SARS	0.11
1957 Influenza	< 0.1

CDC Pandemic Planning Scenarios: COVID-19, May and September 2020; Imke Schroeder, "COVID-19 a Risk Assessment Perspective," *Journal of Chemical Health and Safety* (May 11, 2020); Wikipedia, "The Basic Reproduction Rate," first table and associated references; Associated Press, "WHO Says 10 Percent of World Population Infected," October 5,2020

How Does COVID Affect Economic Conditions? Some Definitions

- If the disease is left uncontrolled, it can create *widespread illness, labor shortages, and supply chain disruptions* as economic activity is disrupted
- *Reactive social distancing* by the public has been part of every past pandemic as the fear of the virus forces us to avoid crowds, stores, bars and restaurants, public transportation, and travel
- In many cities, *mandatory public orders* have also been a part of past epidemics: limits to crowd size, closing of bars and restaurants, closing schools, travel restrictions, etc.
- The widespread use of *mandatory stay-home orders and closing all nonessential businesses* is a new feature. They pull economic damage to a point early in the pandemic but are meant to ease later infection rates. Once stay-home orders are lifted, the reactive social distancing and other mandatory public health orders continue if COVID is active
- In Texas, the unspoken public policy is to *open the economy as far as possible without allowing the virus to overcome the hospital system*

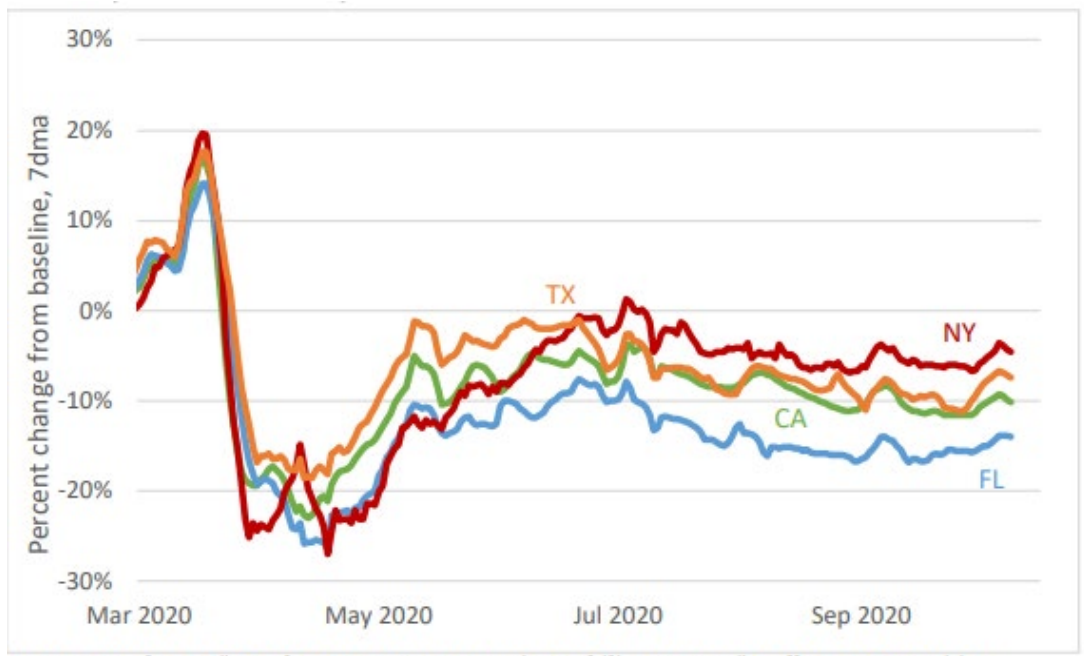
COVID-19 Lessons from the Economist?

- Reactive and mandatory social distancing – including stay-home orders -- have a significant effect in *slowing the spread of the virus*
  - Effectiveness in any locality depends on many variables: social cohesion of the population, availability of high-speed internet, sick leave policies, local work rules and protections, etc.
  - Less restrictive policies like testing and masks can substitute for stay-home orders and other mandatory public health restrictions, and even displace some voluntary social distancing
- Mandatory and voluntary social distancing both have a significant role in job losses, substantial spending declines, and *greatly worsened economic outcomes*
  - The division between the economic damage done by stay-home orders, other involuntary social distancing, and voluntary or reactive social distancing is still controversial
  - Lifting stay-home orders has provided only partial economic relief, as reactive distancing and many mandatory restrictions remain in place on travel, public gatherings, business closings, etc.
- Economic impacts are higher for the economically vulnerable with low educational attainment or low wages

For an overview see IMF, *World Economic Outlook*, An Overview of the Literature on the Economic Impact of Lockdowns, Box 2.1, October 2020, pp. 77-78

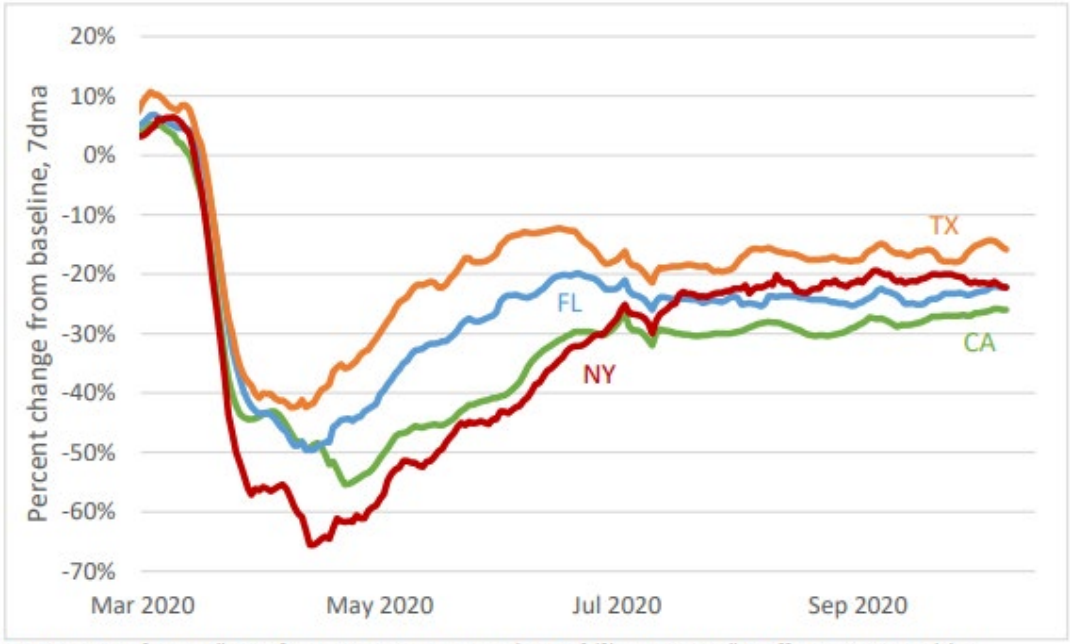
The COVID Shock Limits Mobility: Big Drop with Stay-Home Orders and Partial Recovery

Grocery and Pharmacy



Source: Google LLC "Google COVID-19 Community Mobility Reports," Wells Fargo Securities

Retail and Recreation



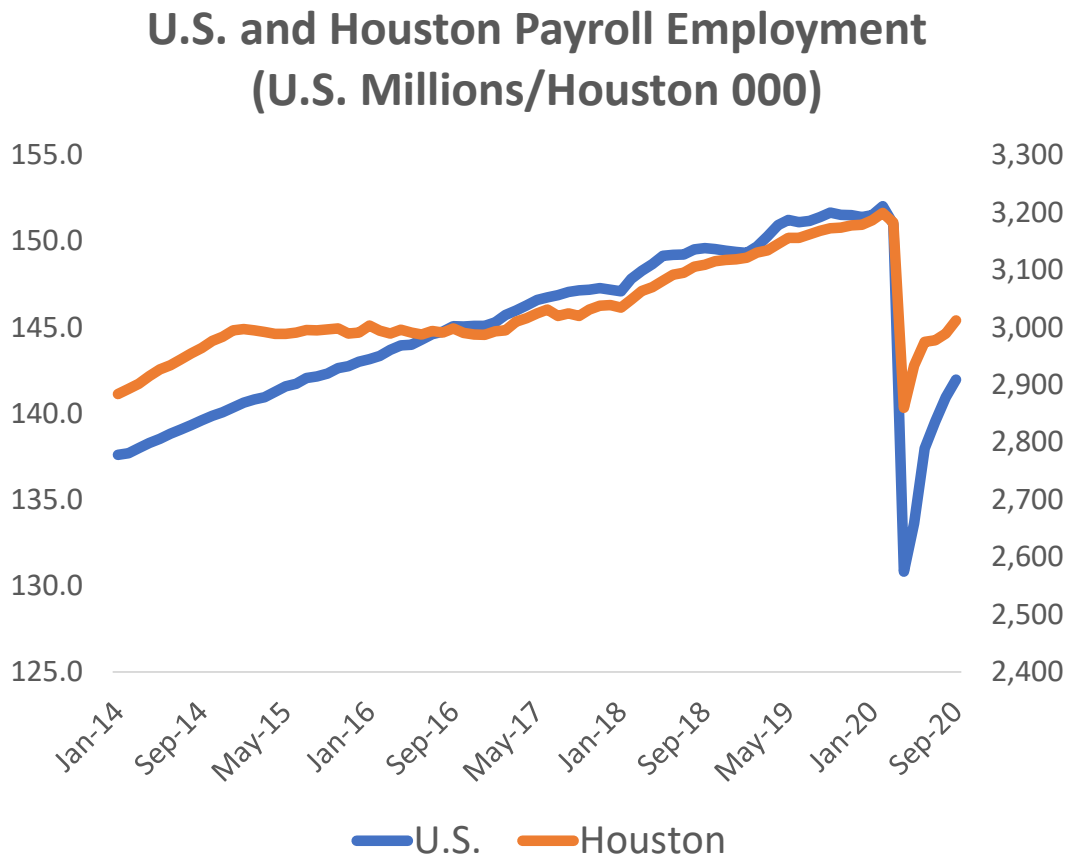
Source: Google LLC "Google COVID-19 Community Mobility Reports," Wells Fargo Securities

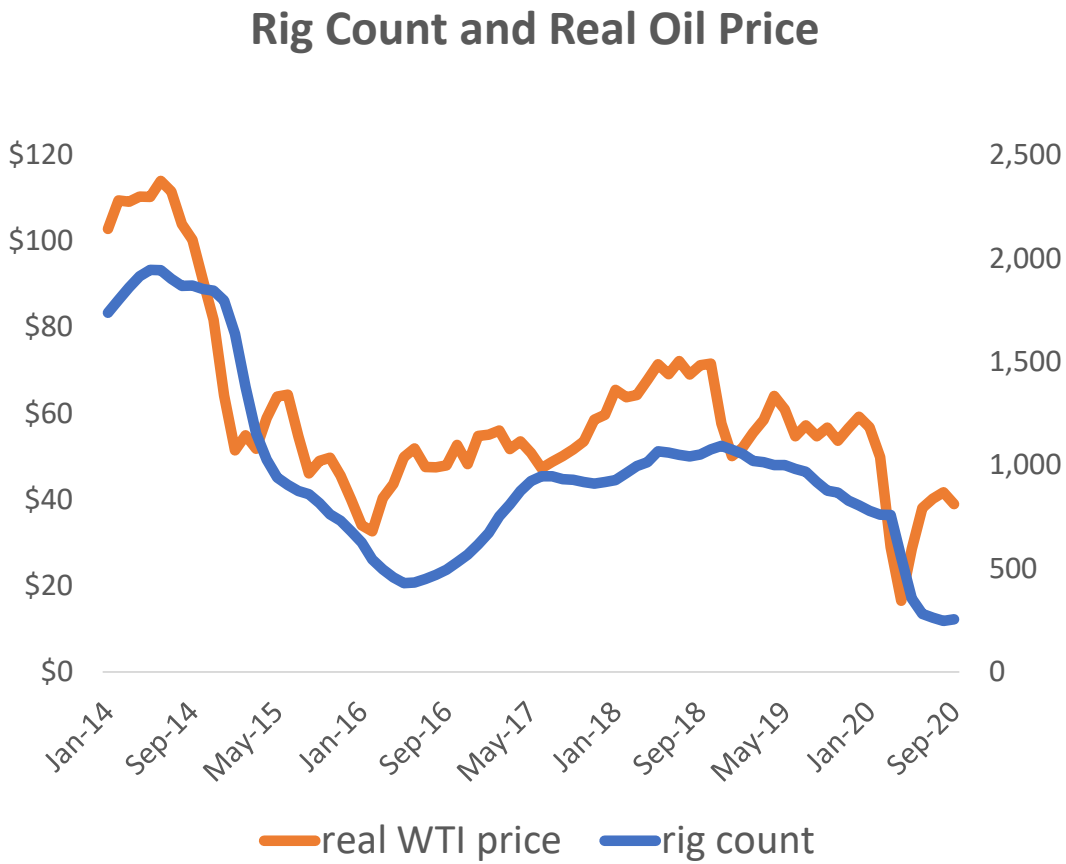
Herd Immunity? A Vaccine? What and When Is the End Game?

- If enough of us contract COVID-19 and become immune, the virus cannot spread and dies out. So-called herd immunity is not likely soon. Admittedly crude calculations based on R_0 say 60 to 75 percent public immunity is required. Current immunity is close to 10 percent. (Herd immunity = $R_0 – 1/R_0$)
- When is a vaccine likely? It is probably in reach, even if we put the current political noise aside
  - Health and Human Services Secretary Alex Azar said on October 2 that 100 million doses could be available by year-end, and available to all Americans by April of 2021
  - Some scientists and vaccine-makers say if all goes well, it could be available to high-risk groups this year, and available to all by late summer
  - The less optimistic say things rarely go well, and perhaps a vaccine is only widely available beginning in mid-2021
- We are apart by a matter of a few months. We potentially could see the negative economic and public health impacts of COVID largely disappear during 2021, particularly the reactive social distancing and most public health restrictions

COVID and the Houston Economy

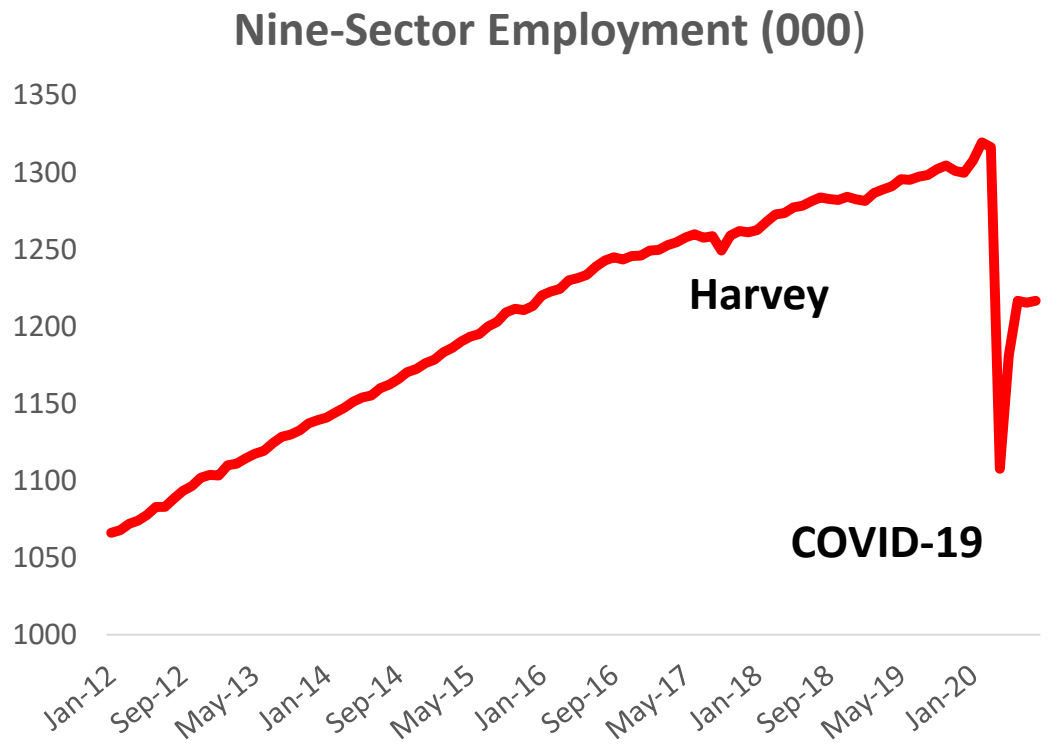
COVID-19 Shock Plays Out Through All Parts of Houston's Economy In the Second and Third Quarter





Nine Local Service Sectors Account for 43% of Houston's Jobs in 2019, But Made 70% of March/April Job Losses

Nine Key Service Sectors Accounted for 70.0 % of Houston's April Jobs Losses



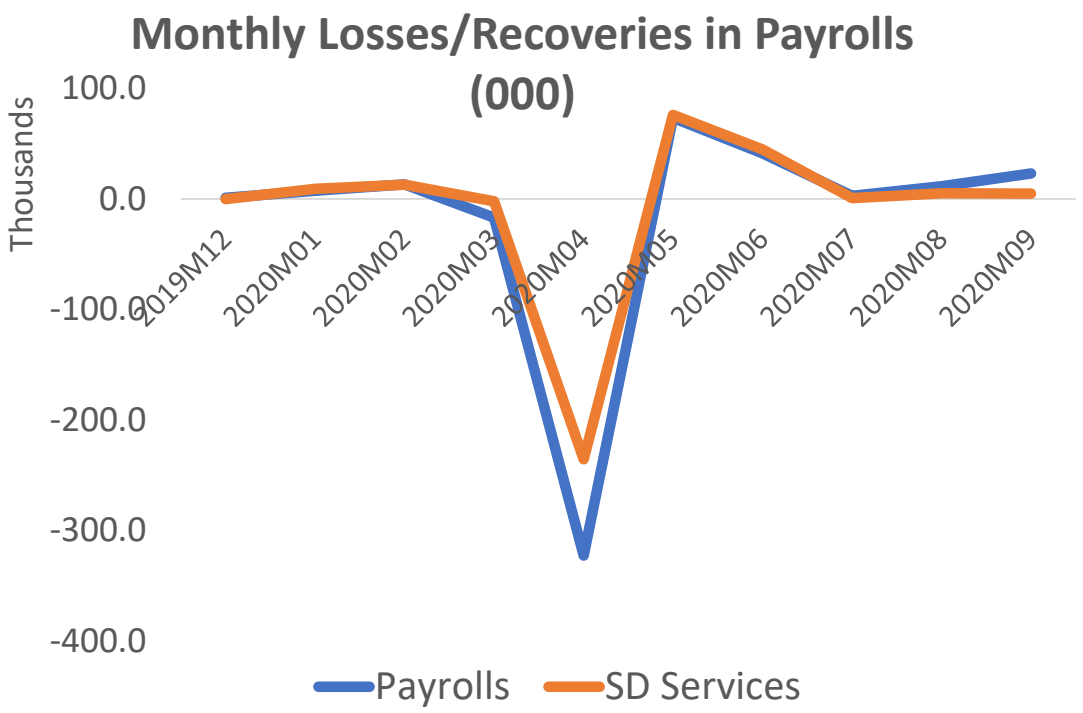
Sectors Sensitive to Social Distancing Made Up 42.6% of Local Jobs in 2019

- 391,000 Health Care
- 303,600 Retail
- 267,000 Food Service
- 166,000 Finance
- 115,800 Other Services
- 63,400 Private Education
- 37,400 Arts and Entertainment
- 28,700 Accommodation

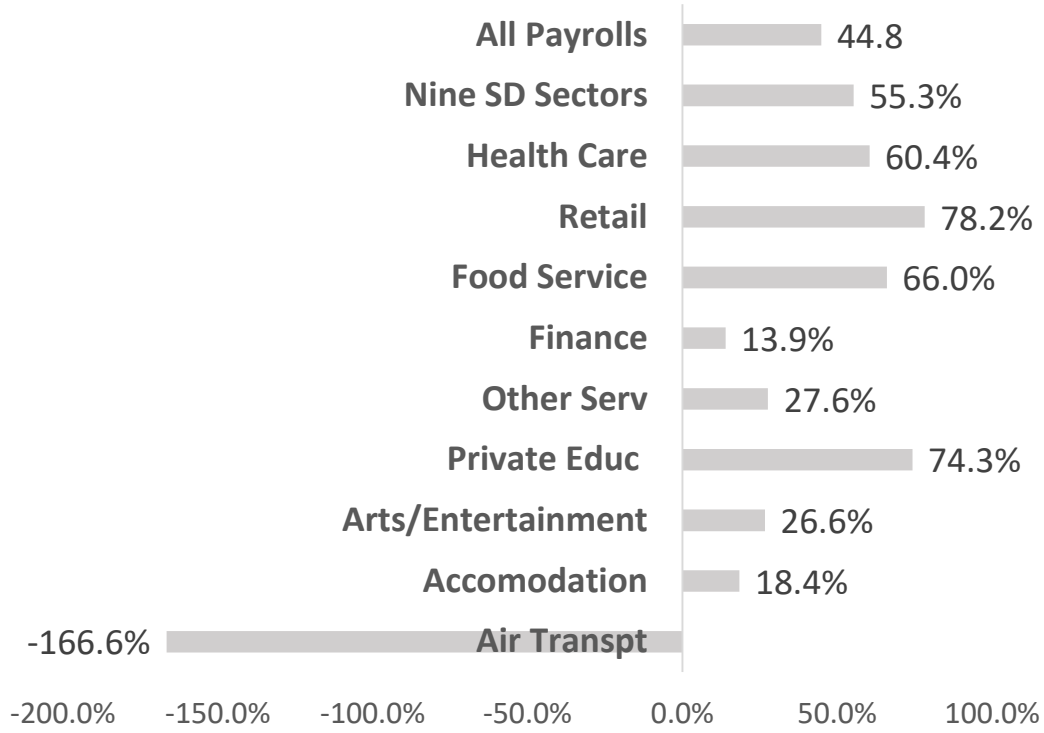
  20,200 Air Transportation
- *1,343,600 All 9 sectors*
- *3,156,000 Total Payrolls*

Houston's Payroll Job Recoveries Through September Are Only 44.8% of March/April Losses, As Nine Service Sectors Make-Up Most Gains

Soc. Dist. Services Fell in March/April With 55.3% Recovered By September

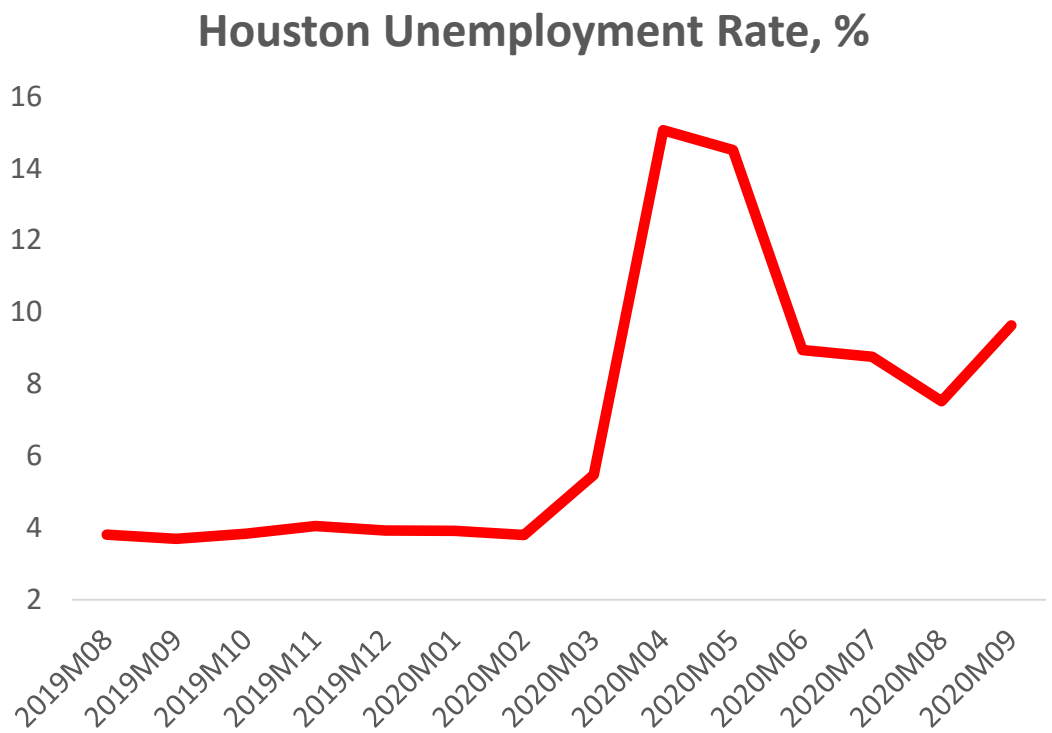


Social-Distance Services: Percent Recovery By Sector Since April

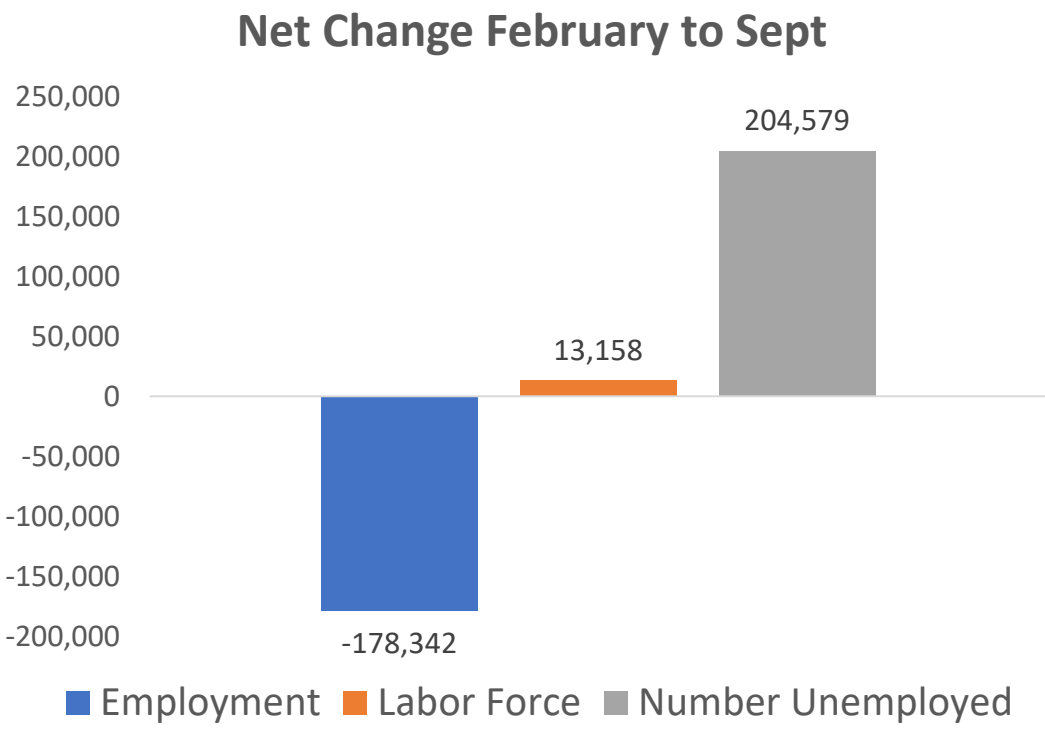


Houston's Unemployment Rate Spikes and Begins Slow Turnaround

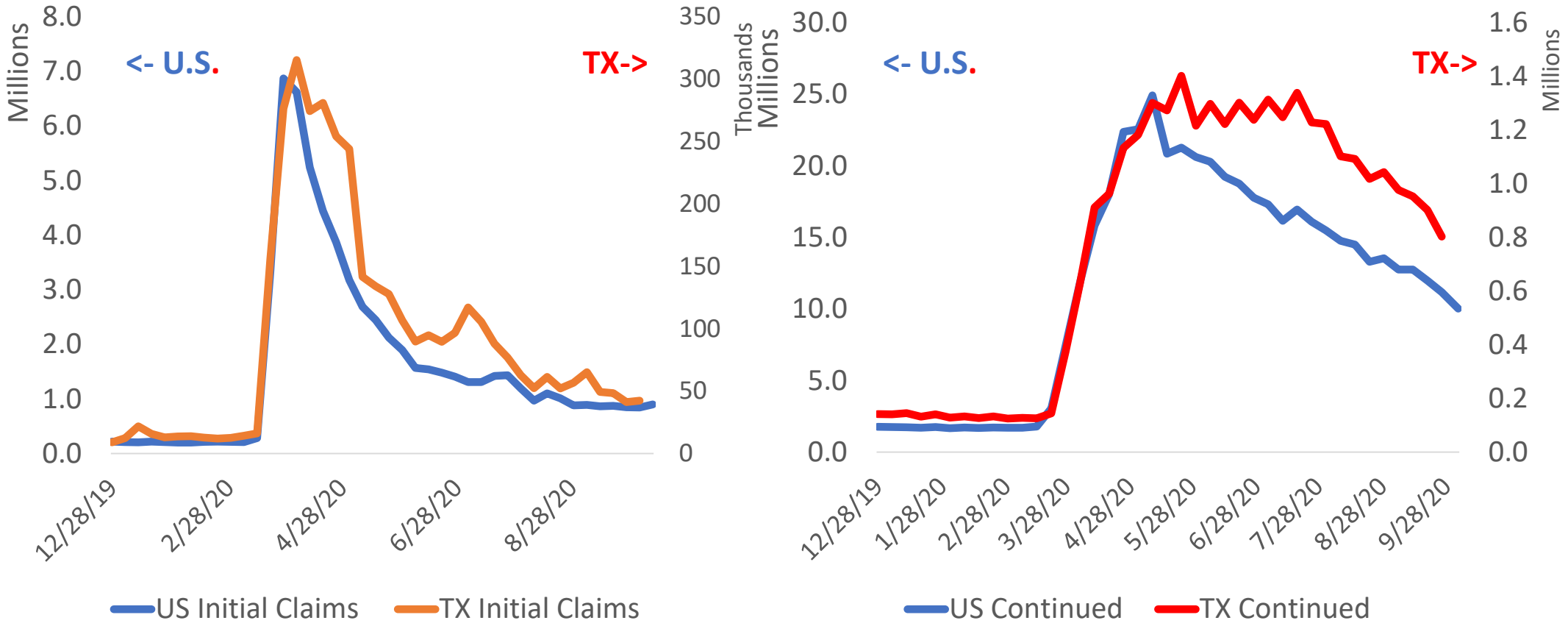
Houston' Unemployment Rate Peaks at 15.1% in April, Falls to 9.6% in September



Fall In Unemployment Rate Looks Real As the Labor Force Grows

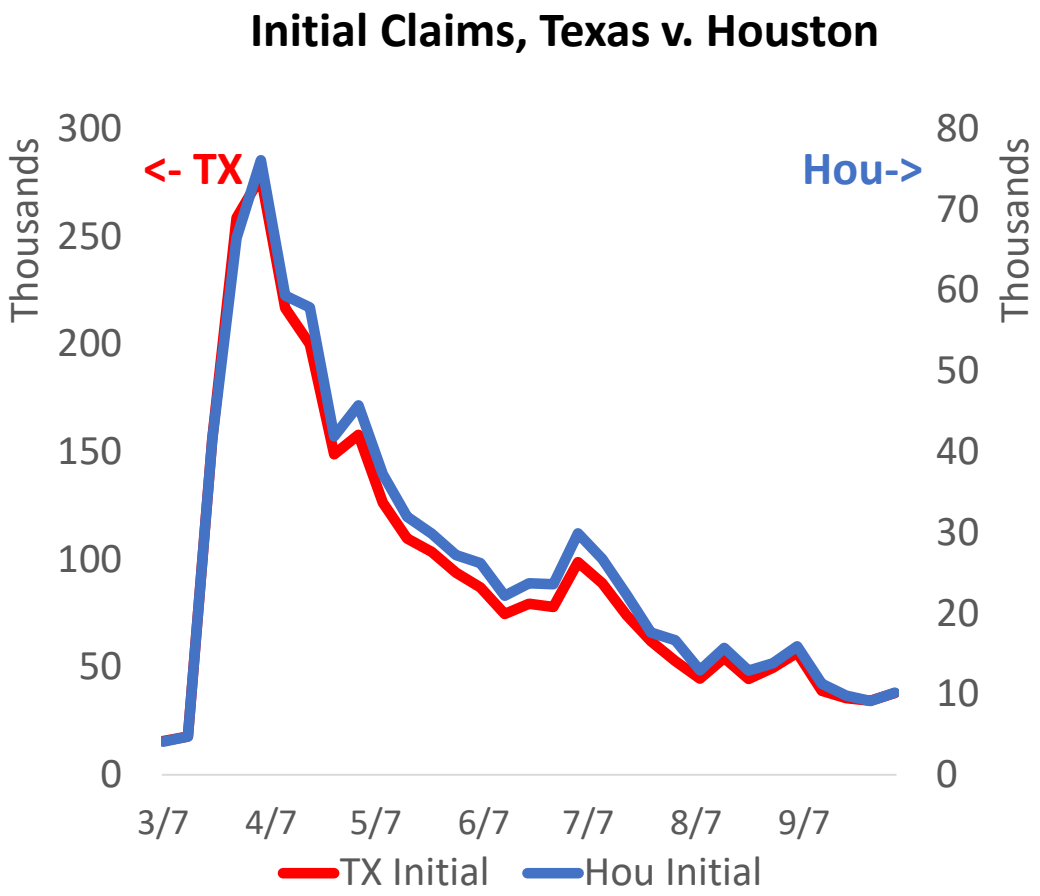


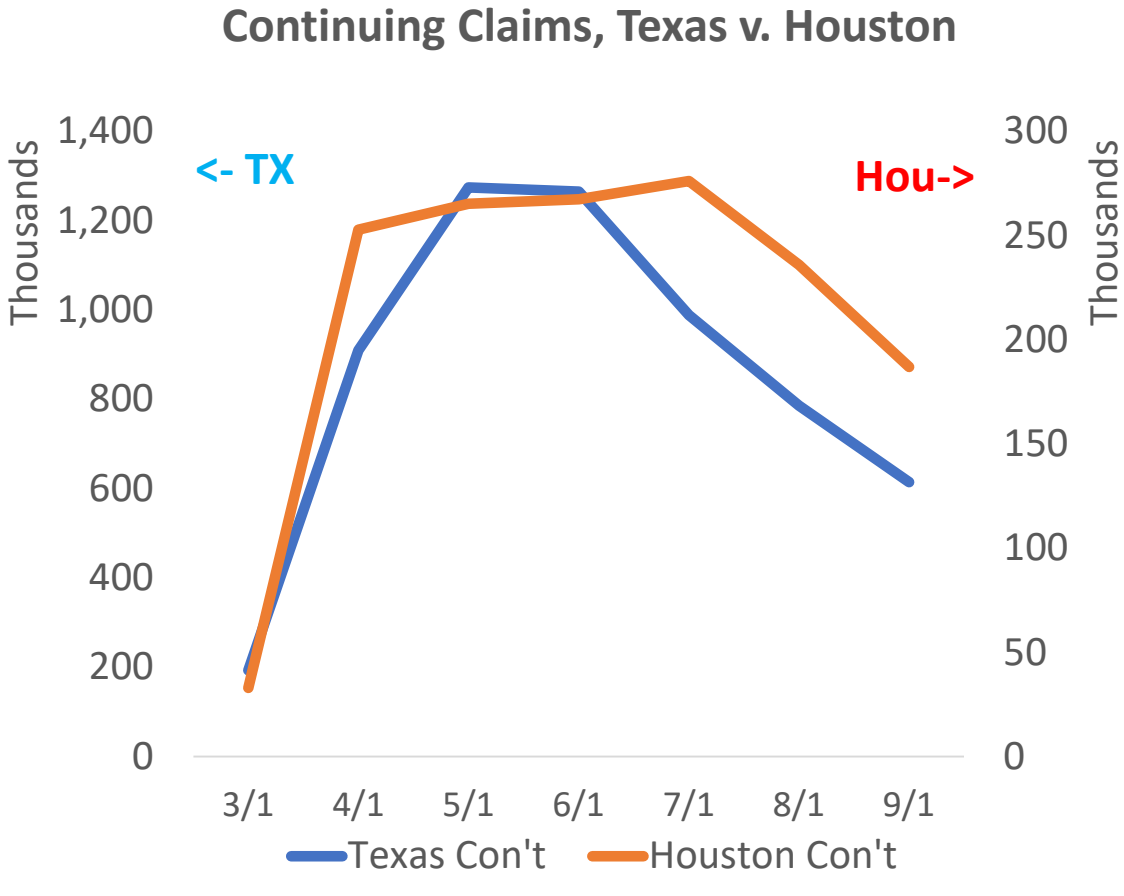
Initial and Continued Claims for Unemployment: A Similar March/April Response in Texas vs. U.S.



FRED, St Louis Federal Reserve Bank. State unemployment programs

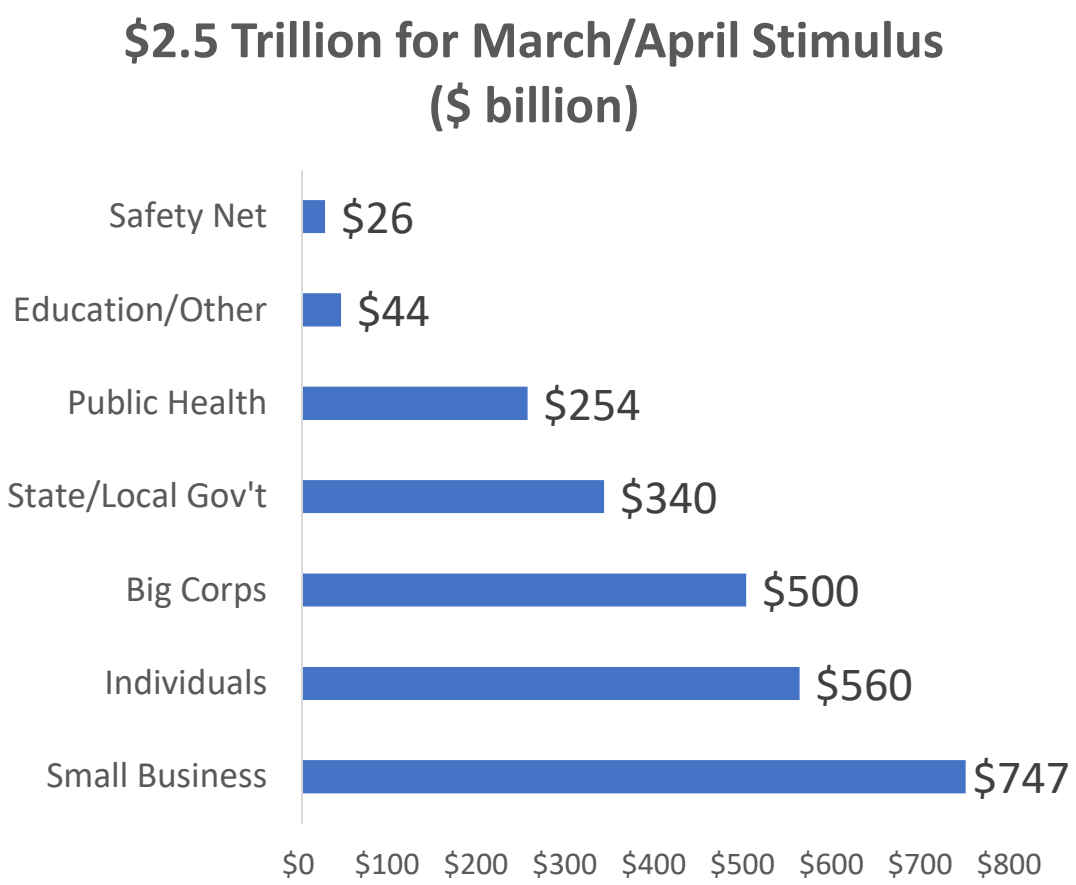
Initial Claims in Texas and Houston Mirror Each Other, Local Continued Claims Lag the State By a Month





Initial claims for Houston are the 9-county metropolitan area; continued claims for Houston are for the 13-county Gulf Coast Workforce Development Board, including the metro area plus four small counties with less than 2% of 13-county claims

Trillions of Dollars Poured Into COVID-19 Programs to Support the Economy in March/April



Federal Reserve Stimulus

- Return of zero rates, QE2, forward guidance
- Return of 2008 credit facilities: primary dealers, money market funds, commercial paper, etc.
- Major corporations with investment grade credit for up to $750 billion lending expansion
- Mid-Size/Main Street loan expansion of up to $600 billion in 5-year loans
- Treasury absorbs $75 billion in losses (if any) from each of the corporate lending programs

Includes $470 in additional stimulus from April supplemental appropriation for the Paycheck Protection Program and Public Health

Pandemic Stimulus Keeps U.S. Personal Income Growing From February to August

Monthly Change In Personal Income ($ Billion s.a.)

	March	April	May	June	July	August	Feb - Aug
Personal Income	-29.4	191.5	-73.2	-19.9	7.7	-45.3	43.3
Employee Compensation	-28.4	-71.6	22.1	19.5	11.6	11.4	-26.2
Wages and Salaries	-25.1	-60.8	19.2	15.5	9.8	10.0	-23.2
Benefits	-3.3	-10.8	3.0	4.0	1.8	1.4	-2.9
Self-Employed Income	-10.5	-16.0	4.0	8.8	1.7	3.6	-4.8
Gov't Transfers	6.7	275.5	-93.3	-44.5	-4.0	-60.4	80.6
Economic Impact	0.0	215.7	-165.2	-47.1	-0.6	-2.0	0.8
Unemployment	3.9	34.9	71.9	4.1	-7.0	-57.2	50.5
Disposable Income	-23.4	204.6	-76.6	-22.8	5.2	-47.6	49.1
Personal Consumption	-85.3	-149.8	86.3	69.3	18.8	12.7	-48.3
Personal savings	61.8	354.4	-163.0	-92.2	-13.6	-60.3	97.4

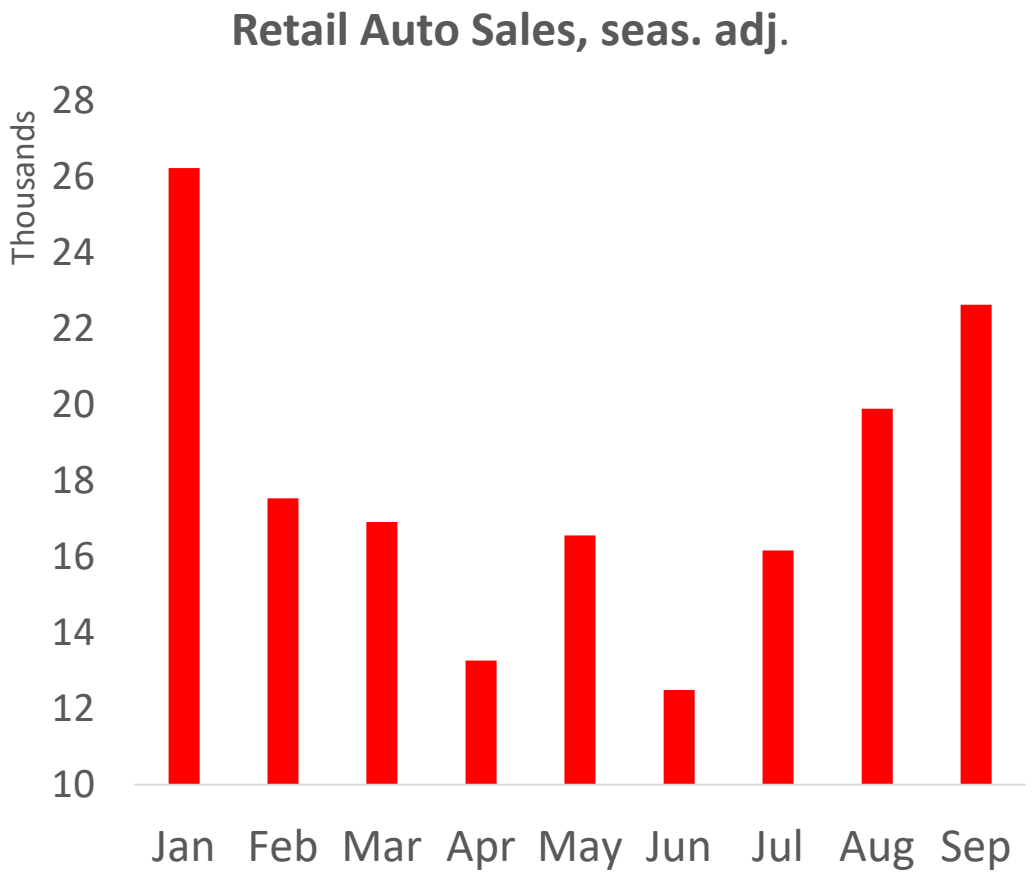
The Bureau of Economic Analysis reports monthly data on an annualized basis and here they have been divided by twelve. Selected sectors only. February to August reported as total change over five months. October 1, 2020.

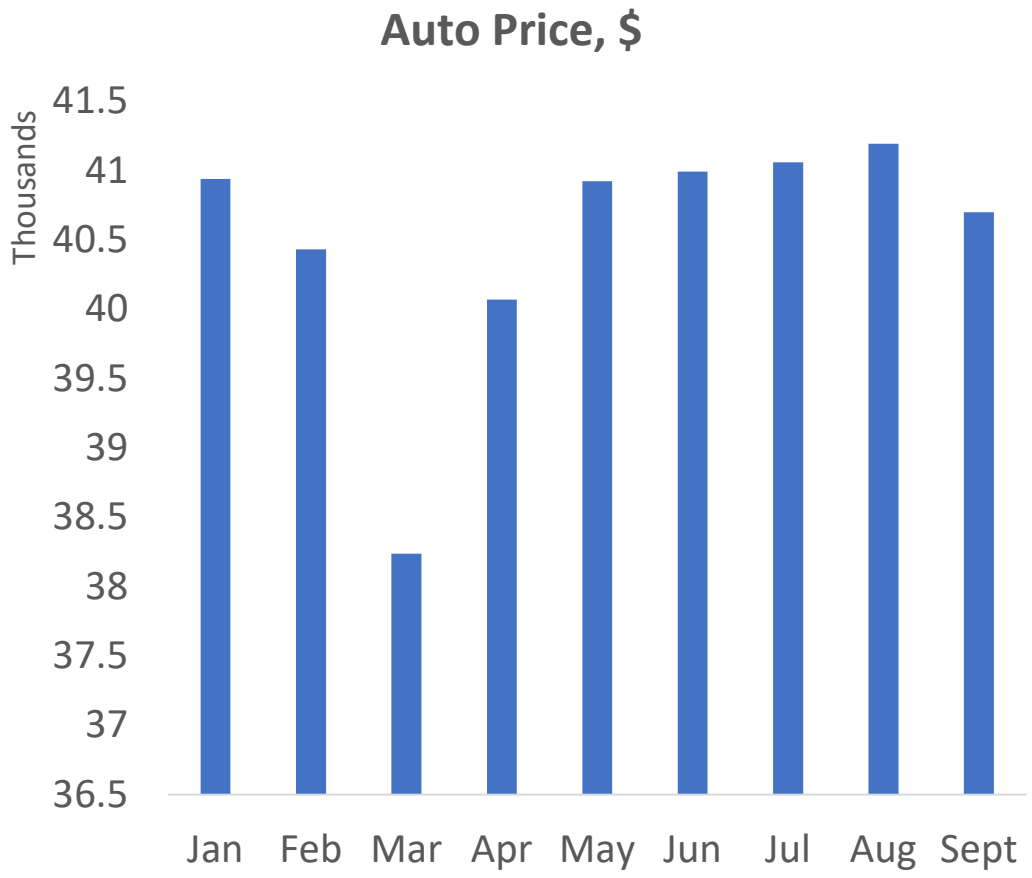
Income Support, Cheap Money, and E-Commerce Drive U.S. Retail Sales Past Pre-COVID Levels to Record Highs

- Income support pushed July/August retail sales past February pre-COVID levels and to all-time highs. The two largest sectors (autos and e-commerce) are the big winners
- September continued the trend to strong growth retail growth, up 1.9 percent for the month
- Food stores, books and hobbies, and home improvement fill in for restaurants, gasoline, clothing, etc.
- Trends in stimulus payments and easy credit also drive the push to high levels of homes sales, including record sales of existing homes in Houston

U.S. Census Bureau, October 16, 2020

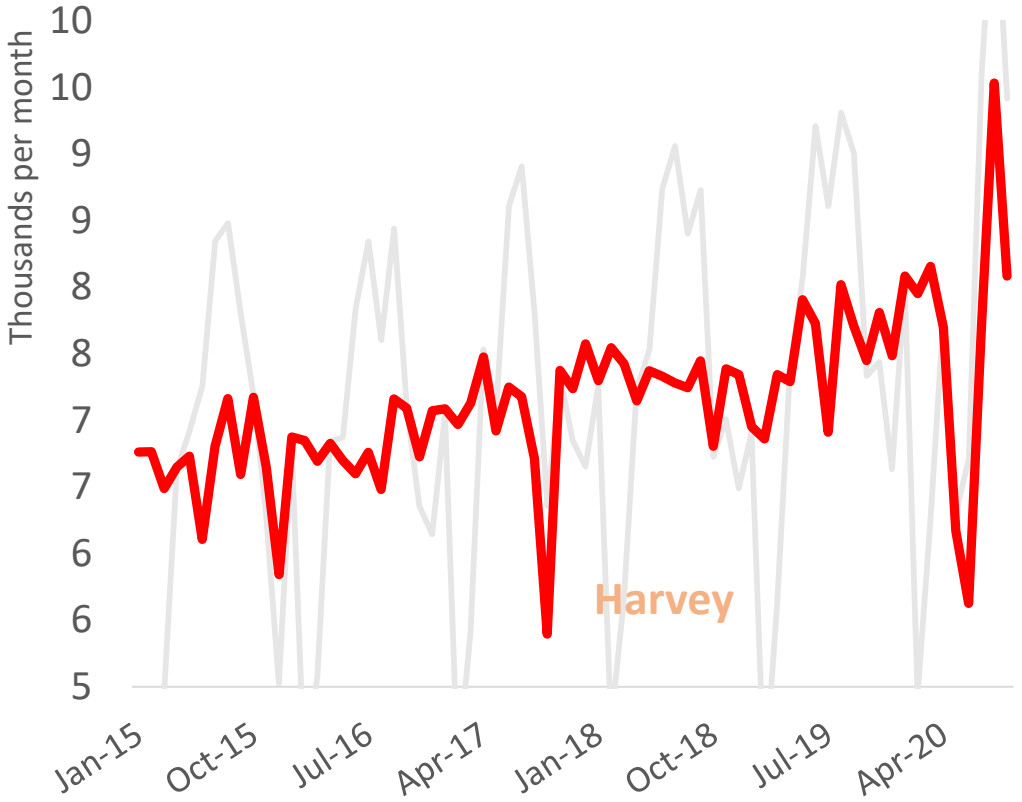
Houston Metro Area Auto Sales and Pricing Show the COVID Dip and Stimulus Recovery





Houston Existing Home Sales Soar in Stimulus-Driven Pandemic

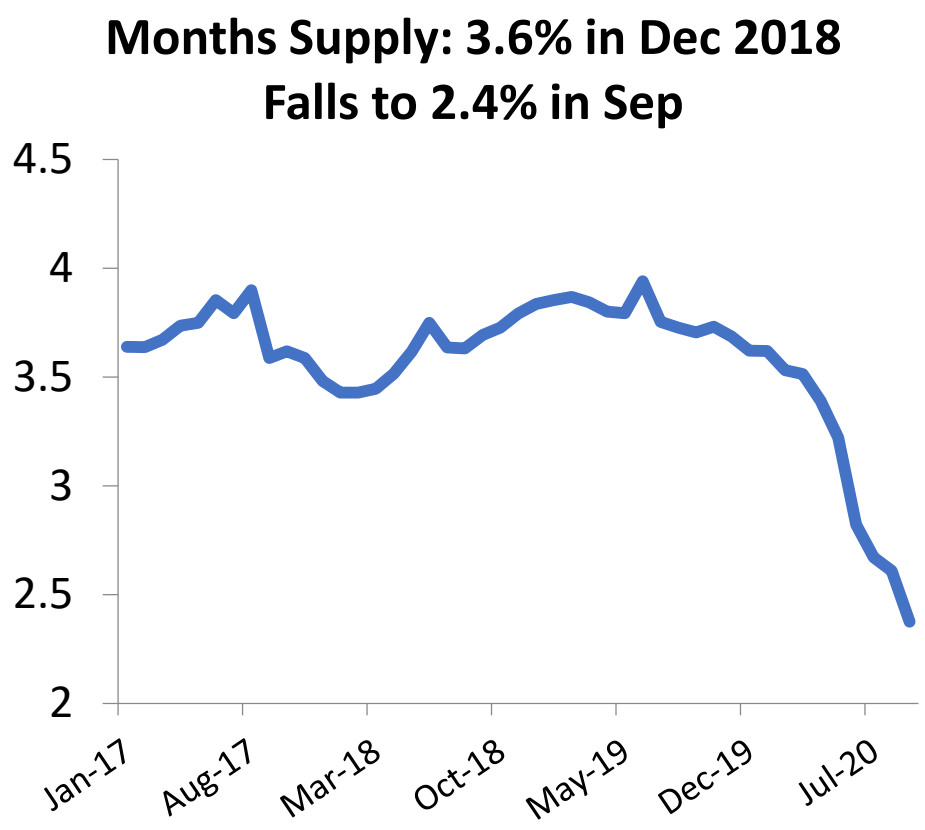
(Houston MLS sales, s.a.)

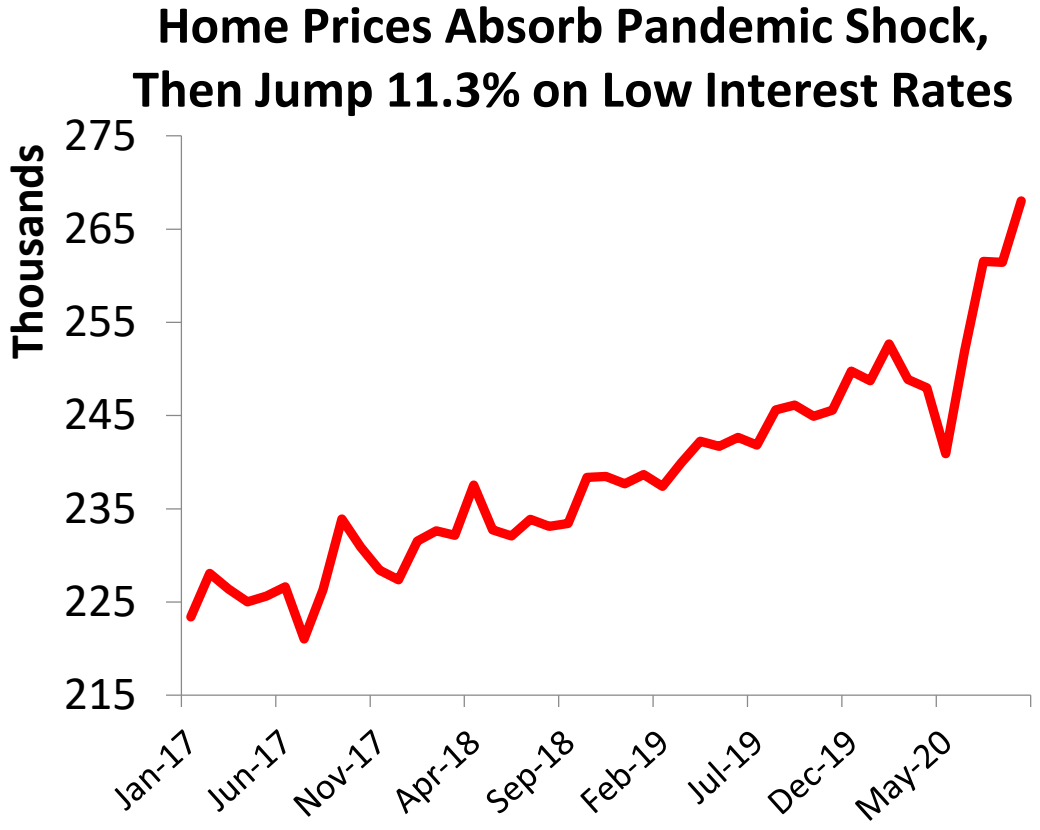


- Houston existing home sales had slowed in 2019 as the Fed paused in its push to raise interest rate
- The initial response to the pandemic was a sharp pull-back in sales due to the stay-home orders and nonessential business closings
- Then a sharp drop in interest rates and a check from the federal government ignited a sharp increase in sales
- Sales slowed in September with schools opening, limited inventory, and a big jump in prices

Source: Texas A&M Real Estate Center, seasonally adjusted by IRF

Houston Existing Home Sales: Pandemic Shrinks Inventory and Raises Prices





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

New Home Starts and Pricing in Metro Area Houston Soar in 2020

- Houston starts were up 34,557 and closings up 33,812 over 12 months
- 2020Q3 saw 10,719 local starts, the most since 2007Q2
- It is still an entry-level market, with 84% of sales geared to $399,000 sales price or below. Local buyers are 95% of sales
- Of 10,747 builder plans analyzed, 89.9% saw price increases of $15,000 or 4.7%

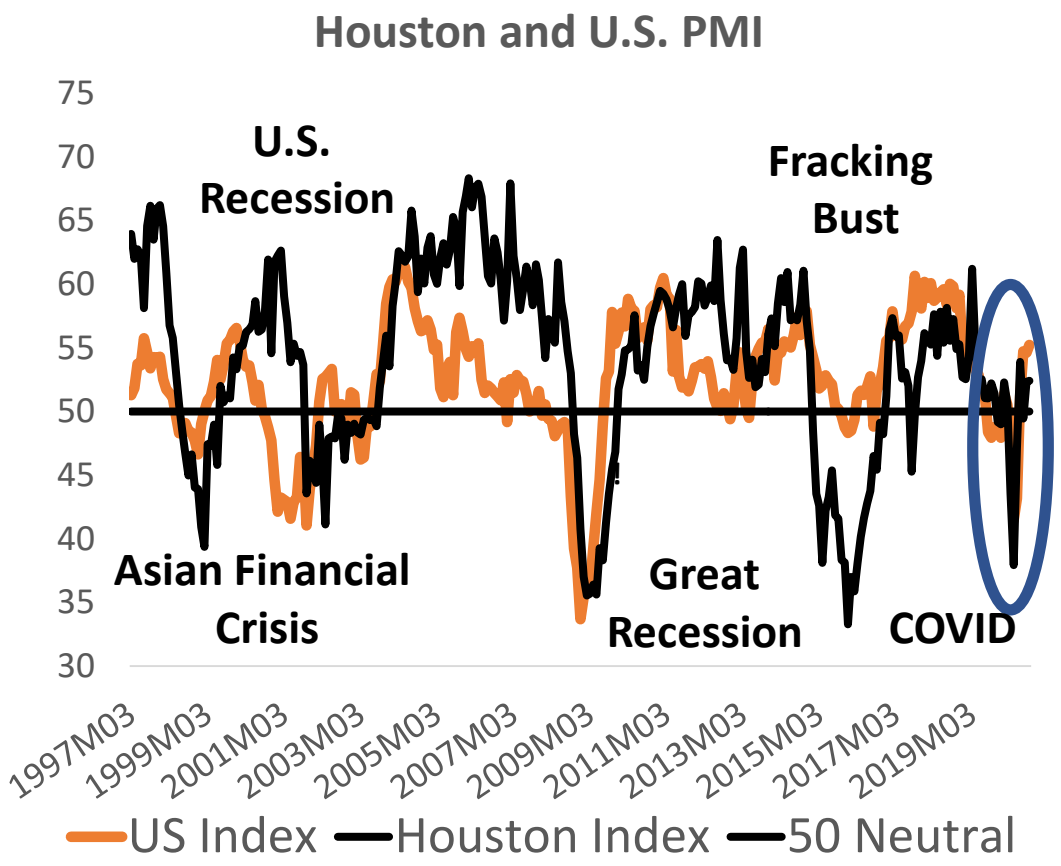
MetroStudy

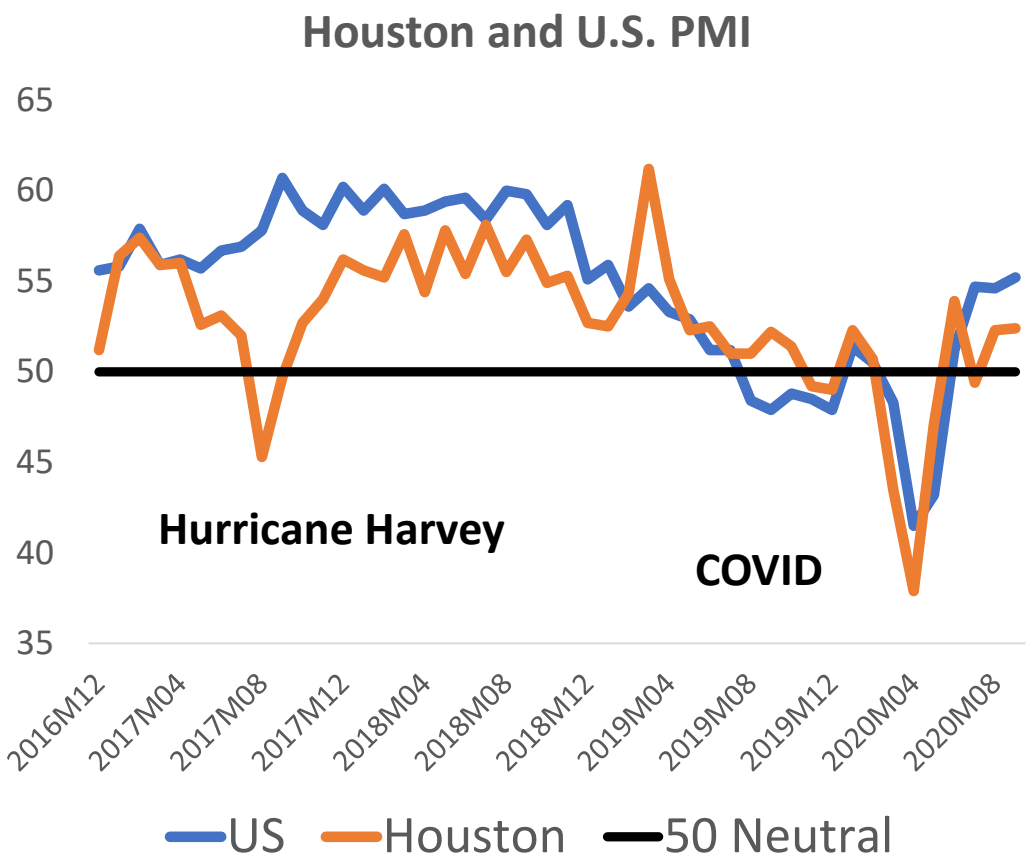
Local Housing Starts
12-Month Change

	Number	Percent
Houston	34,557	17.4%
Dallas-Fort Worth	39,047	16.0%
Austin	20,395	16.1%
San Antonio	15,033	14.4%

How Bad Is This Downturn?
It’s Bad ... But Maybe Not as Bad as Advertised

Purchasing Managers' Index Sees U.S. and Houston Briefly Contract and Quickly Move to Expansion

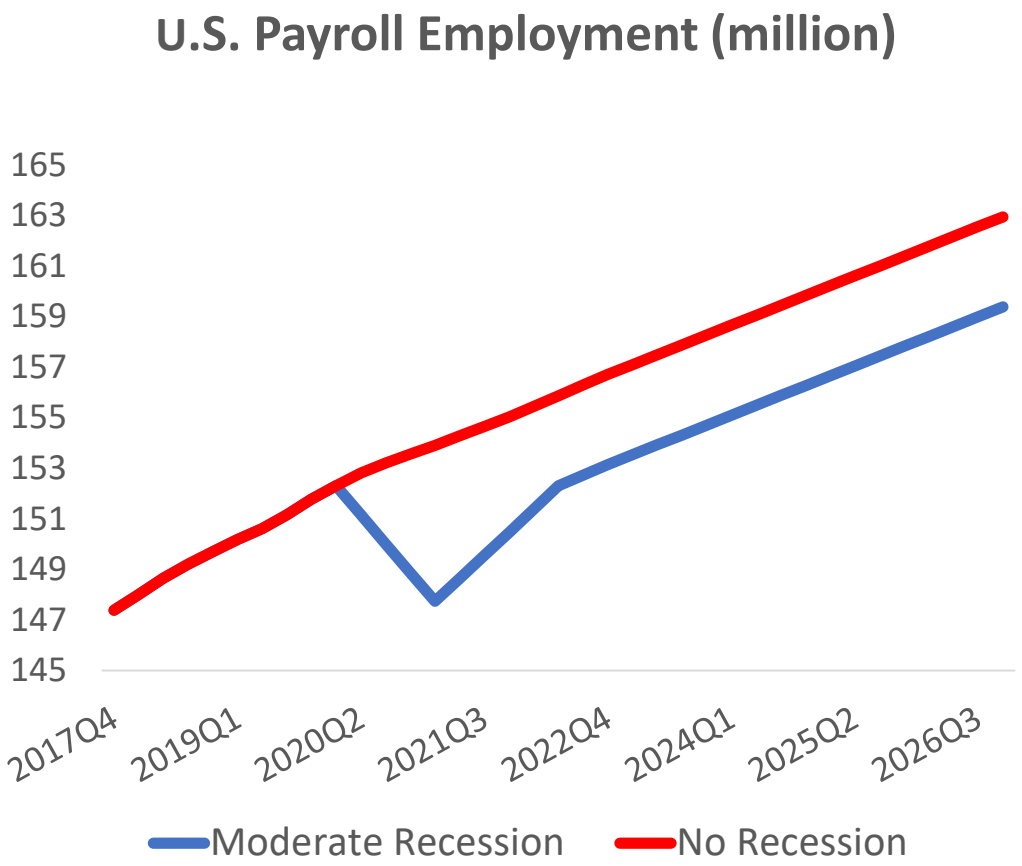




A Health Care Crisis Drives Big Swings in Jobs, Despite Moderate Underlying Recession?

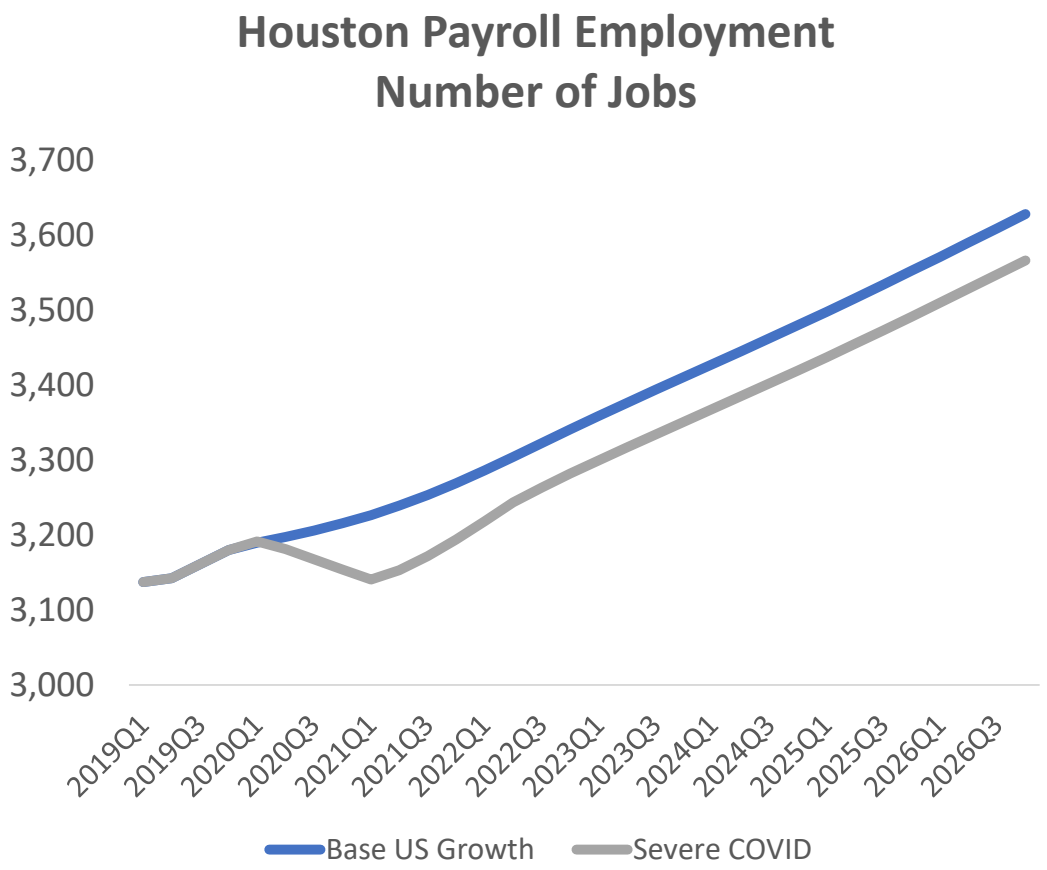
- The COVID pandemic leaves us with a strange mix of unprecedented pandemic-driven job losses and a never-before seen stimulus-driven surge in income and spending
- Could it be a moderate U.S. recession is buried under the huge swings in the employment data that show a worst-ever one-quarter recession that immediately turns modest expansion?
  - The use of widespread stay-home orders and closing of nonessential businesses pulled much economic damage forward to early months of the pandemic -- in ways not seen before.
  - A 2003 pre-COVID paper by the Congressional Budget Office used a historical/bottom-up approach to pandemic impacts and concluded that a severe pandemic like the Spanish-Flu would cause a moderate U.S. recession. Extraordinary use of stay-home orders was not considered
  - A recent paper by Barro, Ursúa, and Weng (2020) found that the Spanish flu probably caused a moderate U.S. recession. Barro and Ursúa have studied many such "macroeconomic catastrophes" including WWI and the Great Depression
- *I assume for planning purposes that recession is certainly underway in the U.S. – but one that will average to a moderate recession once stimulus and public health officials are finished.* When the pandemic is over in the first half of 2021, the U.S. will be working itself out of recession typical of those seen over the last 60 years

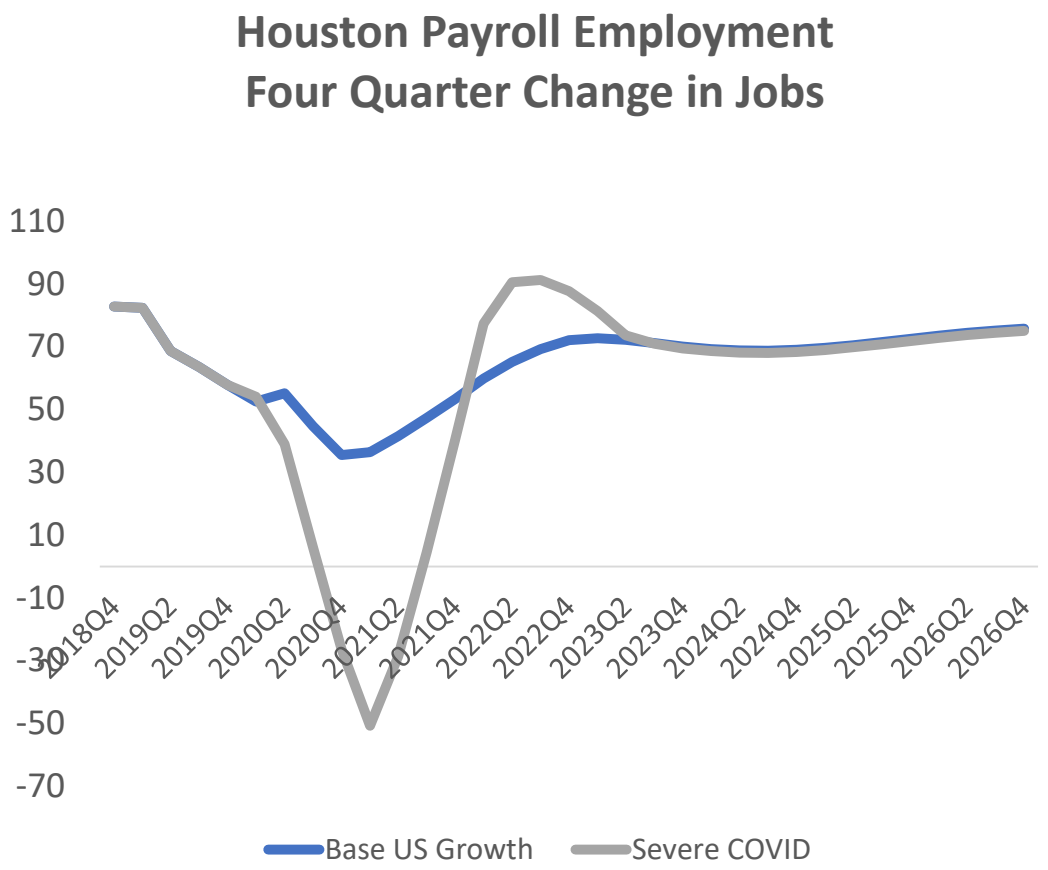
A Moderate U.S. Recession Scenario for COVID-19: Payroll Employment w/o Stay-Home Orders or Social Distancing



- A typical U.S. recession sees payroll employment fall 3.0 percent over four quarters and then recover in five more
- Recovery means a return to the beginning level of employment, but the loss of eight to nine quarters of growth sees no return to the pre-trend *levels* of employment that were forecast before 2026
- *We take this to be our overall economic guide through 2020 and forward, but with a wild ride from quarter to quarter through at least early next year*
- *The wild ride is driven by an unpredictable and unforecastable virus and the public health authority's response to the virus*

The Moderate U.S. Recession Carries Through to the Local Economy: Houston Payrolls with Oil Price at $55





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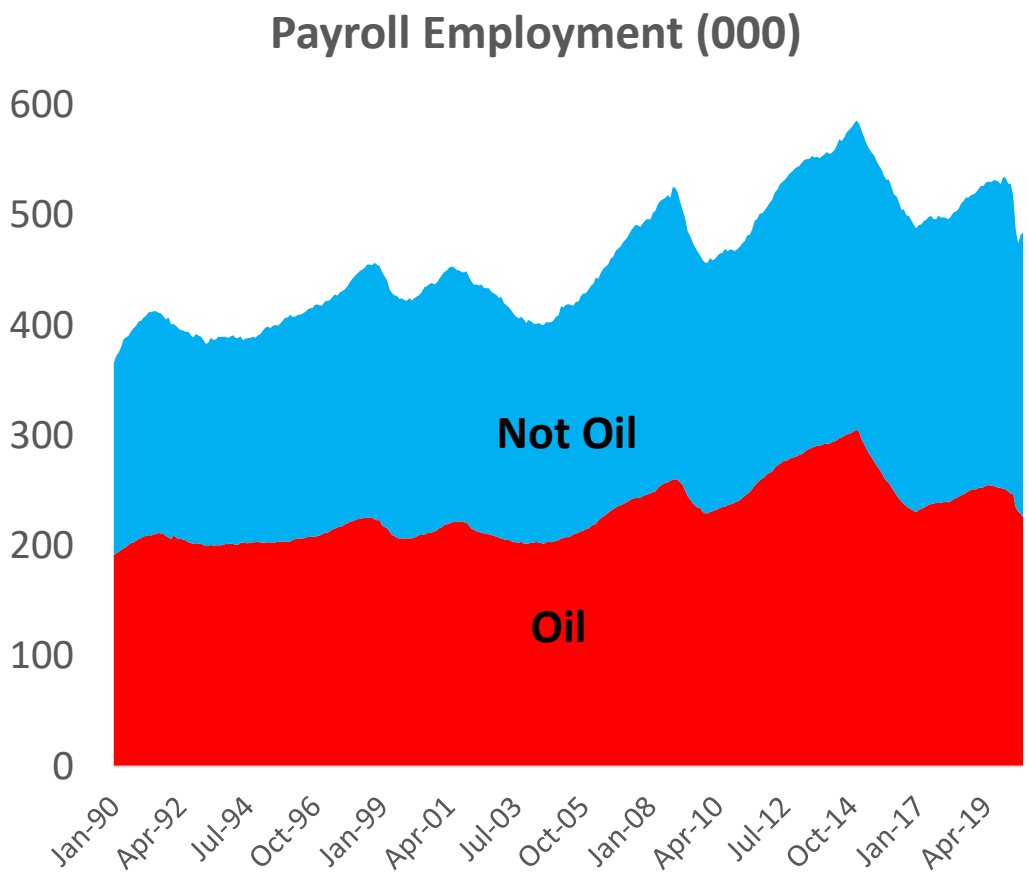
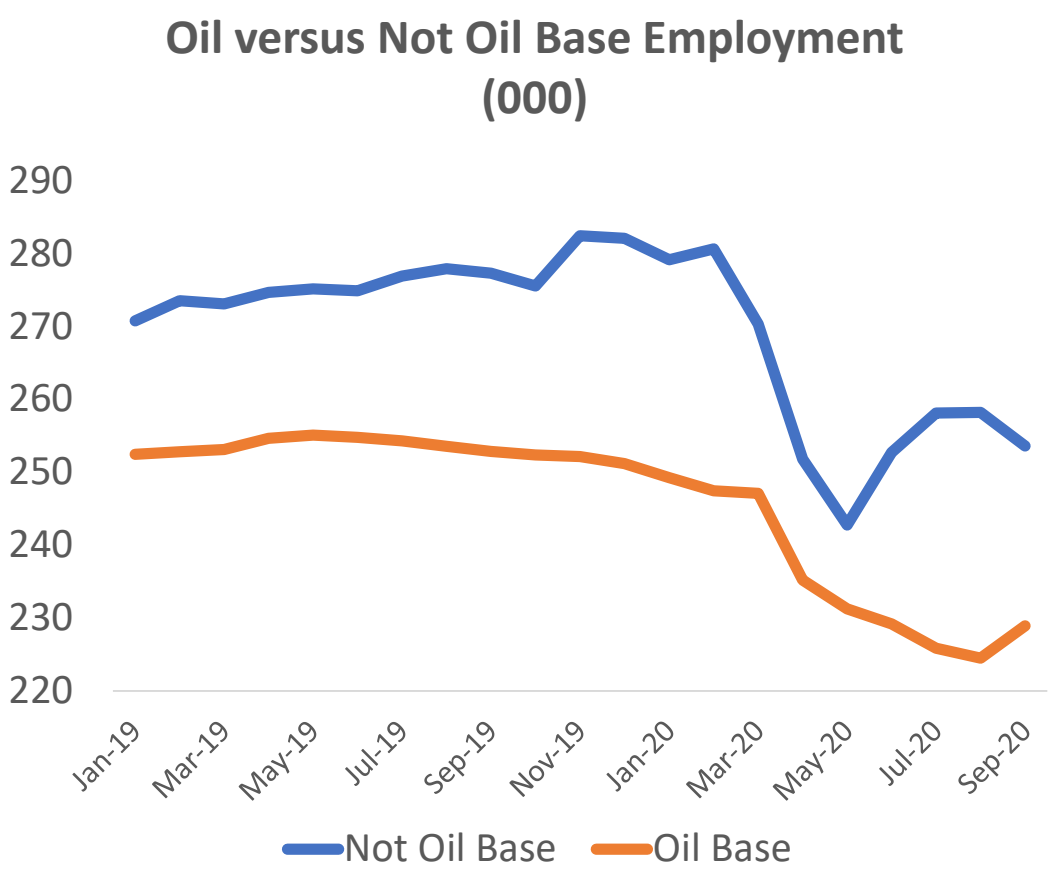
Houston's Economic Base Drives the Economy: Job Losses Are In Secondary Sectors While the Base Points to Moderate Recession





Current Losses in Houston's Economic Base Point to a Typical Houston Downturn Now Underway

Houston's Economic Base in Five Recessions

	Downturn in Economic Base		Oil's Part of Base Losses
Years	**Jobs Lost (000)**	**% Fall**	**%**
1991-93	30.1	7.3	36.4
1998-99	34.0	7.4	51.8
2001-04	52.2	11.5	34.1
2008-09	68.5	13.1	44.9
2014-16	97.0	16.6	76.3
Average	56.4	11.2	48.7
2019 to Sept	***52.0***	***9.7***	***56.2***

Base losses have varied from 50 – 60,000 each month from *May to July. All are consistent with a moderate recession underway.

- *1990-93:* A U.S. recession, Iraq invades Kuwait, First Gulf War and oil price collapse
- *1998-99: The* Asian Financial Crisis saw the global economy collapses along with oil prices, while the U.S. stayed strong
- *2001-04:* U.S. recession, 9/11 Attack, and the Second Gulf War
- *2008-09:* The Great Recession brought both economic and oil collapse
- *2015-2016:* The Fracking Bust was mix of a massive speculative collapse in oil, while the U.S. economy stayed very strong

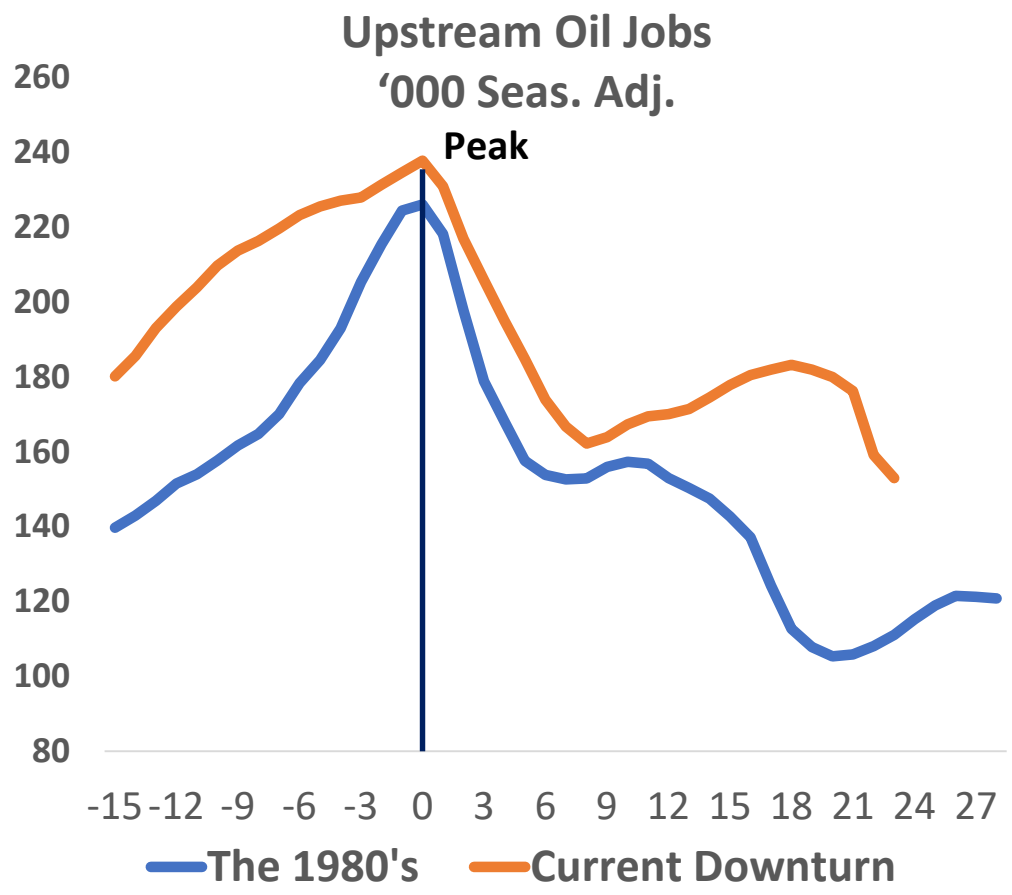
Another Downturn in Oil

Oil and Houston: Difficult Times Since 2014

- From 2011-14, Houston enjoyed an oil boom that rivaled the 1980's, averaging 100,000 or more new payroll jobs each year
- But the fracking bubble burst in November 2014 when OPEC withdrew as swing producer and let the price of oil collapse. While the local oil sector lost 77,300 jobs, the U.S. economy grew strongly. Meanwhile, growth in Houston's payroll employment came to a standstill with no growth in 2015 or 2016
- A moderate recovery in oil prices in 2017-18 brought a partial recovery of local oil employment, but by 2018 an industrywide credit crunch had set in. Oil jobs were in decline again in Houston by mid-2019
- Then comes the COVID-19 pandemic and the Saudi-Russian oil war, resulting in complete collapse in oil markets in May
- We now see a nascent recovery underway, with little movement in drilling and the rig count, but with better growth in fracturing and completion of a backlog of uncompleted wells.

Perspective Since 2014: All the Speculative Excesses Wrung Out in 2015-16 as the Fracking Bubble Burst

(Houston Oil Jobs '000)



--The 2015-16 Fracking Bust was a speculative bubble that burst, and initially looked much like the early 1980's

-- We saw oil prices fall from $100 to $30 in 2015-16; the rig count fell from 2000 to 400; local upstream job losses were 77,300.

-- *Only 22,700 of those Houston lost oil jobs returned by 2019Q2 or about 30 percent*

-- The industry was lean as we enter this downturn, with few speculative excesses to wring out.

-- The large job losses of 2015-16 are harder to reproduce in 2020, even given current events

*Texas Workforce Commission estimates. Upstream Jobs = Oil Producers and Services, Machinery, and Fabricated Metal

Wall Street Turns Its Back on Fracking Producers

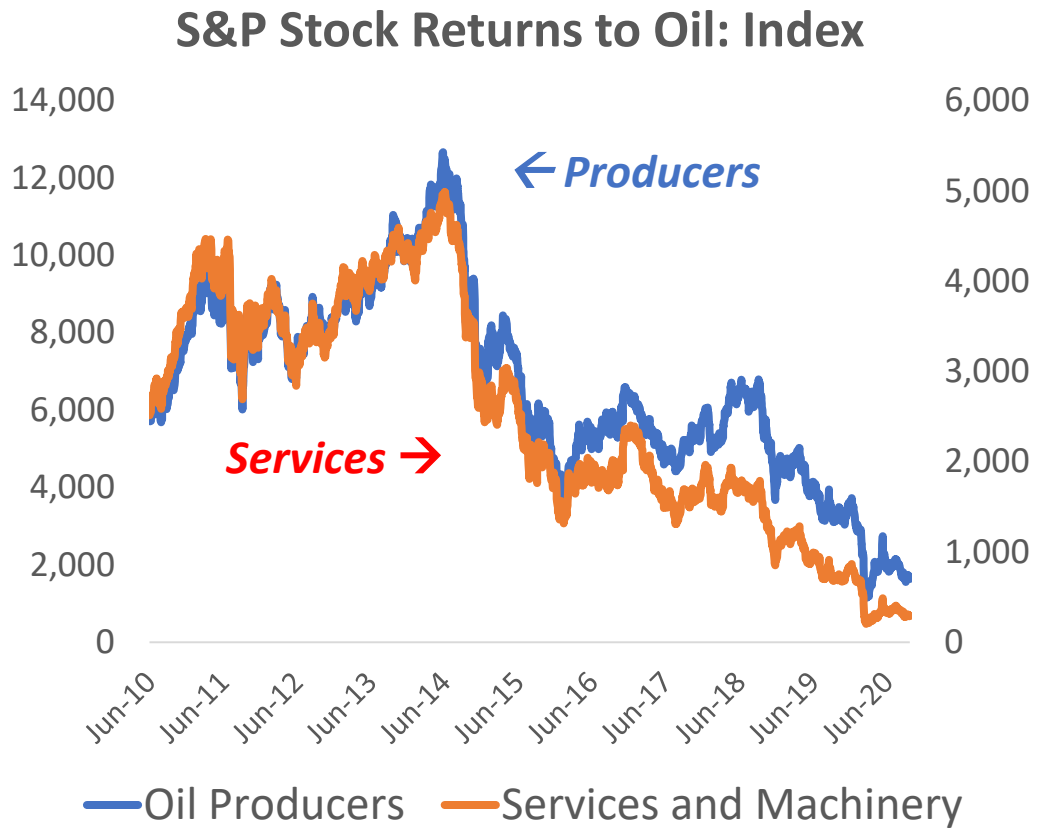
Fracking Is a New Model for Oil Production

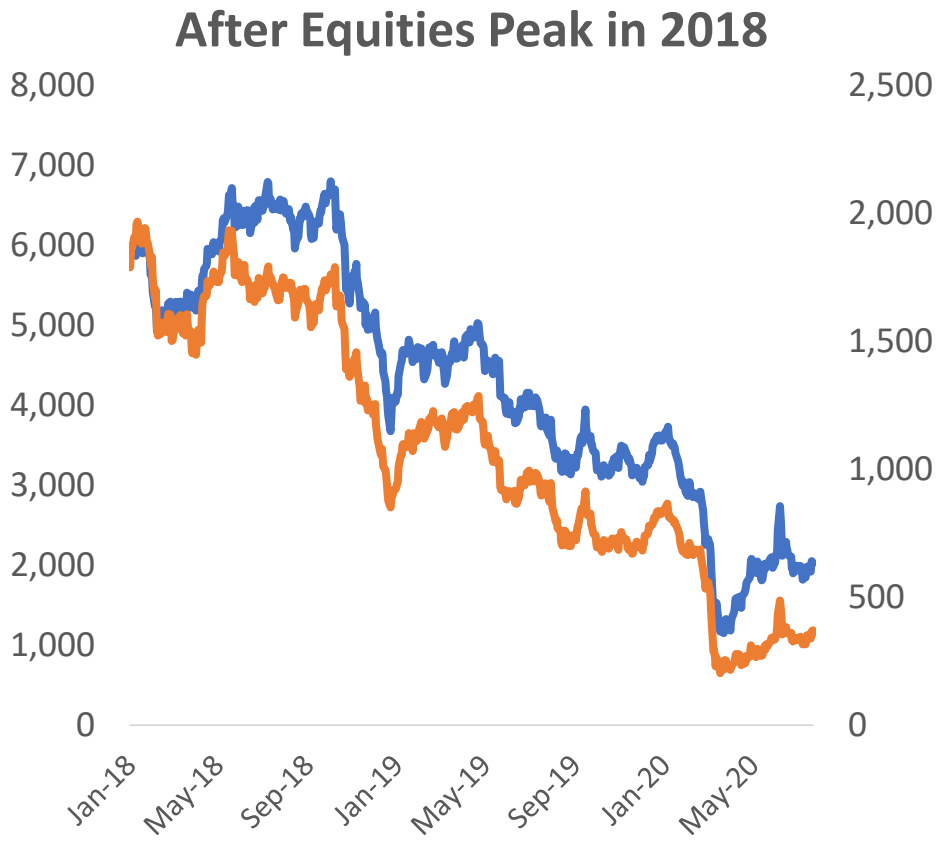
- Looks more like a competitive industry. Many small operators, price-takers, and assembly-line production
- Low barriers to entry for new producers, i.e., capital, some geology, leases, and a hire a service company. Today a hedge fund, tomorrow an oil producer
- Traditional exploration risk is gone, production costs are understood, and the oil is there
- Get a quick and certain rise or fall in oil production in response to changing oil price incentives

Fracking's Problems Now?

- Fracking is a high-cost source of oil, and even $55 oil hurts many companies, and $2 natural gas is lethal for others
- The industry was born in an era of cheap money from the central bank, and too many companies used low interest rates and a rising stock market to try for a quick killing – instead of building a viable business
- Many producers struggled in 2019 to deliver steady income and growth to impress the stock market, which has now turned its back on the industry
- A wave of bankruptcies, delistings, forbearance, etc. hit hard in 2019

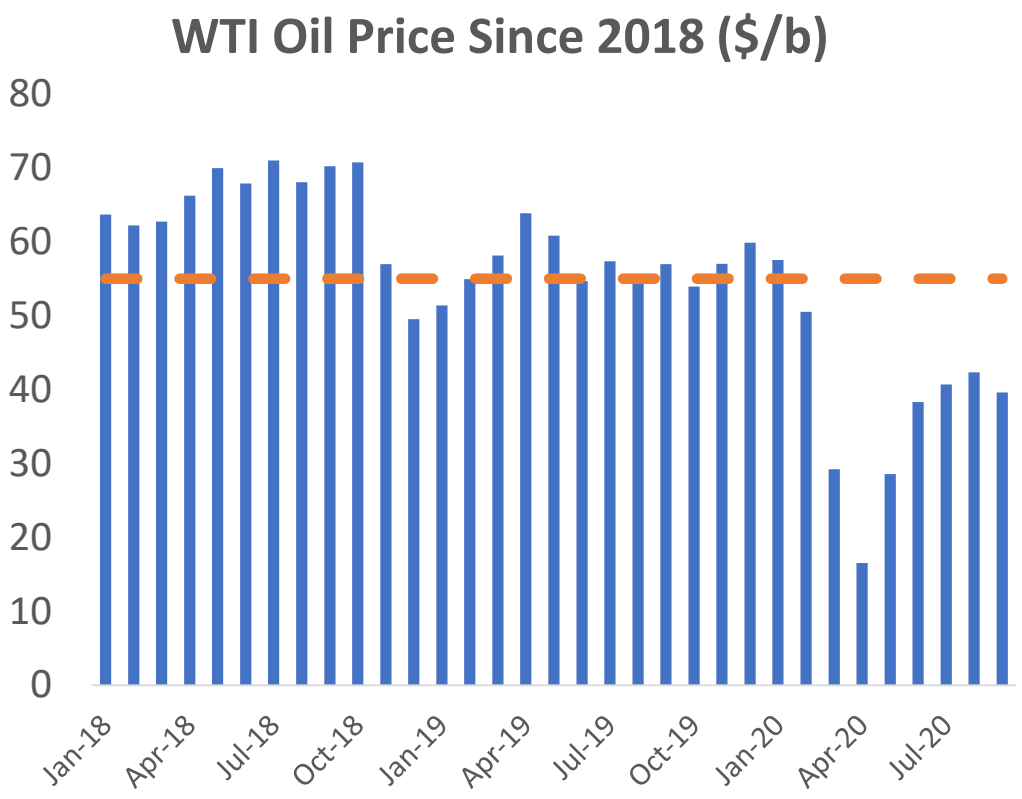
Lower Oil Prices and Poor Performance Pressures Fracking Profits, Leads to Lower Stock Prices and a Credit Squeeze





S&P Dow Jones to October 21, 2020

Moderate Oil Prices and a Squeeze on Credit Generate Bankruptcies in 2018-19



DOE/EIA and Haynes and Boone *Bankruptcy Monitor*

Oil-Related Bankruptcies in 2019-20: Number and Secured & Unsecured Debt

	Producers		Oil Services	
	Number	Debt ($B)	Number	Debt ($B)
2019Q1	5	1.62	3	.01
2019Q2	13	4.67	11	7.77
2019Q3	15	6.70	2	.00
2019Q4	10	12.81	7	.26
2020Q1	5	2.52	7	10.81
2020Q2	18	28.10	11	13.05
2020Q3	18	23.10	26	10.99

Oil Bankruptcies Mounted Quickly in Late 2019: Pandemic Oil Prices Bring More Pain in 2020

	Oil Producers		Oil Services	
	Number	**Debt ($ bil)**	**Number**	**Debt ($ bil)**
2015	44	17.38	39	5.31
2016	70	56.80	72	13.49
2017	24	8.54	52	34.74
2018	28	13.16	12	3.89
2019	42	25.77	15	8.07
2020*	41	53.72	44	34.85

* Through end of September

Haynes and Boone, *Oil Patch Bankruptcy Monitor*

Largest Bankruptcies 2019/2020

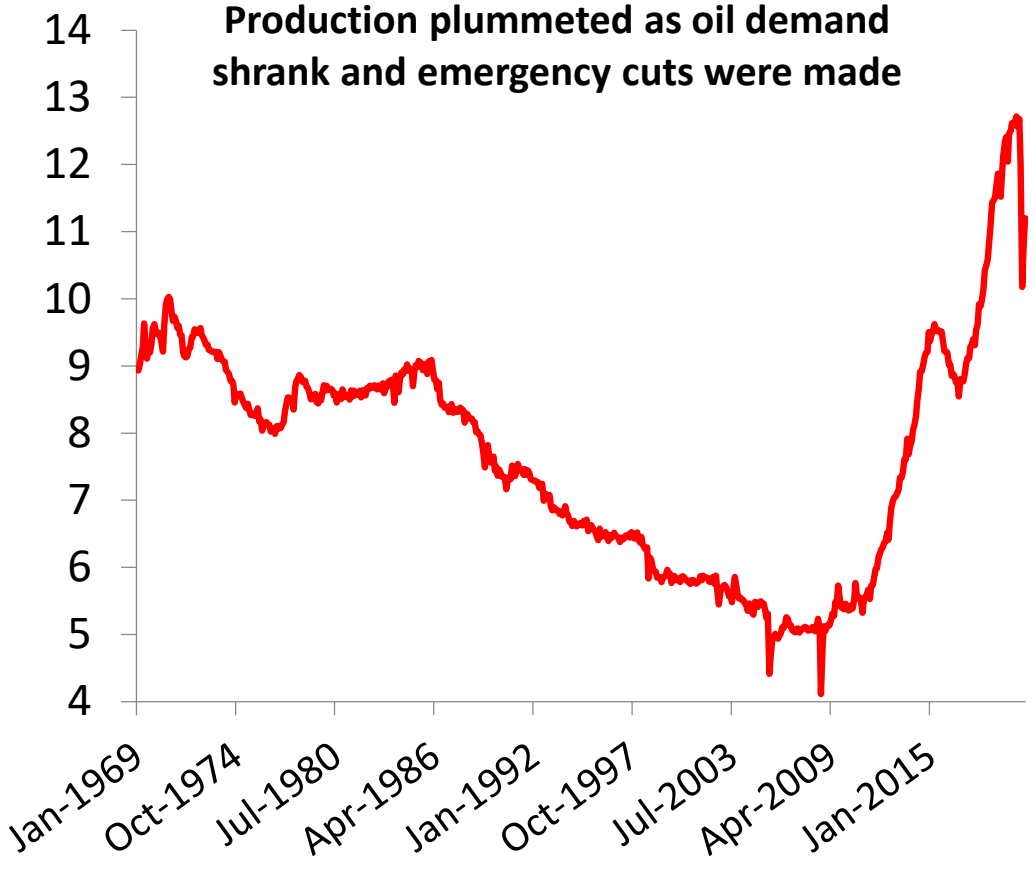
Producers:	**Debt ($ bil)**
Chesapeake Energy	9.2
EP Energy	7.3
Ultra Petroleum	5.6
Unit Corporation	4.8
Legacy Reserve	2.6
Approach Resources	3.7
Whiting Petroleum	3.6
Sanchez Energy	2.3
Services:	
Diamond Offshore	11.8
McDermott Intl'l	9.9
Weatherford	7.4

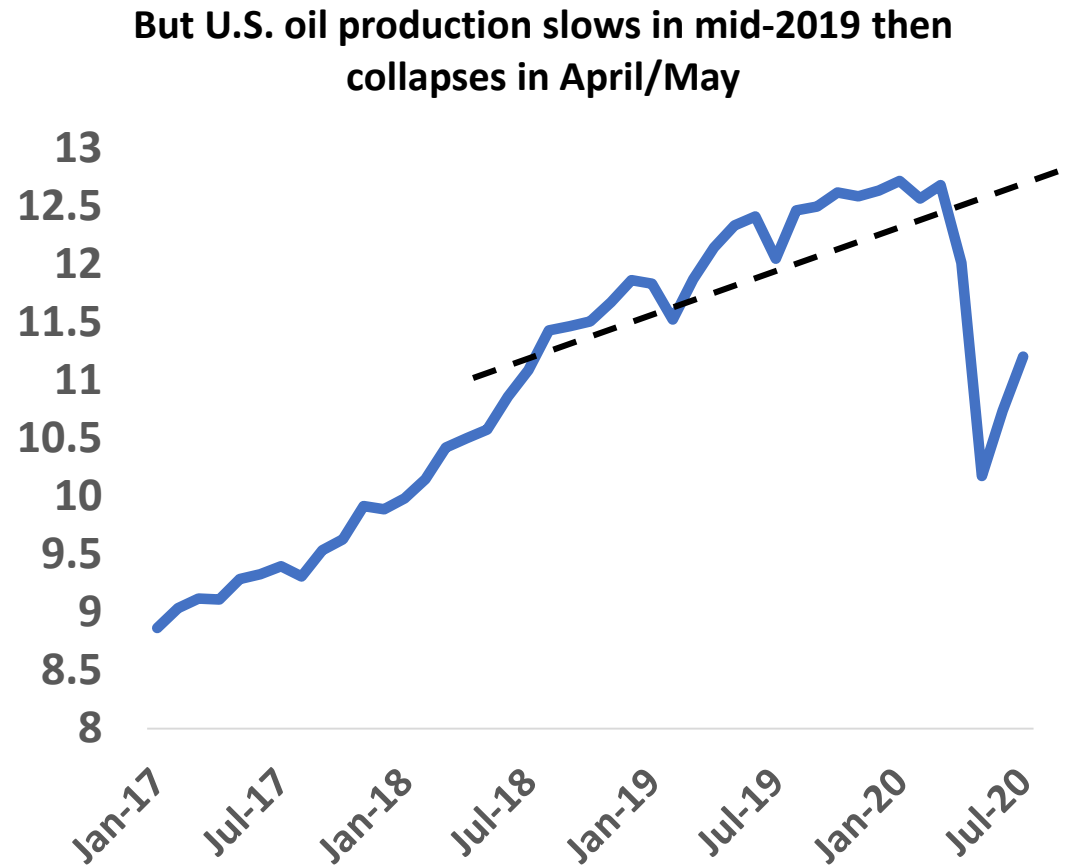
Oil Becomes a Dividend-Paying Value Stock? Leaves Its Growth Stock Roots Behind?

- Fracking is highly sensitive to current oil prices: About 40 percent of recoveries or half of net present value from a newly-fracked well come in the first year. Hedging is essential
- The pressure from Wall Street means oil producers must learn to themselves *as a low P/E, dividend-producing value stock*. In the past, they have been *rapidly-growing growth stock that reinvested all profits*
- $60 oil? About 20% goes to royalties and production taxes, $15 to production costs, and *30% for dividends and debt reduction*. That leaves $23 for reserve replacement, capital expansion, and contingencies. At $40? The bottom line falls to $7

Lower Oil Prices, a Credit Squeeze and then COVID-19 Take a Toll On U.S. Oil Production

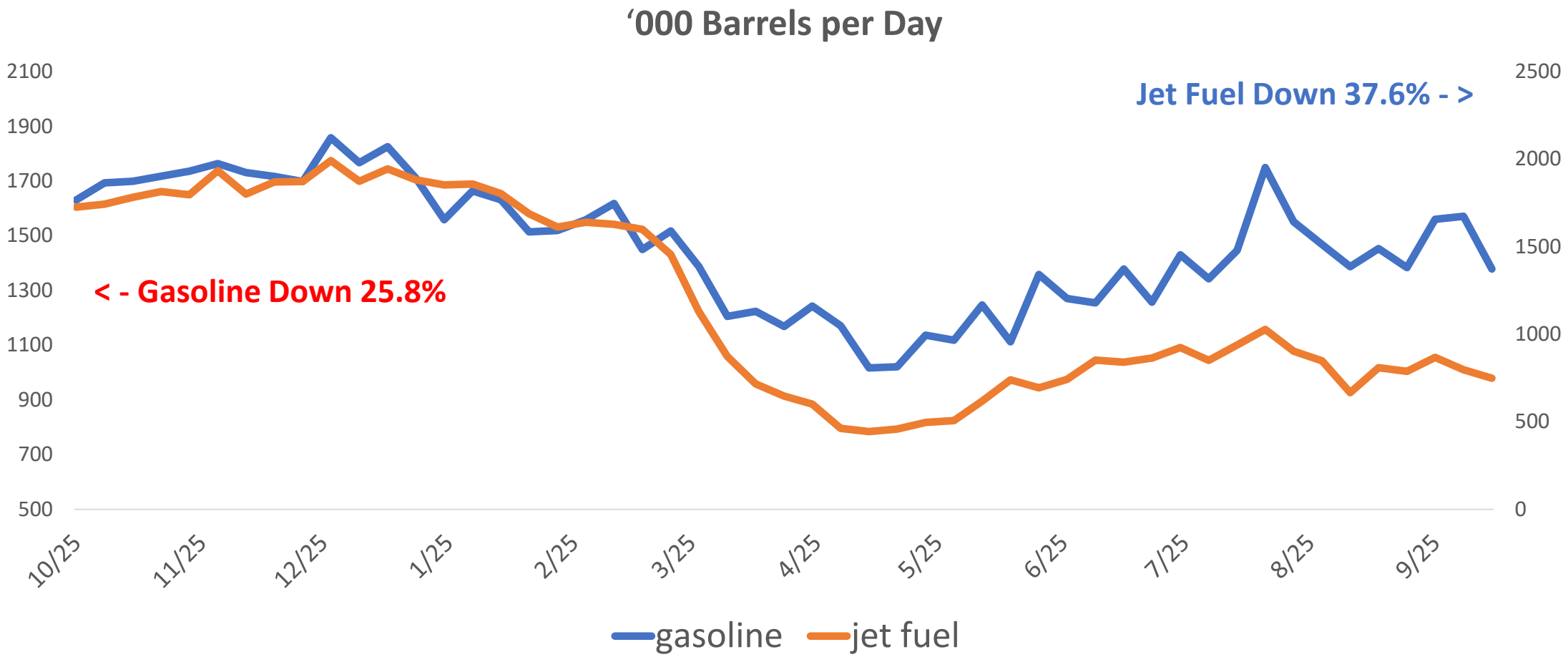
(million barrels/day, s.a.)





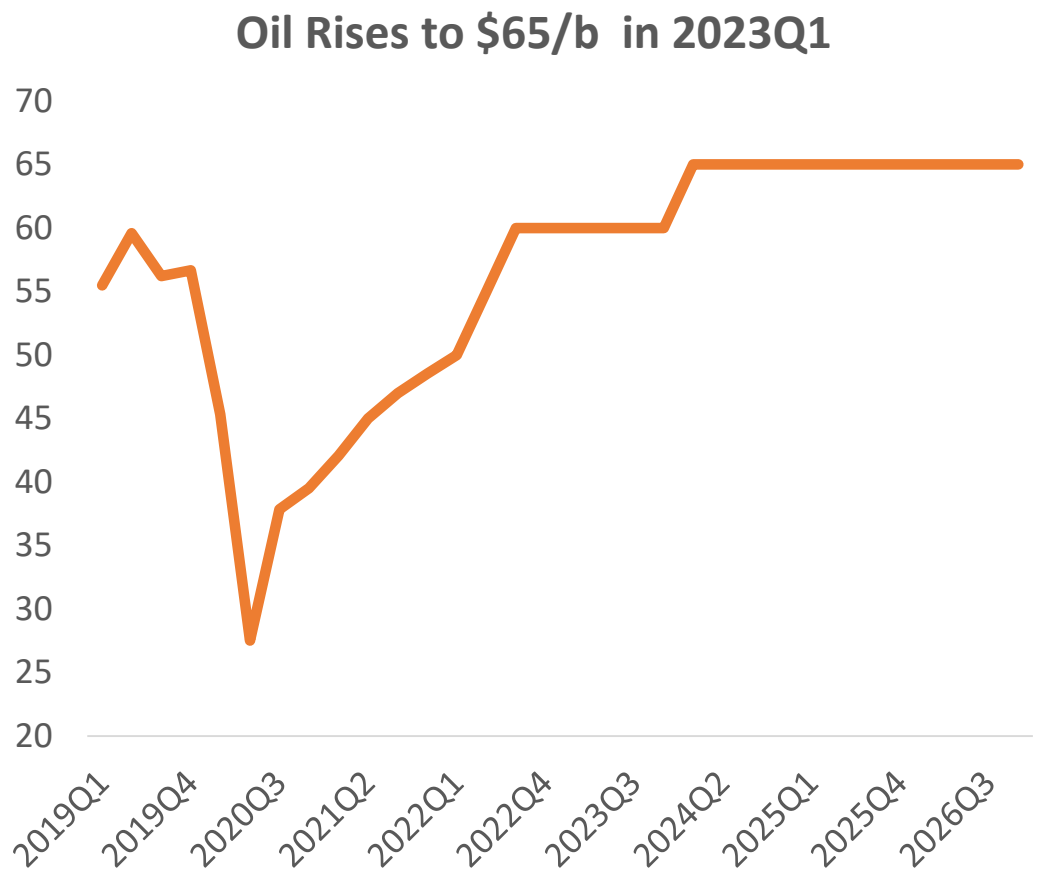
DOE/EIA, Seasonally adjusted by IRF

COVID Still Has the Reins: U.S. Production of Gasoline and Jet Fuel Reflect Partial Recovery With Little Progress in Sept/Oct



Assume COVID Ends By Early 2021 Leaving Behind a Moderate Recession and Weak Oil & Gas Prices

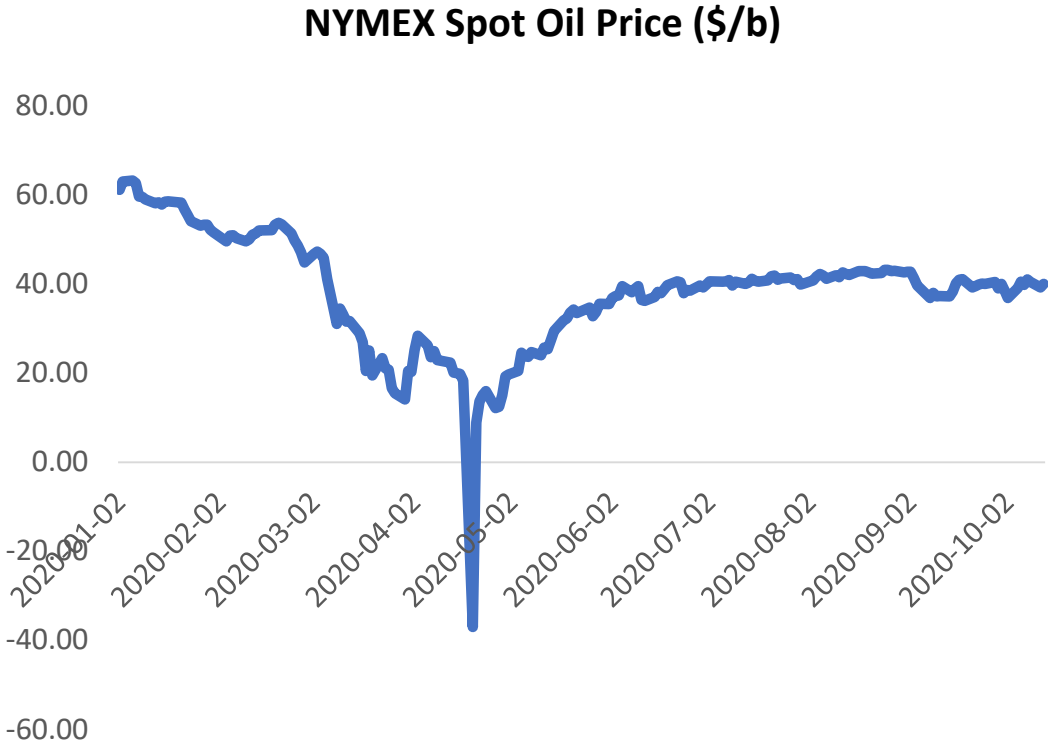
	WTI Spot Oil ($/b)	Spot Natural Gas ($.Mcf)
2019Q1	$55.49	$2.95
2019Q2	$59.58	$2.66
2019Q3	$56.22	$2.38
2019Q4	$56.66	$2.29
2020Q1	$45.33	$1.89
2020Q2	$27.53	$1.17
2020Q3	$37.84	$1.65
2020Q4	$39.50	$2.46
2021Q1	$42.07	$3.05
2021Q2	$45.00	$2.99
2021Q3	$46.99	$3.12
2021Q4	$48.52	$3.23
2022Q1	$50.00	$3.00
2022Q2	$55.00	$3.00
2022Q3	$60.00	$3.00
2022Q4	$60.00	$3.00



DOE/EIA, *Short-Term Energy Outlook* to 2021Q4, IRF in forecast in 2022 and later

Post-Trauma Pick-Up in the Oil Fields as Oil Prices Near $40/Barrel and the Rig Count Slowly Moves Up

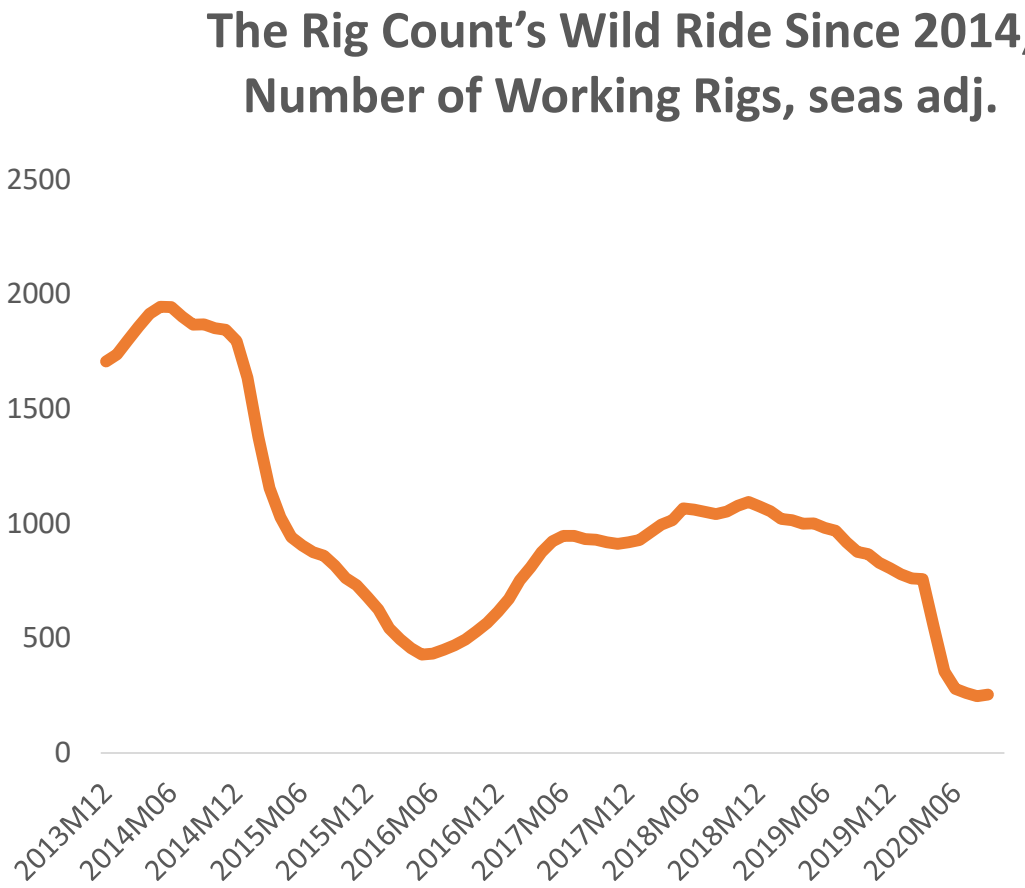
Oil Price Stabilize Near $40/b in July

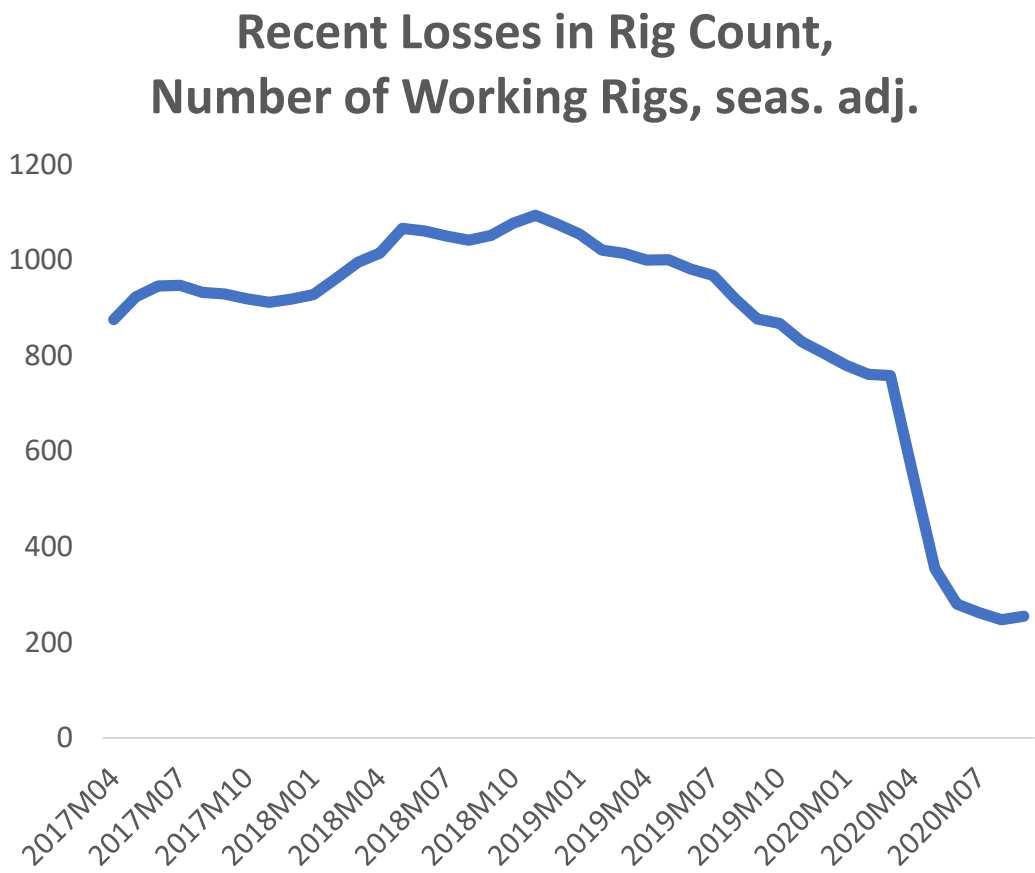


Weekly Change in the U.S. Rig Count

FRED, St. Louis Federal Reserve Bank; Baker Hughes and IRF calculations

The Rig Count Fell by 336 Rigs After November 2018, Then COVID and the Oil War Pile On More Losses

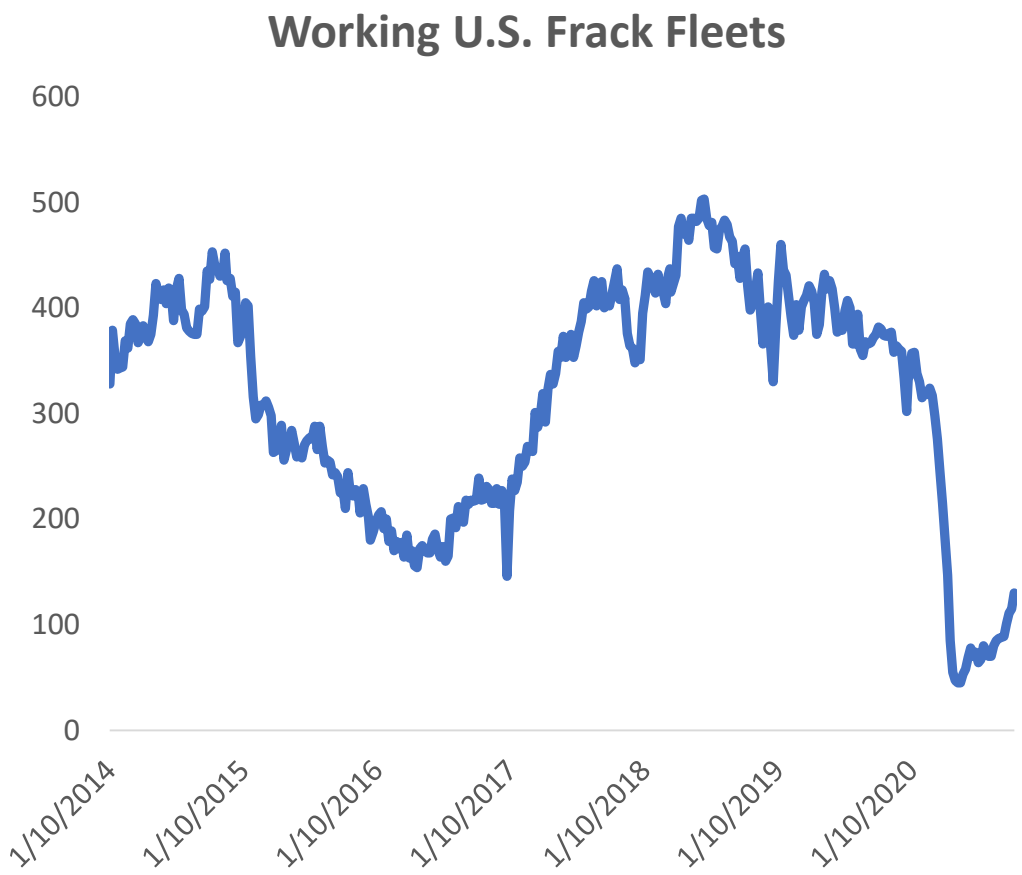




Baker Hughes Rig Count

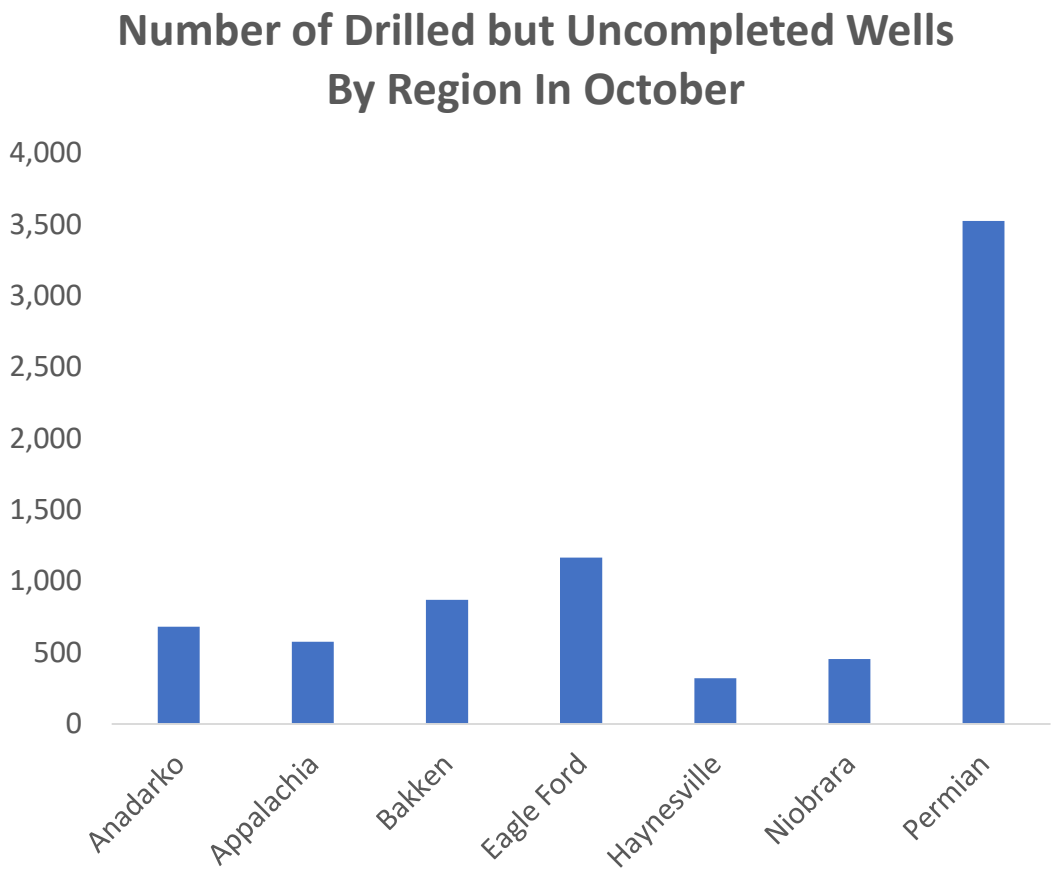
Fracturing and Completion Is the Quickest Way to Replace Reserves and Earn Cash

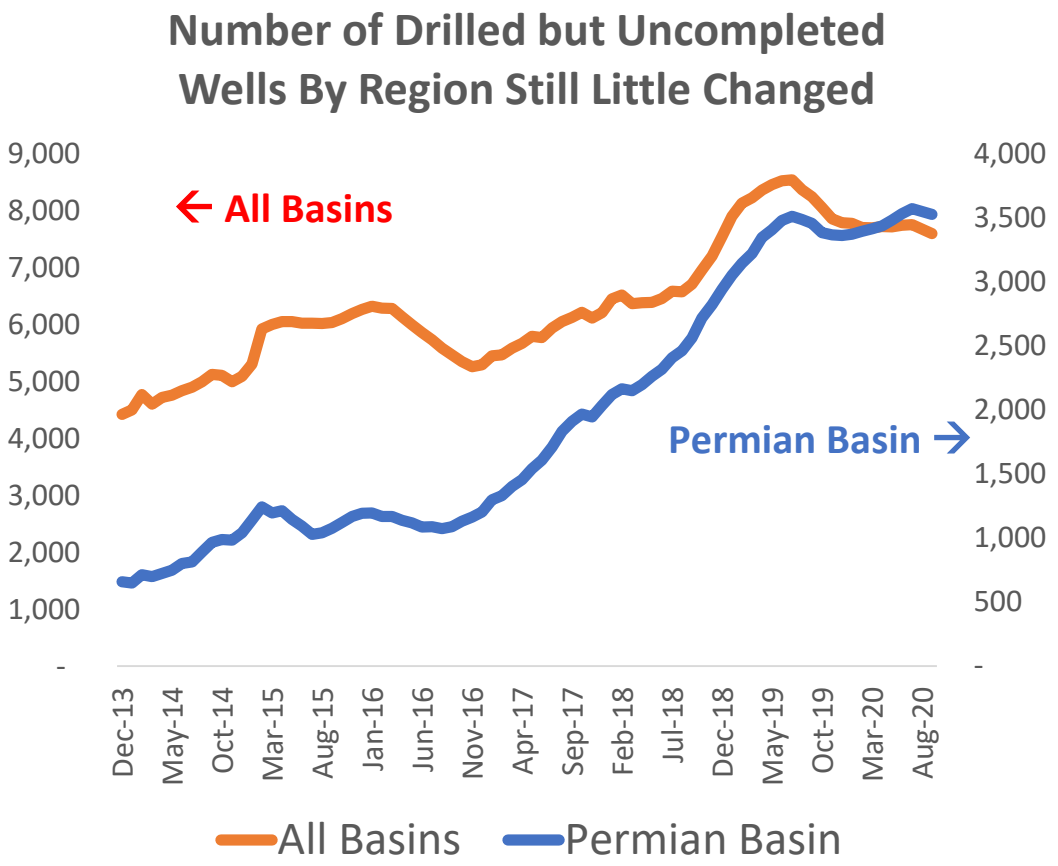
- To the right, you see the number of fracking fleets at work to fracture and complete wells that have already been drilled
- The first meaningful signs of oil-field recovery were in early June as the number of fracking fleets rose from 45 to 130 by mid-October
- Drilling is a separate process from fracking and completion and incurs costs that are similar to drilling
- Sunk cost of drilling makes this the quickest and least costly avenue for producers to replace reserves and earn cash



Primary Vision data through October 14, 2020

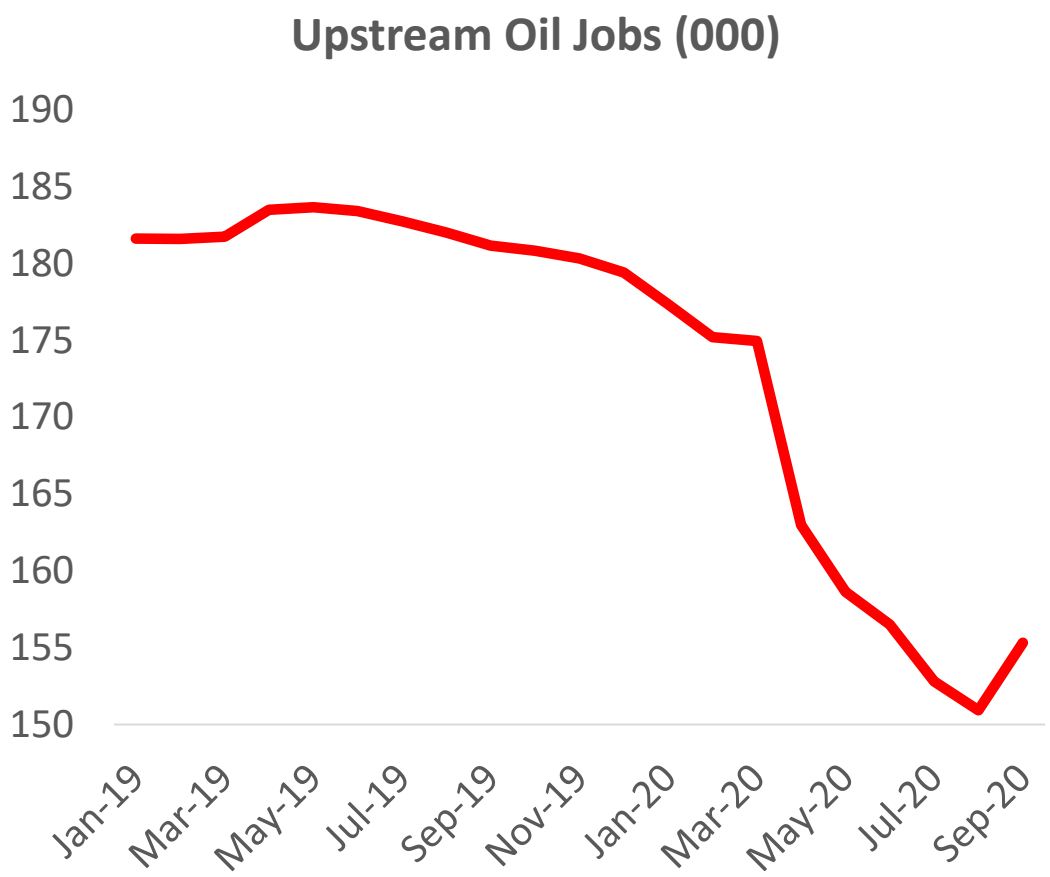
Drilled But Uncompleted Well Inventory Still High, But Now Leading the Early Recovery in the Oil Fields

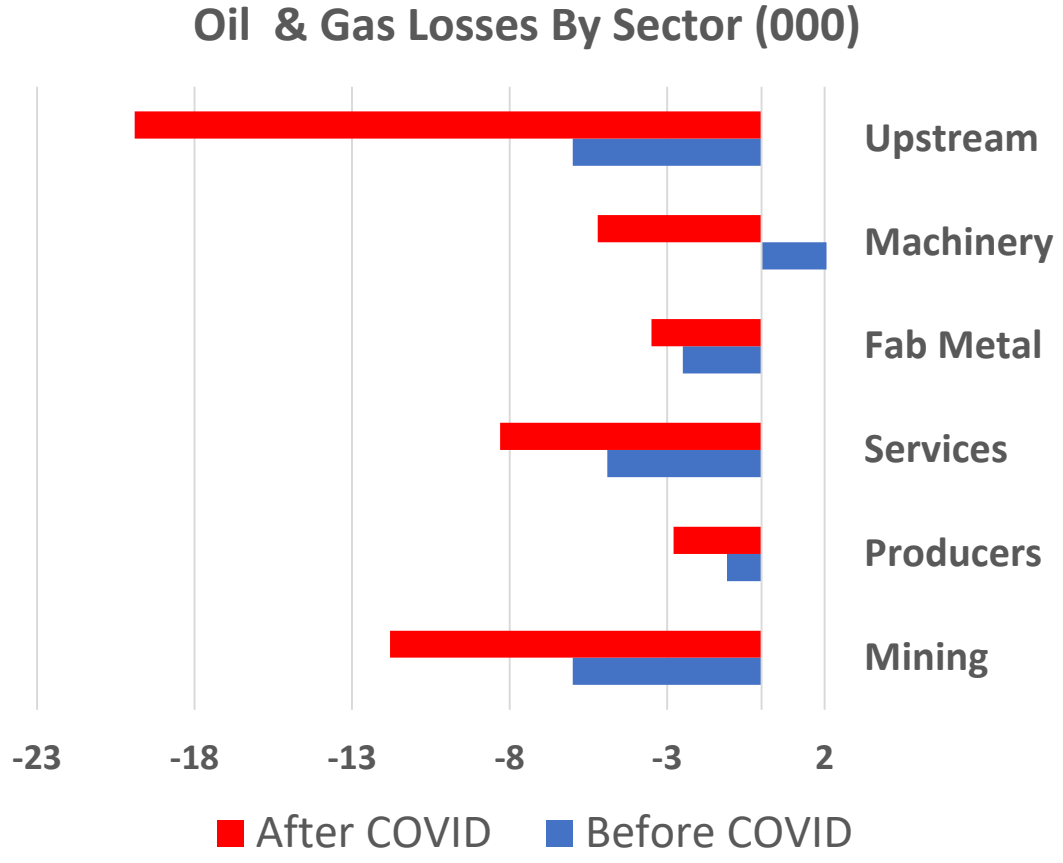




DOE/EIA, *Drilling Productivity Report*, Oct 13, 2020

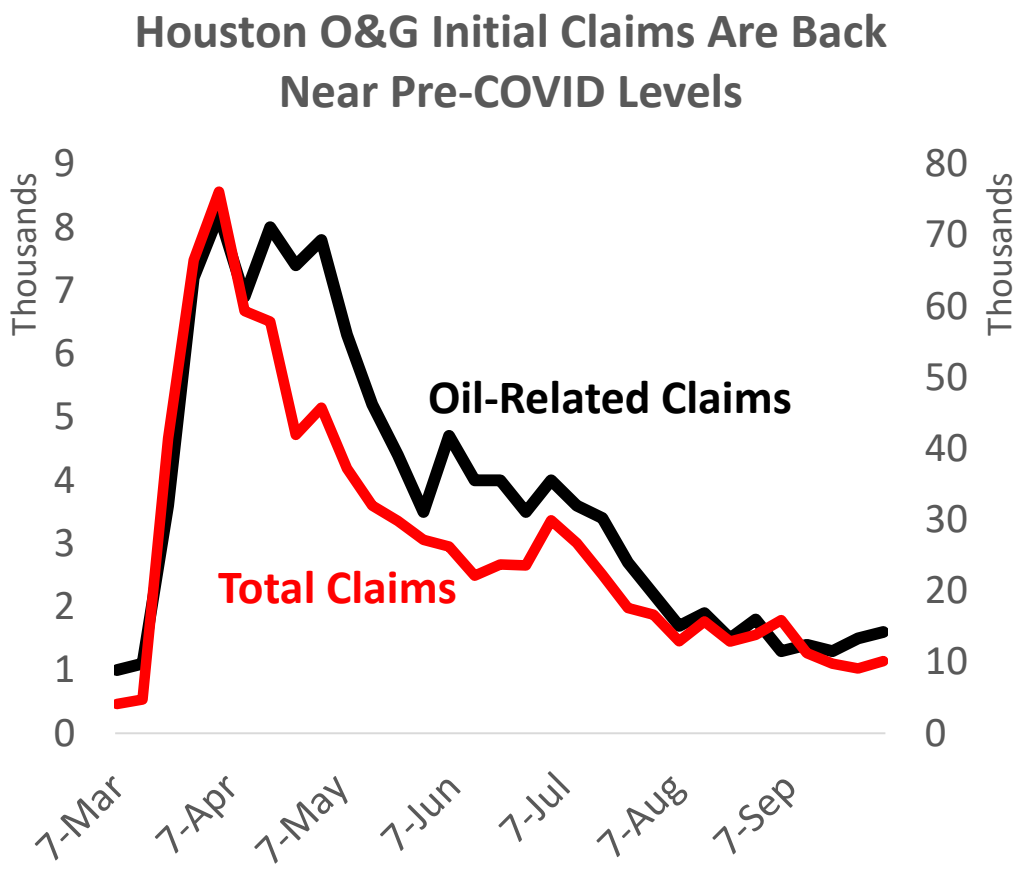
Houston's Lost 28,200 Oil & Gas Jobs Since Peaking in April 2019, With 30 Percent of Losses Coming Pre-COVID

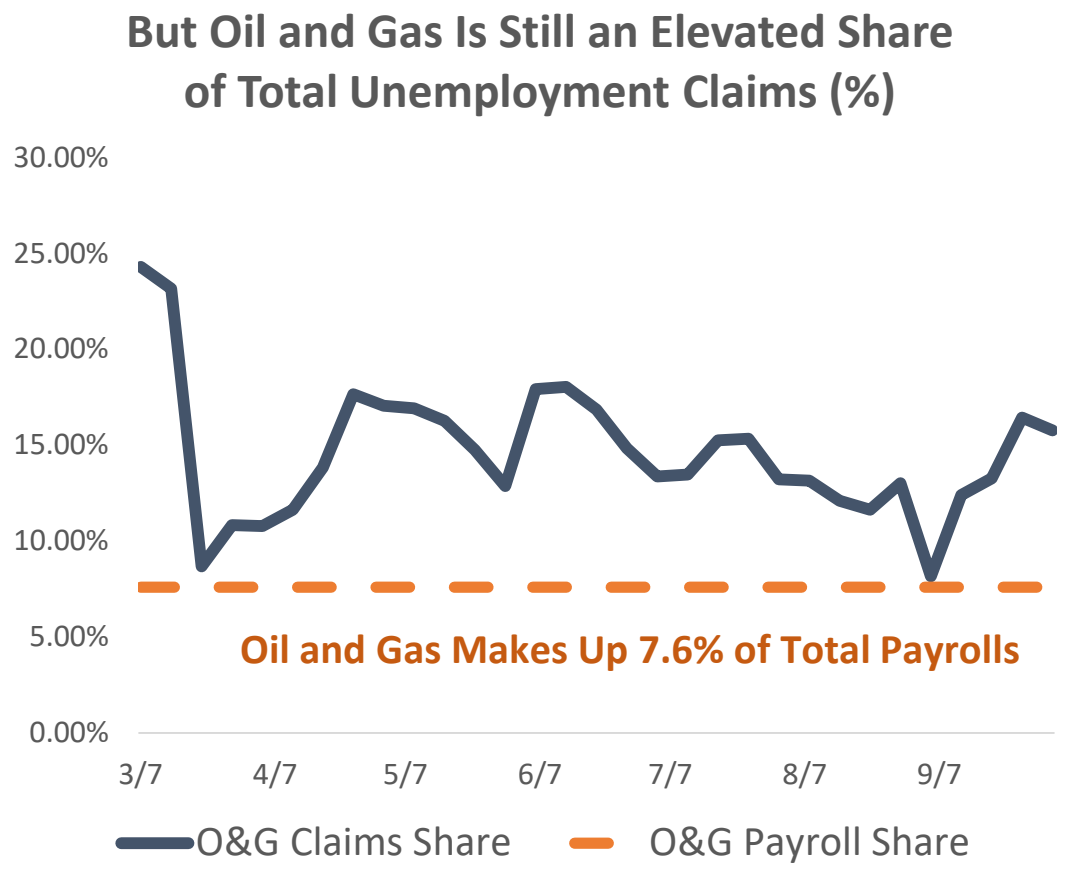




Texas Workforce Commission, calculations of IRF

Initial Claims in Houston's Oil and Gas Sector Behaved Like Total Claims, But with Elevated Numbers Claims Relative Size





Texas Workforce Commission, data is for *both upstream and downstream oil* in the Houston metro area plus two small adjacent counties

The Global Economy?
It Is Mostly About COVID, Too

IMF Says World Growth to fall 4.4% in 2020 And Recovery of 5.2% Comes in 2021

Percent GDP Growth, Year-Over-Year

	2017	2018	2019	2020	2021
World	3.8	3.5	2.8	-4.4	5.2
Advanced Economies	2.4	2.2	1.7	-5.8	3.9
U.S.	2.3	2.9	2.2	-4.3	3.1
Euro Area	2.4	1.8	1.3	-8.3	5.2
Germany	2.5	1.3	0.6	-6.0	4.2
France	2.2	1.8	1.5	-9.8	6.0
Italy	1.7	0.8	0.3	-10.6	5.2
United Kingdom	1.7	1.3	1.5	-9.8	5.9
Japan	1.9	0.3	0.7	-5.3	2.3
Emerging/Developing	4.8	4.5	3.7	-3.3	6.0
Brazil	1.1	1.3	1.1	-5.8	2.8
Russia	1.6	2.3	1.3	-4.1	2.8
India	7.2	6.8	4.2	-10.3	8.8
China	6.8	6.6	6.1	1.9	8.2

IMF, *World Economic Outlook*, update as of October 2020

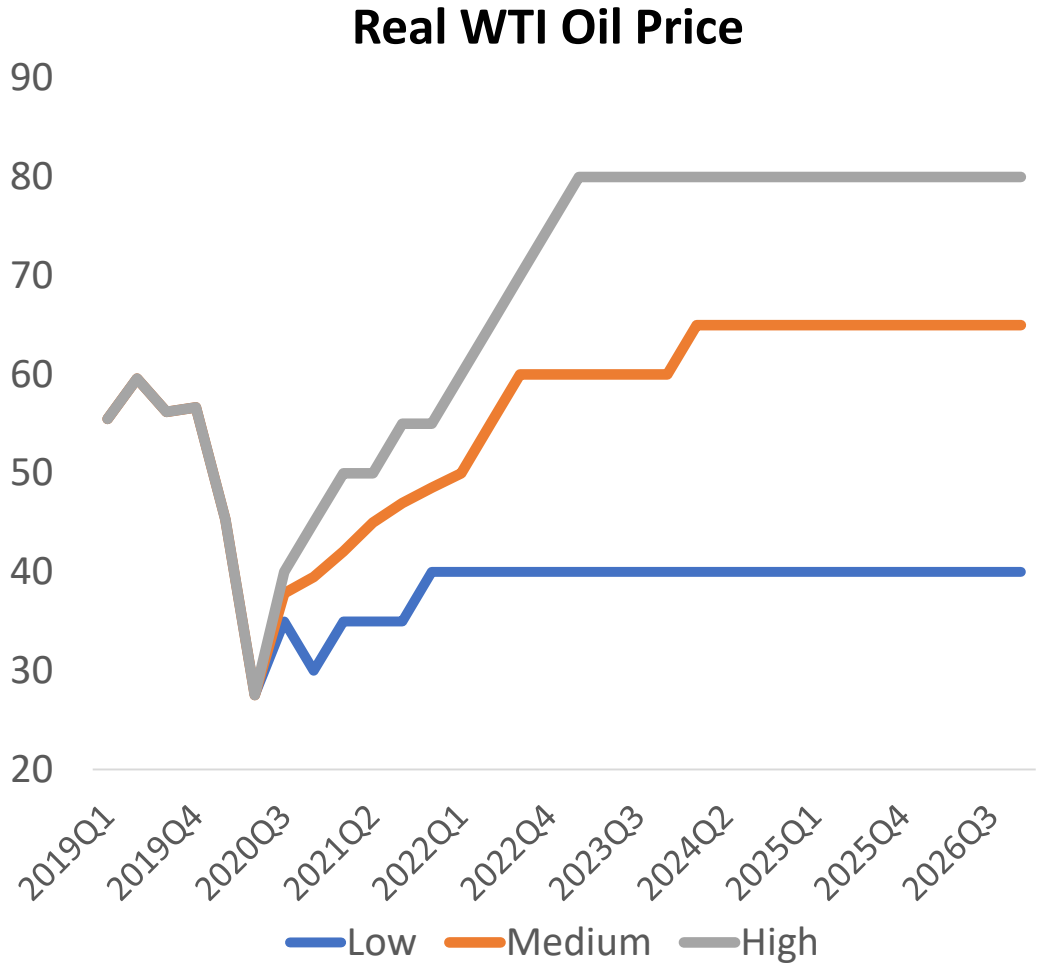
The Global Economy: COVID-19 Dominates the Outlook

- The U.S. joined the global economy in a deep second quarter recession and partial recovery. Country-to-country differences in economic performance around the world mostly reflect COVID and the timing and duration of lockdowns.
- The IMF forecasts a global growth rate of -4.4 percent in 2020 and 5.2 percent in 2021
  - On the IMF's list of major economies shown above, China is alone a positive growth rate in 2020 at 1.9 percent, followed by 8.2 percent next year
  - As bad as it is, the – 4.2% decline for U.S. is among the best among large developed countries. The projected 3.1 percent recovery is subdued, however.
  - If China is excluded from the list of emerging and developing countries, they have a combined -5.7 percent fall in 2020 and a 5.0 percent gain next year
- The global fiscal response has been $12 trillion dollars, with deep rate cuts and massive liquidity injections and asset purchases
- The IMF sees economic recovery as having already taken root in 2020Q3, and social distancing and lockdowns slowly end as a vaccine arrives in 2021

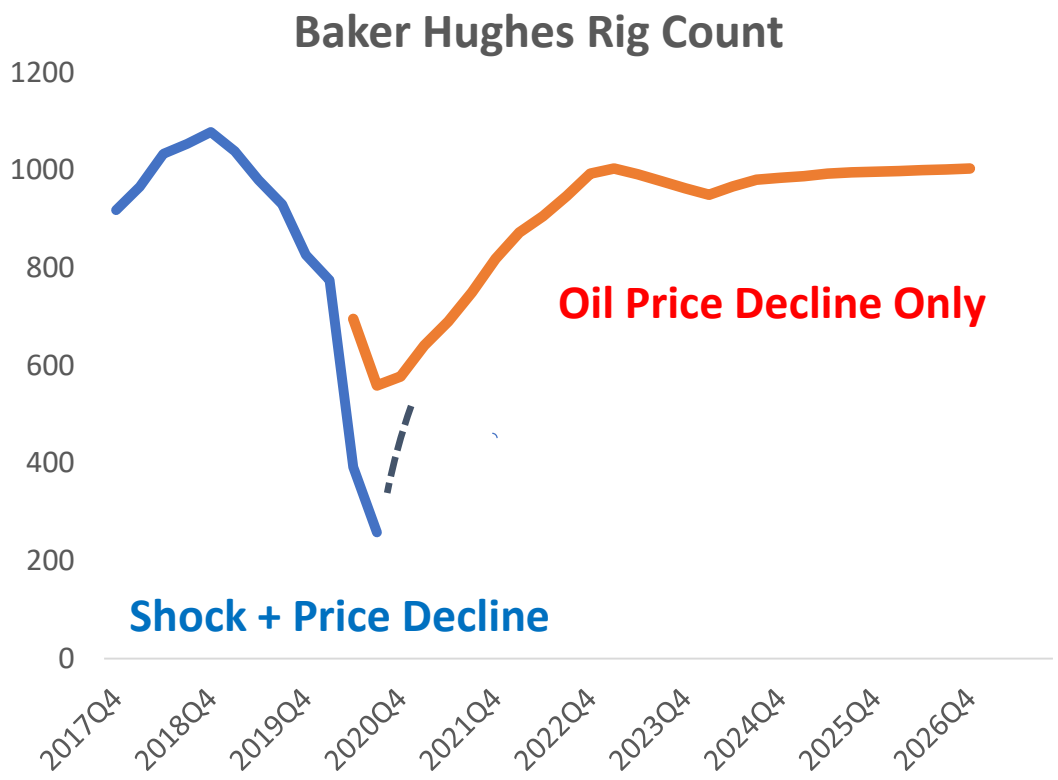
Outlook for Houston

COVID and Moderate Recession End in 2021 -- and Oil Prices Drive Differences in the Low, Medium and High Forecasts

- After the big swings in U.S. and Houston employment in 2020 driven by COVID and public health orders, the U.S. economy emerges from moderate recession in 2021 and returns to growth.
- The primary differences in our high, medium, and low forecast are driven by oil prices. Our medium forecast is based on Energy Information Administration's July forecast
- The high projection accelerates the EIA forecast and has oil prices rise as high as $80 per barrels and stay there to 2026. Perhaps driven by the loss of a major oil field to fire or attack or the emergence of oil shortages
- The low projects of a long period of $40 per barrel as weak global growth in oil demand depresses price

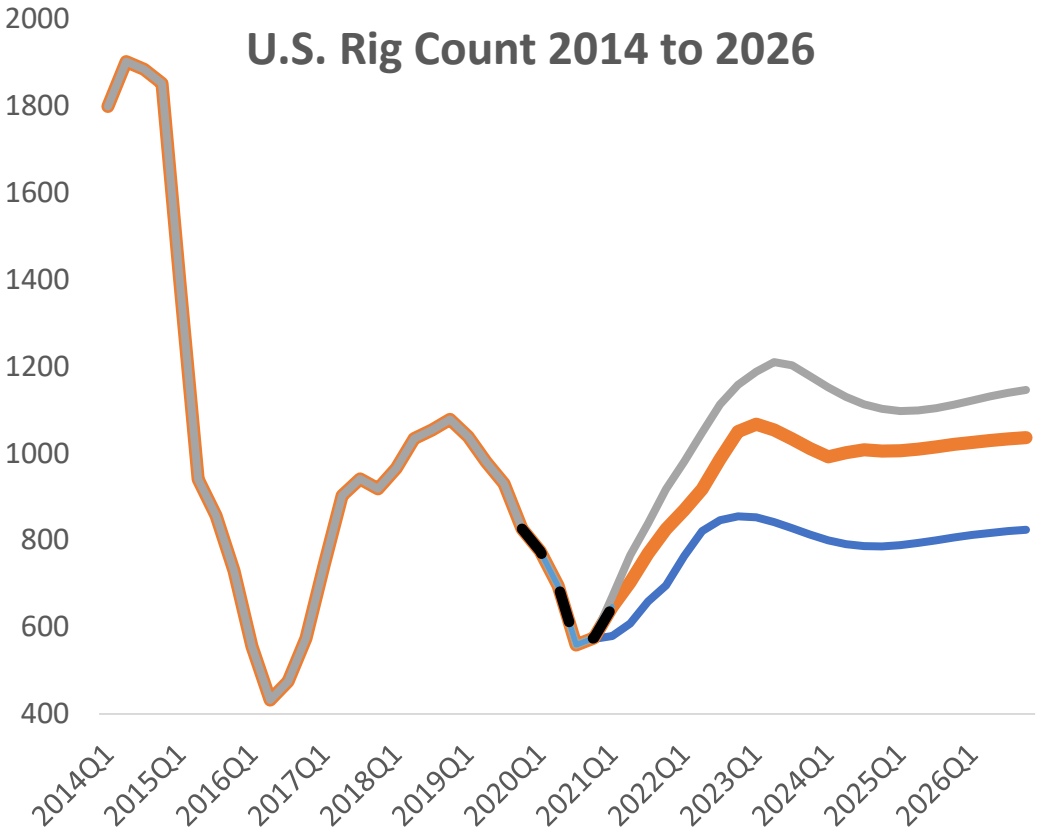


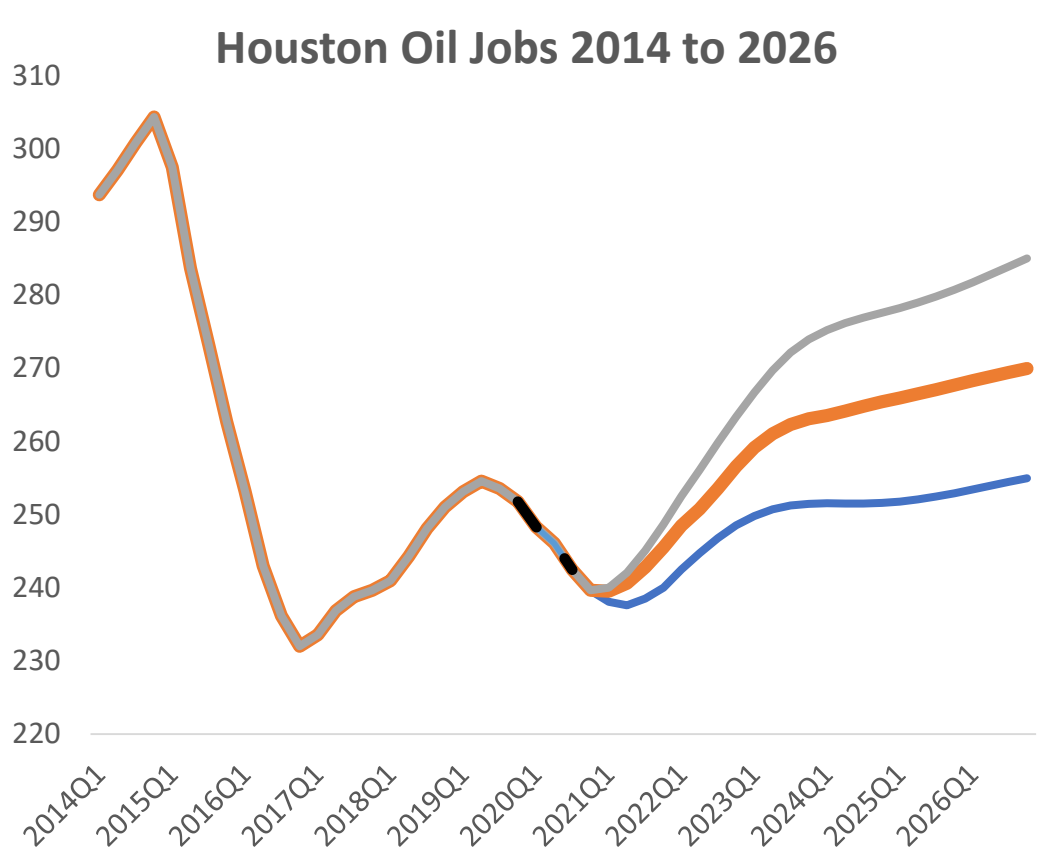
Recovery in the Rig Count By Late 2022, But the Exact Timing and Path of Recovery Is Uncertain



- The second quarter shock to the rig count from COVID and the oil war pushed it down to 258 rigs in 2020Q3 (Blue Line)
- Price collapsed, but price fundamentals alone only would have pushed the rigs count down to 719 in 2020Q2, then to fewer than 600 rigs in Q3 and Q4 (Red Line). The difference (Blue to Red) is the COVID shock
- At some point, price fundamentals reassert themselves and we return to the Red Line. Where? When?
- Post-COVID recoveries in oil price and U.S. growth push the rig count back to 2019 levels by late 2022

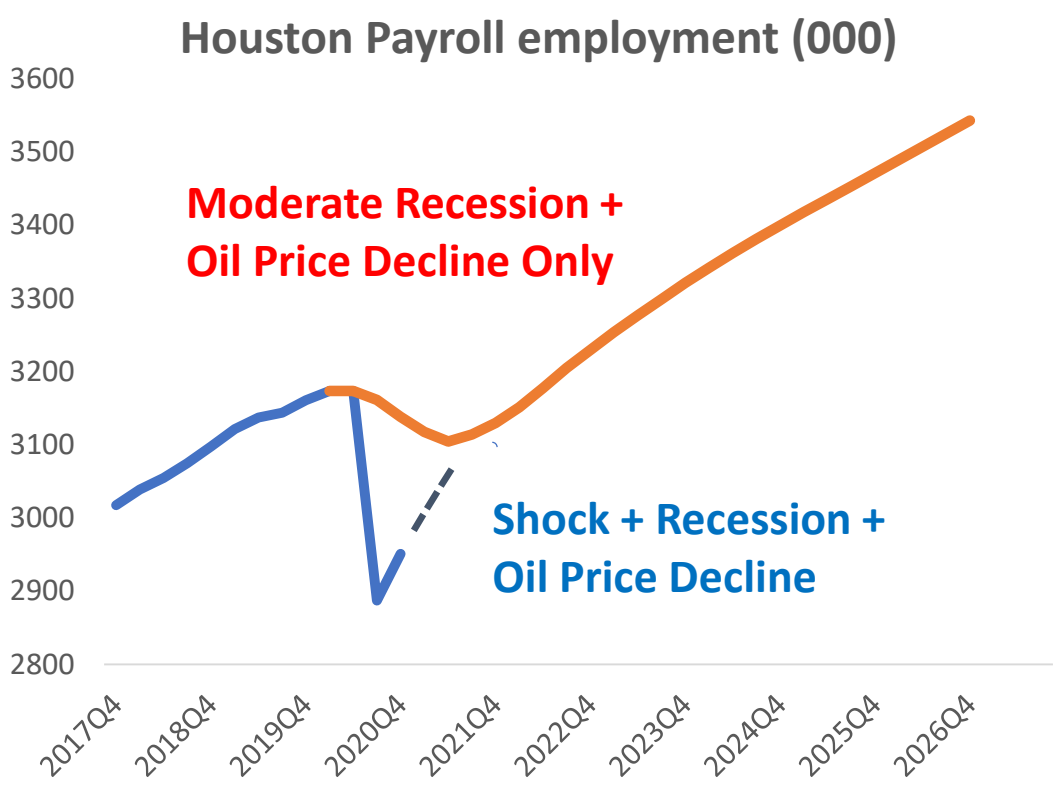
An Optimistic Return of the Rig Count and Recovery of Oil-Related Jobs in Houston By 2026





The broken line indicates we have lost track of price and other fundamentals in this period due to COVID-19 and worldwide stay-home orders. By early 2021, fundamentals return to oil markets.

A Similar Recovery of Payroll Employment By 2022, With the Exact Timing and Path to Recovery Is Unknown



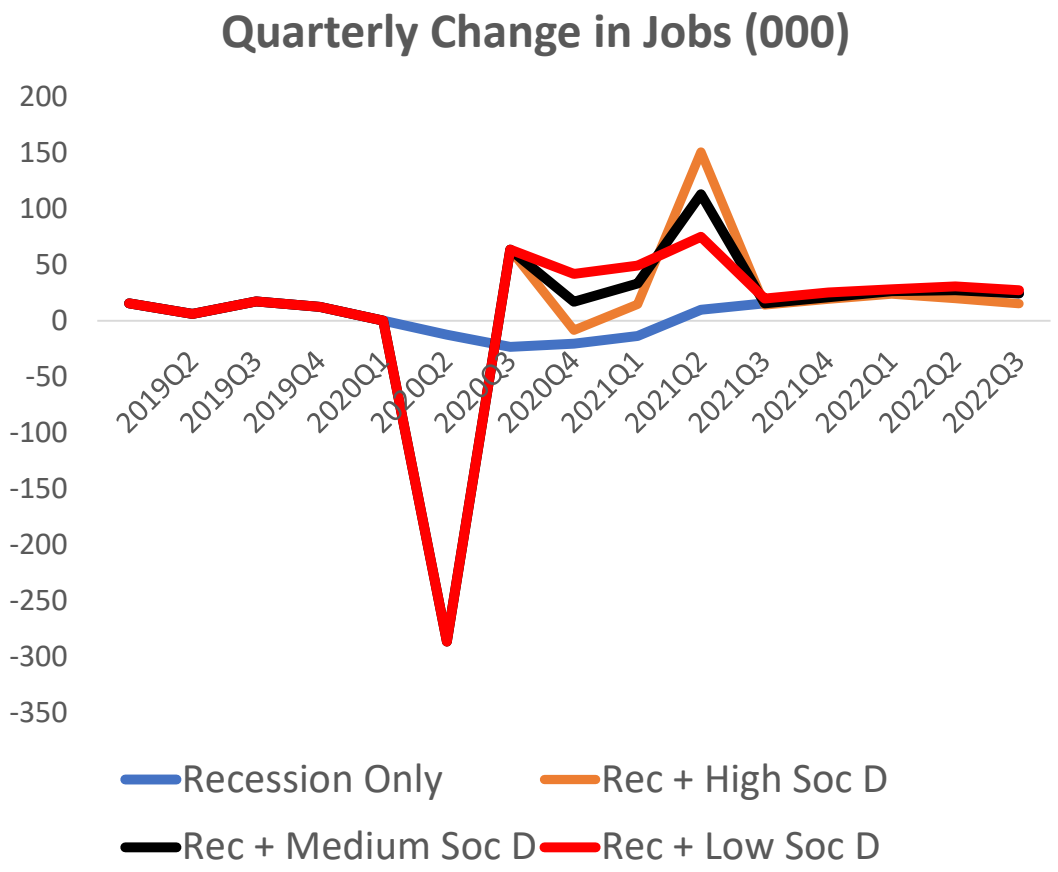
- The second quarter shock to Houston's payroll employment from COVID and the oil war pushed it down by 273,800 jobs in 2020Q2 and it was still down ***187,200*** jobs in Q3 (Blue Line)
- Employment collapsed, *but a moderate U.S. recession and oil fundamentals alone would* account for only 12,400 lost jobs 2020Q2 and another 23,100 in Q3. The difference – again -- is the COVID shock
- At some point, business cycle fundamentals (including oil, the U.S. economy, and the retreat of COVID) reassert themselves and we return to the Red Line. Where? When?

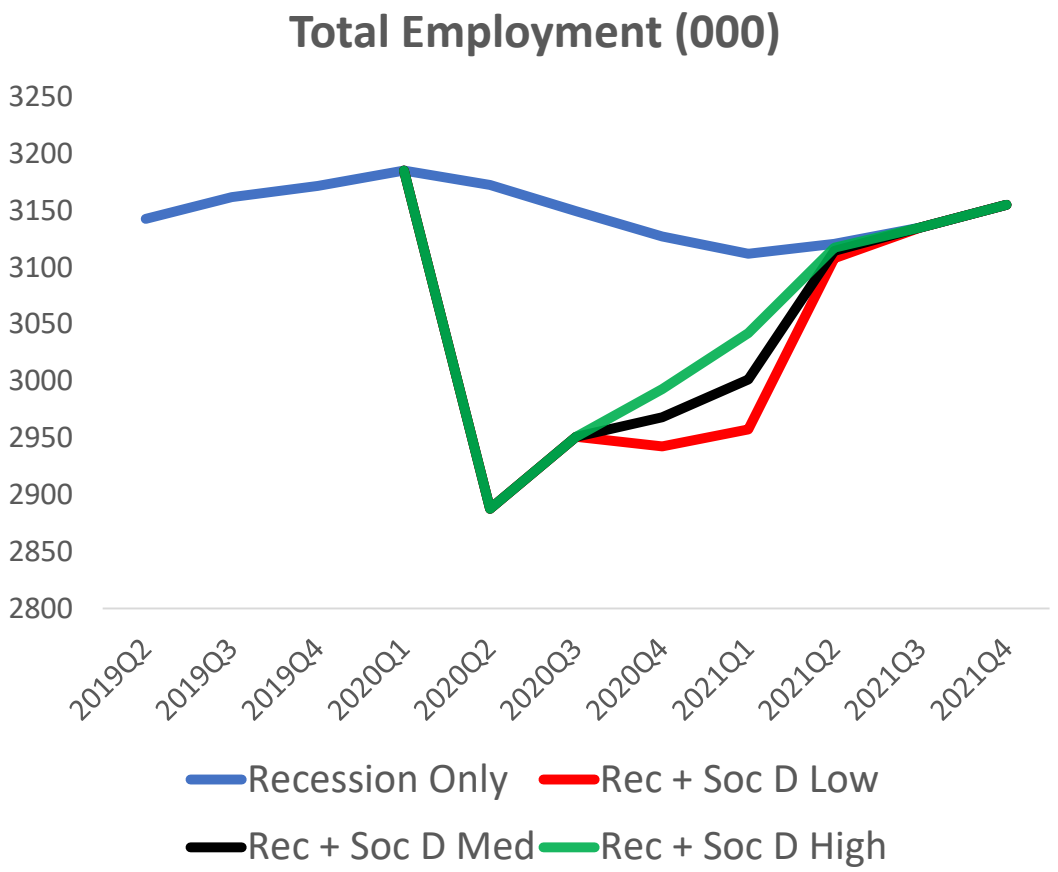
Making Up the Story About Getting from Here to There

- Assume the social distancing disappears by 2021Q3 with the arrival of a vaccine
- Houston is left at the trough of a moderate recession that is the COVID and oil war hangover
- We cannot know what path takes us back from 2020Q4 (now) to 2021Q2 (recession only). I would have to forecast the virus and public health response!
- I just need to fill that gap with about 187,200 jobs left from the COVID shock. See below. It is a hypothetical example with three example outcomes. Not a forecast!

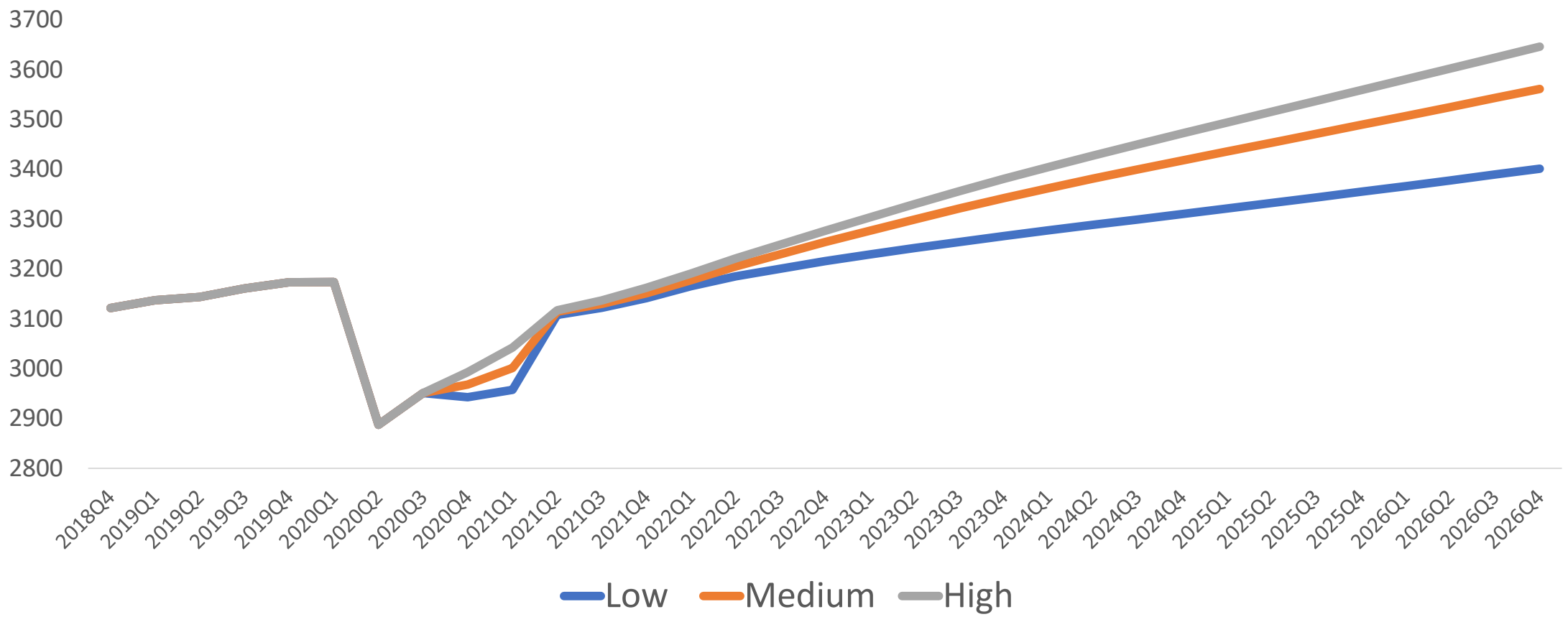
	Thousand Jobs		
	Best	**Medium**	**Worst**
2020Q2	-273.8	-273.8	-273.8
2020Q3	86.6	86.6	86.6
2020Q4	62.4	37.4	12.5
2021Q1	62.4	46.8	31.2
2021Q2	62.4	103.0	143.6

This Is How The End Game for COVID-19 Might Look As Houston Moves Forward





Houston Payroll Employment to 2026 Including the Last of Social Distancing



Contributions to Houston Job Growth 2020 to 2026: Payroll Employment ('000 Q4/Q4)

	Change in Payrolls			Business Cycle Change			Social Distancing			Payroll Growth Rate		
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
2019	51.7	51.7	51.7	51.7	51.7	51.7				1.7%	1.7%	1.7%
2020	-230.9	-205.5	-180.6	-56.2	-55.7	-55.7	-174.8	-149.8	-124.8	-7.3%	-6.5%	-5.7%
2021	199.0	183.1	169.4	24.3	33.3	44.6	174.8	149.8	124.8	6.8%	6.2%	5.7%
2022	73.9	103.0	114.2	73.9	103.0	114.2				2.4%	3.3%	3.6%
2023	50.4	87.9	104.1	50.4	87.9	104.1				1.6%	2.7%	3.2%
2024	44.4	75.7	91.5	44.4	75.7	91.5				1.5%	2.6%	3.1%
2025	44.5	71.3	86.6	44.5	71.3	86.6				1.3%	2.1%	2.5%
2026	46.2	72.0	87.0	46.2	72.0	87.0				1.4%	2.1%	2.4%

Contributions to Houston Job Growth 2020 to 2026: Payroll Employment ('000 Year/Year)

	Change in Payrolls			Business Cycle Change			Social Distancing			Payroll Growth Rate		
	Low	Medium	High	Low	Medium	High	Low	Medium	High	Low	Medium	High
2019	66.6	66.6	66.6	66.6	66.6	66.6				2.2%	2.2%	2.2%
2020	-165.2	-158.8	-152.6	-6.3	-6.1	-6.1	-159.0	-152.7	-146.5	-5.2%	-5.0%	-4.8%
2021	93.6	104.2	113.4	-29.5	-22.8	-17.4	123.1	127.0	130.9	3.1%	3.5%	3.8%
2022	109.5	117.3	119.7	73.6	91.5	104.1	35.9	25.7	15.6	3.6%	3.8%	3.8%
2023	56.0	93.3	108.1	56.0	93.3	108.1				1.8%	2.9%	3.3%
2024	46.1	93.3	108.1	46.1	80.3	96.1				1.4%	2.4%	2.9%
2025	44.1	80.3	96.1	44.1	72.2	87.8				1.3%	2.1%	2.6%
2026	45.6	72.2	87.8	45.6	71.6	86.8				1.4%	2.1%	2.5%

BAUER
COLLEGE OF BUSINESS
UNIVERSITY of HOUSTON

INSTITUTE FOR
REGIONAL FORECASTING

Houston and COVID-19:
Are We Nearing the End-Game?

Robert W. Gilmer, Ph.D.
C.T. Bauer College of Business
October 2020