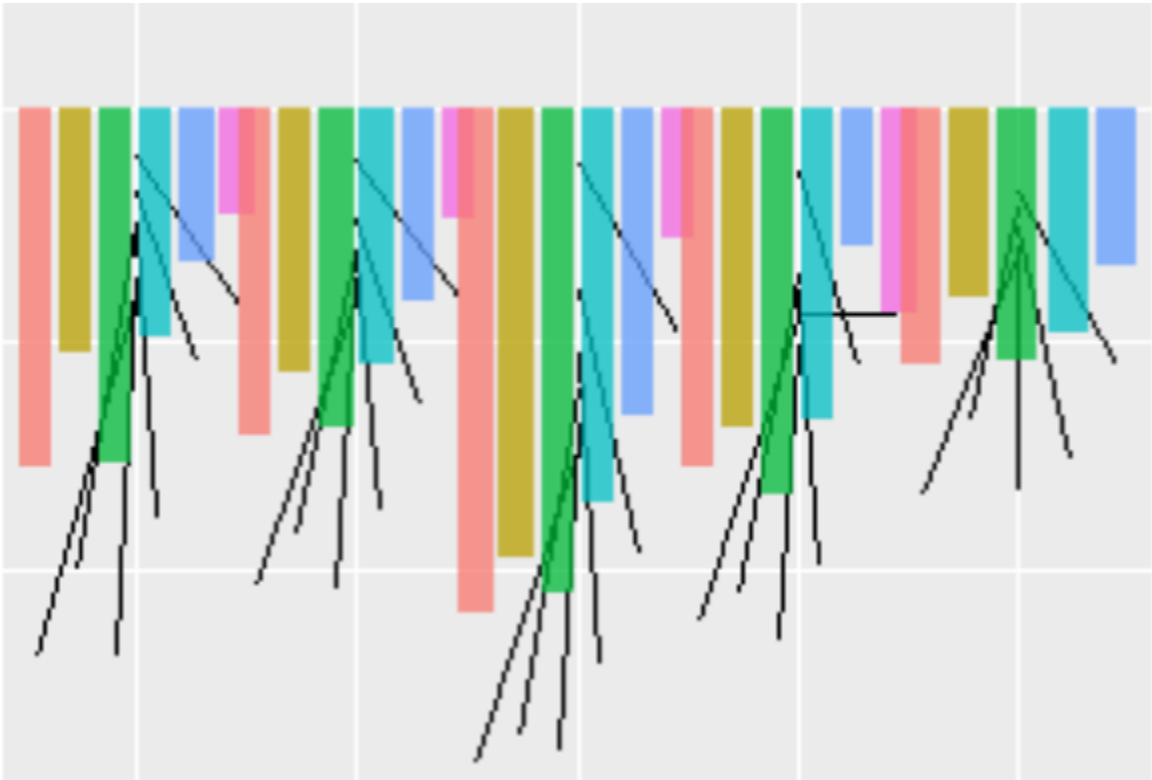
Data Visualization

Len Kiefer, Dec 2020

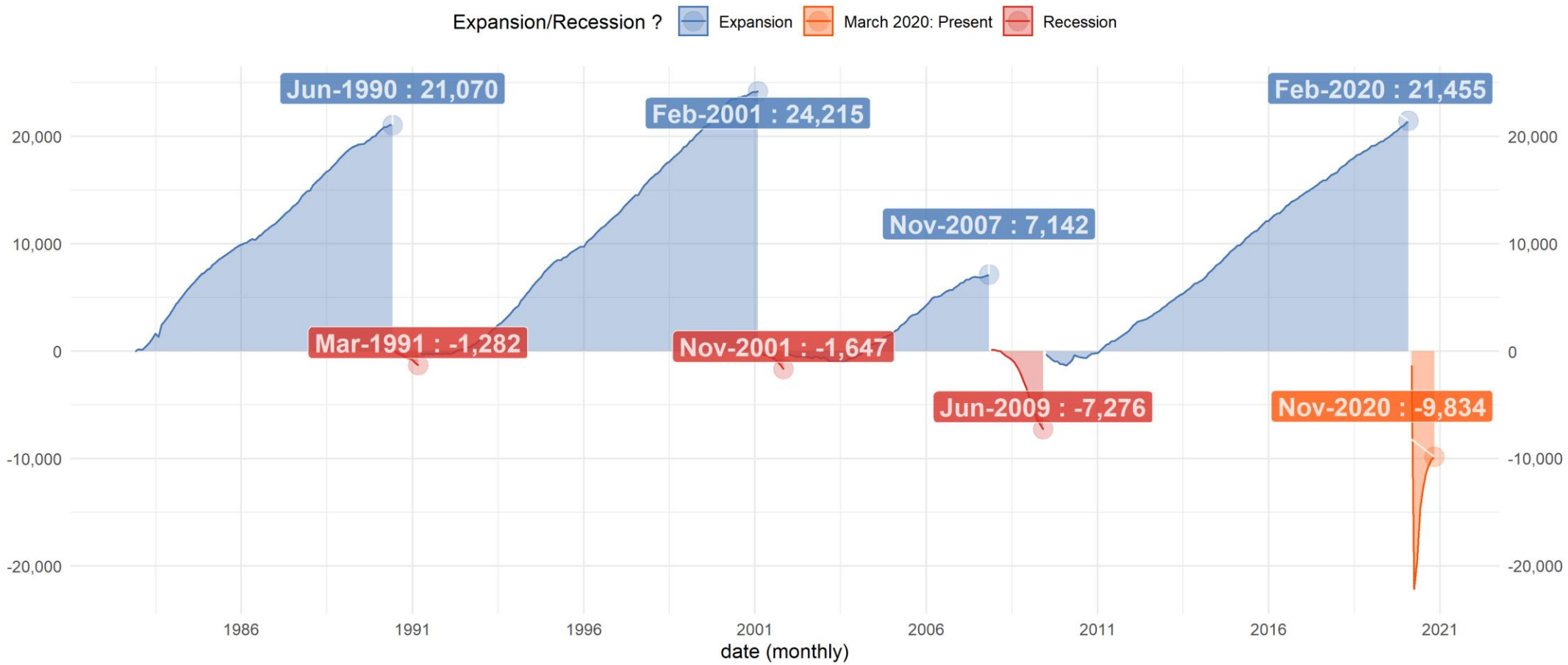
What can be [charted] at all can be [charted] clearly; and whereof one cannot [chart] thereof one must be silent.



Visualizing Labor Market Data

Cumulative U.S. nonfarm payroll employment growth (1000s) in expansion/recession

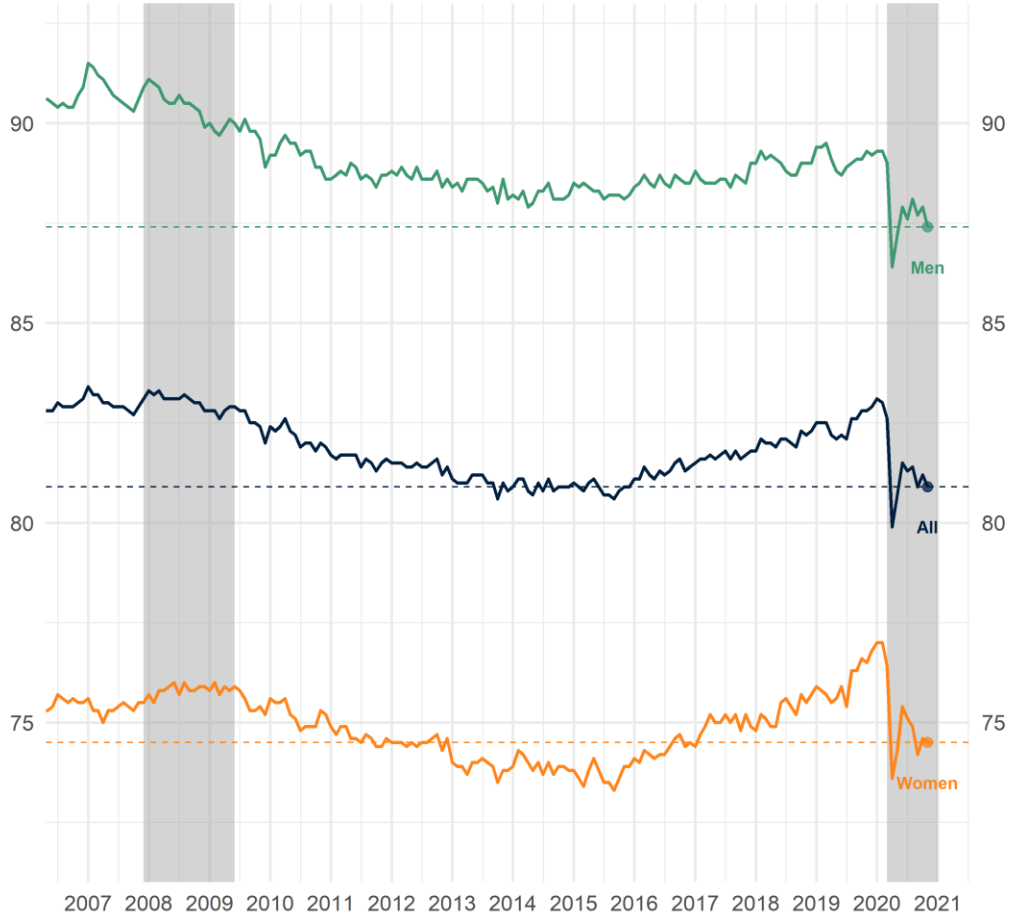
labels indicate cumulative growth through end of expansion/recession



@lenkiefer Source: U.S. Bureau of Labor Statistics All Employees: Total Nonfarm Payrolls, retrieved from BLS, Dec 4, 2020. NBER recession dates

Labor Force Participation Rate: Prime Working Age (25-54)

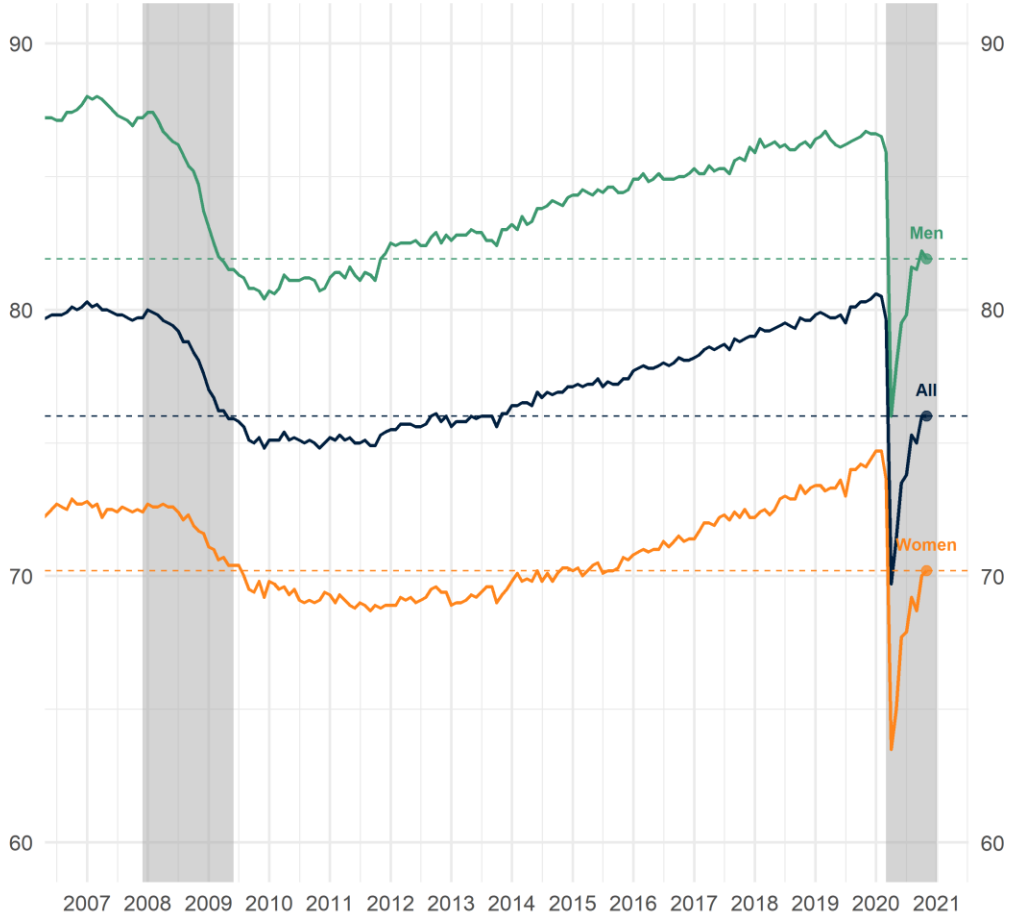
in percentage points (seasonally adjusted)



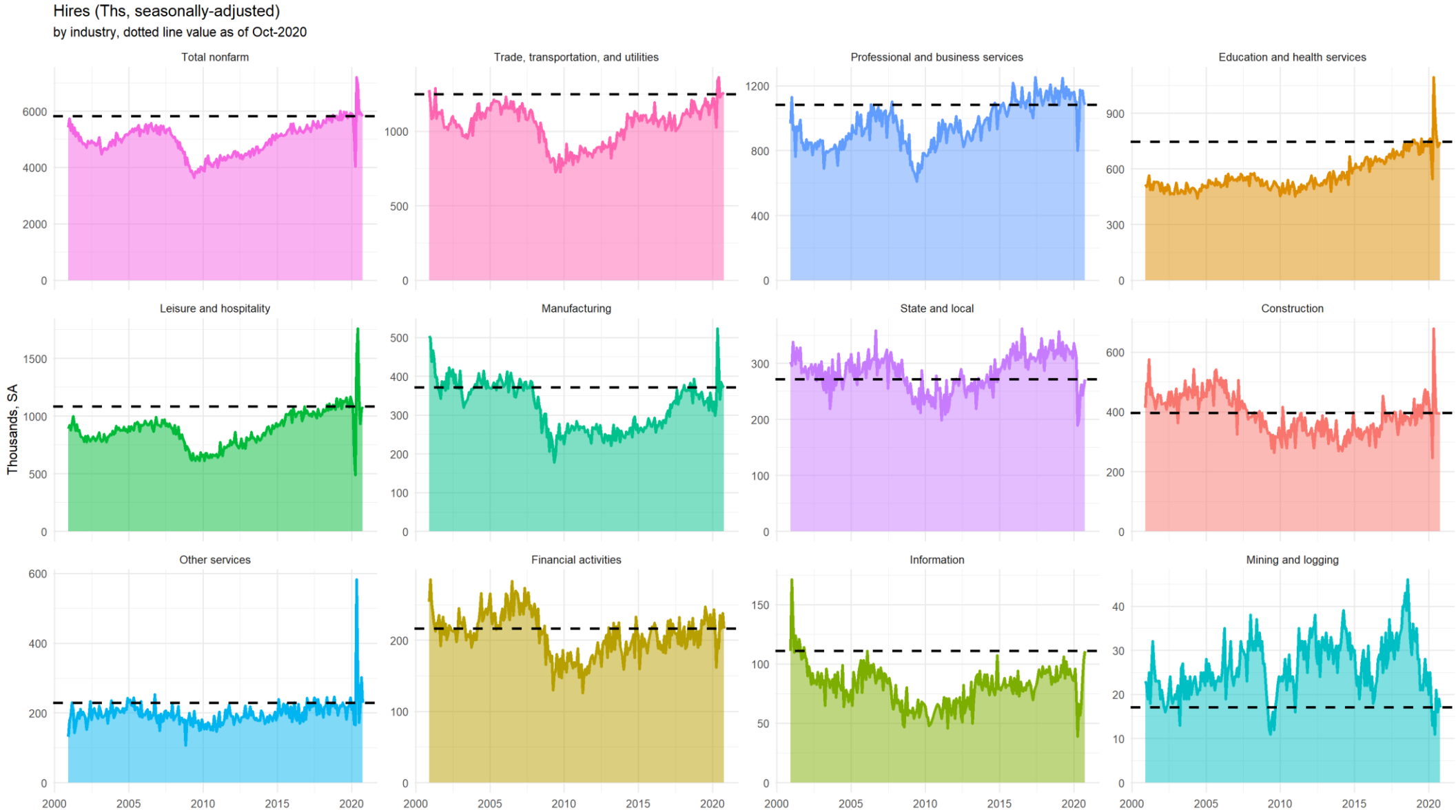
@lenkiefer Source: U.S. Bureau of Labor Statistics, shaded bars NBER Recessions

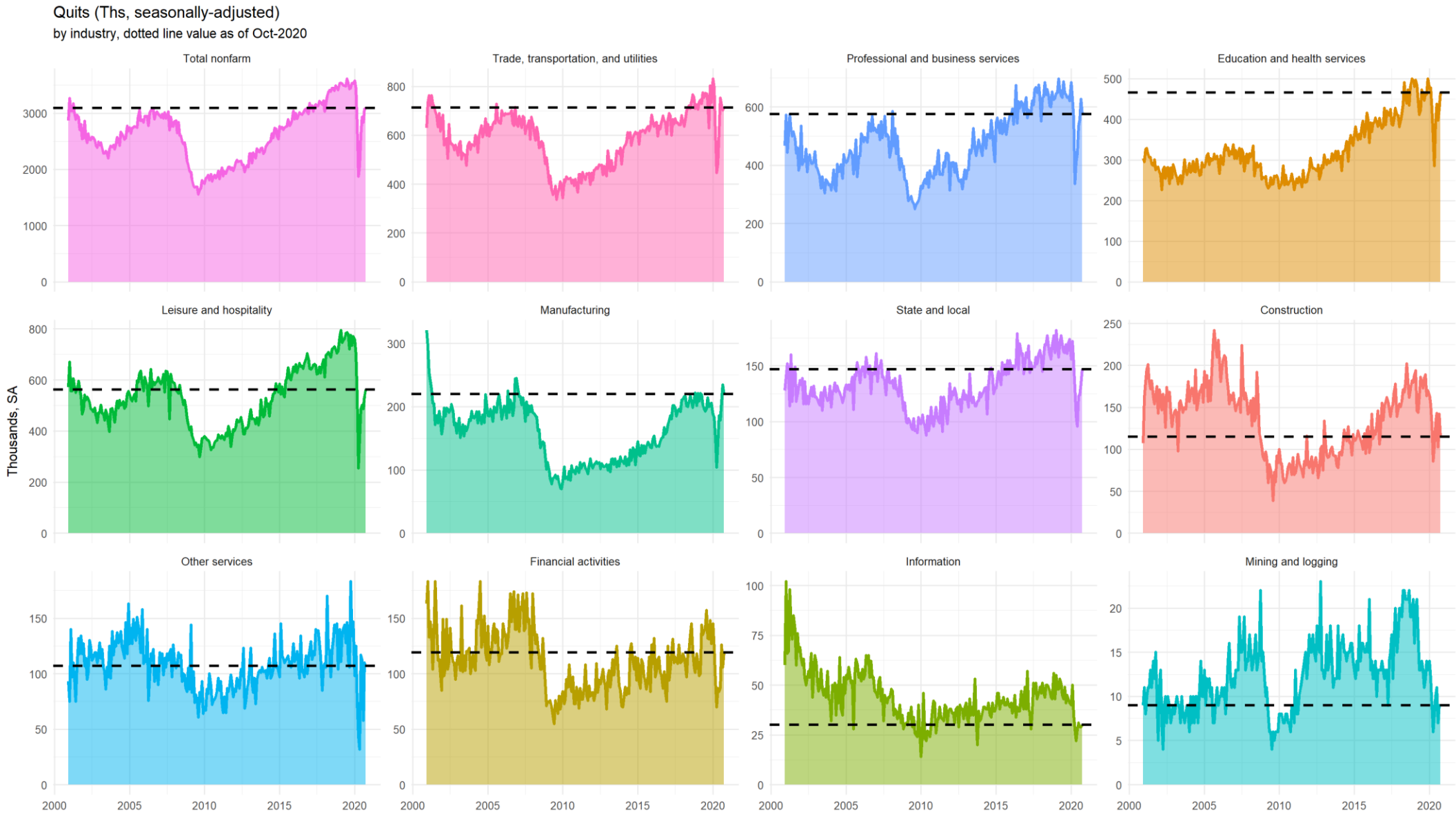
Employment-Population Ratio: Prime Working Age (25-54)

in percentage points (seasonally adjusted)



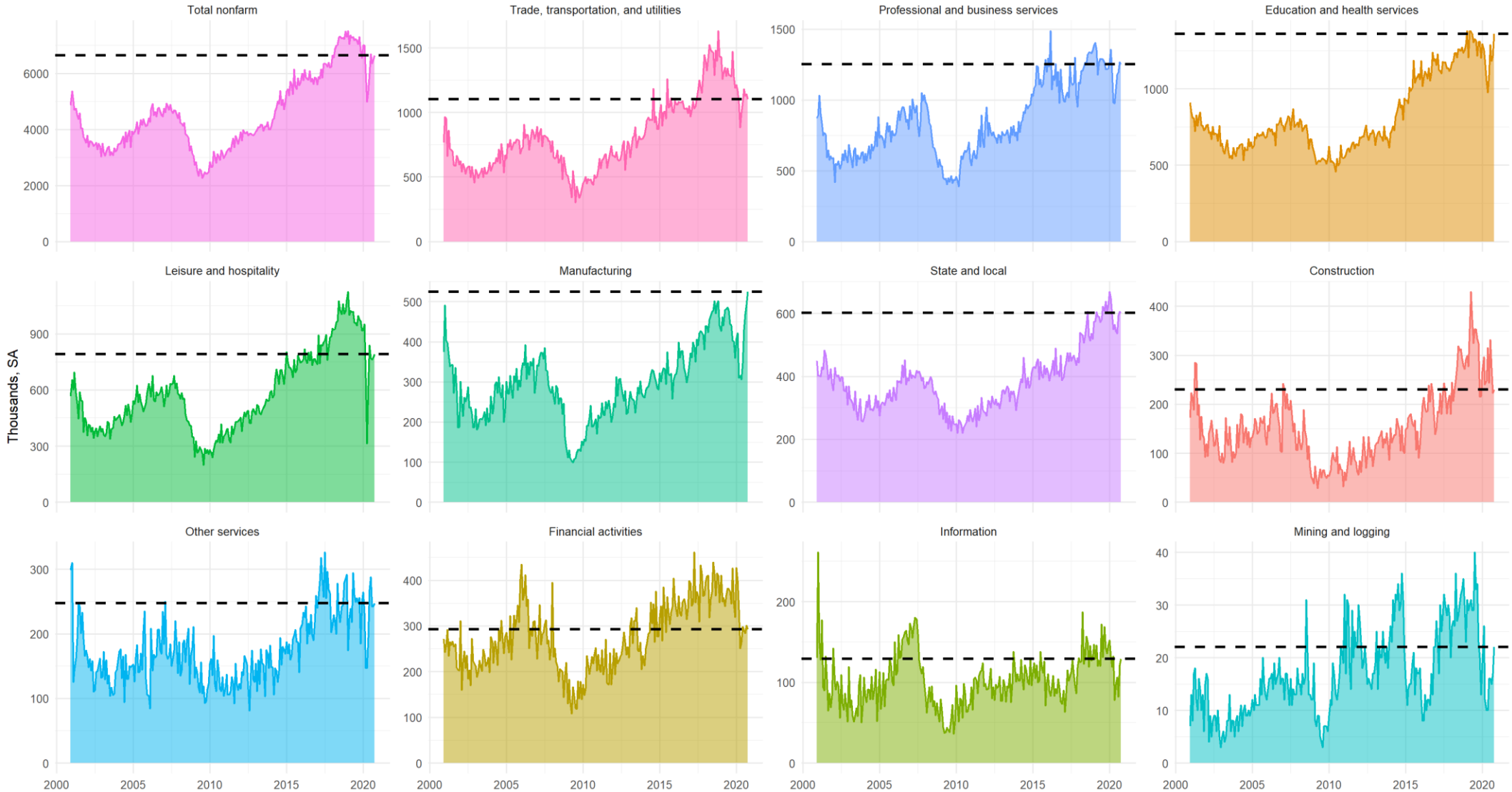
@lenkiefer Source: U.S. Bureau of Labor Statistics, shaded bars NBER Recessions


Hires (Ths, seasonally-adjusted)
by industry, dotted line value as of Oct-2020
Total nonfarm
Trade, transportation, and utilities
Professional and business services
Education and health services
Leisure and hospitality
Manufacturing
State and local
Construction
Other services
Financial activities
Information
Mining and logging
Thousands, SA
@lenkiefer Source: U.S. Bureau of Labor Statistics Job Openings and Labor Turnover Survey (JOLTS)


Quits (Ths, seasonally-adjusted)
by industry, dotted line value as of Oct-2020
Total nonfarm
Trade, transportation, and utilities
Professional and business services
Education and health services
Leisure and hospitality
Manufacturing
State and local
Construction
Other services
Financial activities
Information
Mining and logging
Thousands, SA
@lenkiefer Source: U.S. Bureau of Labor Statistics Job Openings and Labor Turnover Survey (JOLTS)

Job Openings (Ths, seasonally-adjusted)

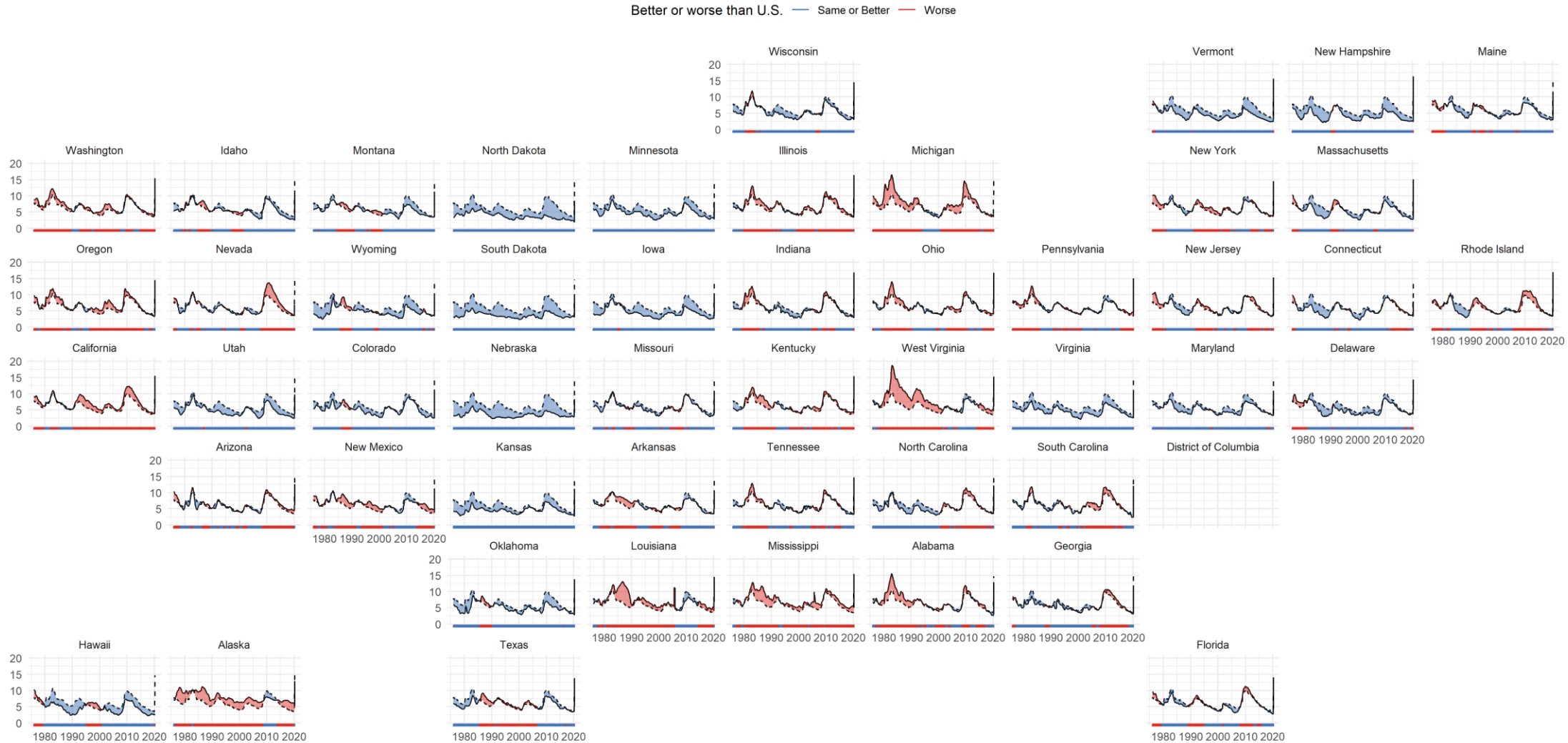
by industry, dotted line value as of Oct-2020



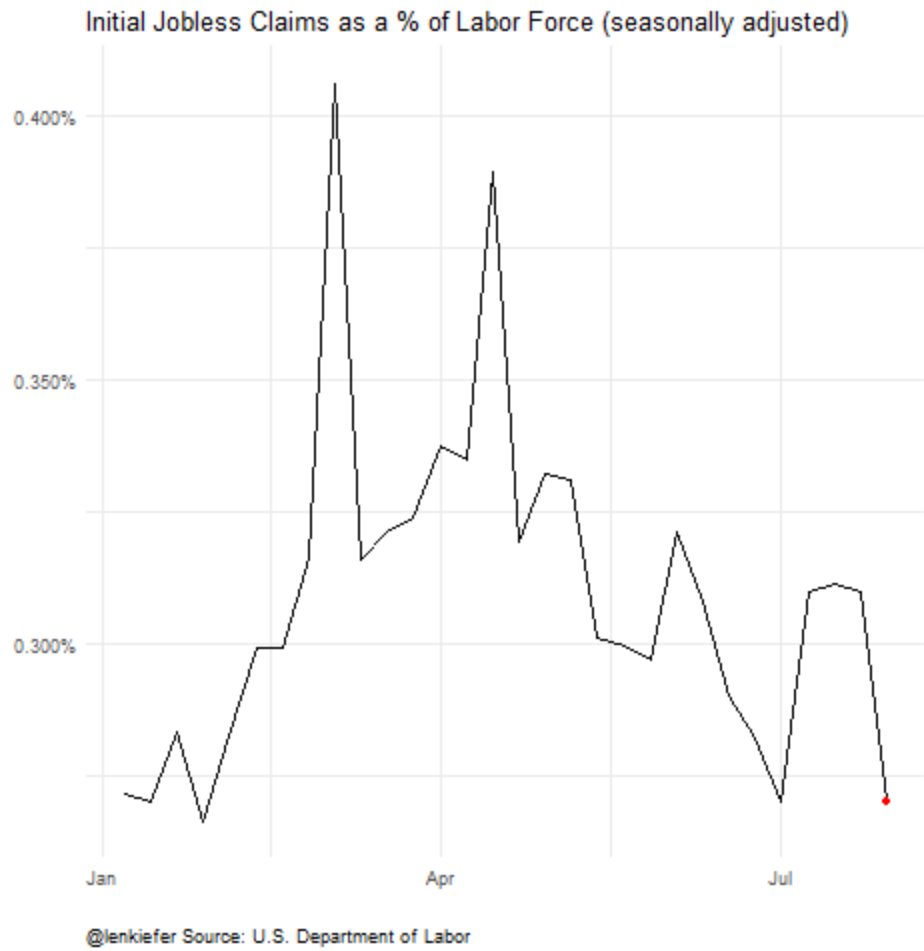
@lenkiefer Source: U.S. Bureau of Labor Statistics Job Openings and Labor Turnover Survey (JOLTS)

The state of U.S. jobs - Working out @hrbmstr's workout of @stiles' Viz

Solid line is state unemployment rate, dotted line is U.S. average unemployment rate
Red (blue) indicates the state level is higher (lower) than the national average



@lenkiefer Data Source: U.S. Bureau of Labor Statistics
Viz based on https://rud.is/b/2017/01/18/workout-wednesday-redux-2017-week-3/,
itself based on http://thedailyviz.com/2016/12/14/four-decades-of-state-unemployment-rates-in-small-multiples-part-2/


Initial Jobless Claims as a % of Labor Force (seasonally adjusted)
0.400%
0.350%
0.300%
Jan
Apr
Jul
@lenkiefer Source: U.S. Department of Labor

Visualizing Mortgage Data

Mortgage Rates Remain Flat

December 10, 2020

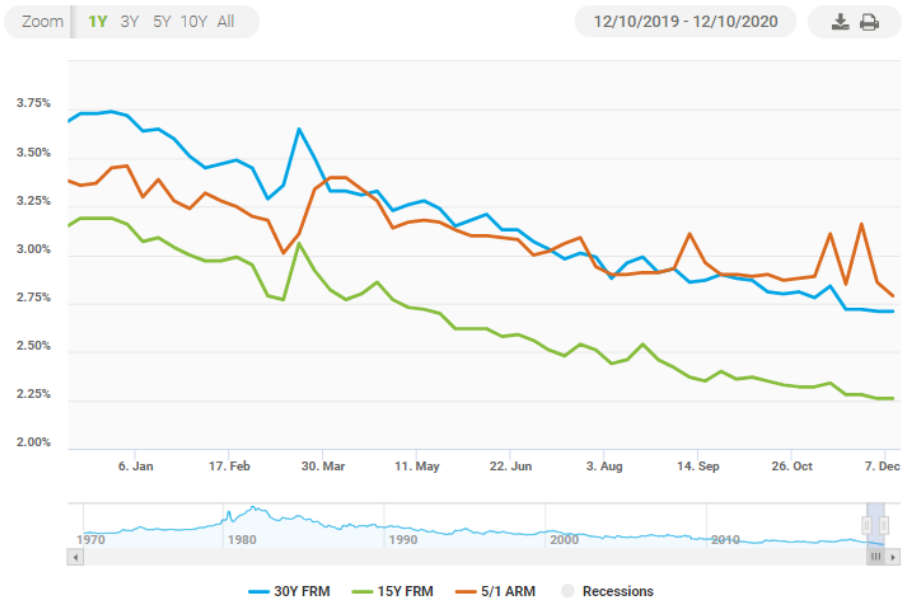
Mortgage rates remain at record lows, resisting their typical correlation to Treasury yields, which have recently been moving higher. Mortgage spreads – the difference between mortgage rates and the 10-year Treasury rate – are declining from their elevated levels earlier this year. Although today's mortgage spread is about 1.8 percentage points and still has some room to move down if the 10-year Treasury continues to rise, it's encouraging to see that the spread is almost back to normal levels.

- Current Mortgage Rates Data Since 1971 XLS

Primary Mortgage Market Survey®

U.S. weekly averages as of 12/10/2020

30-Yr FRM	15-Yr FRM	5/1-Yr ARM
2.71%	**2.26%**	**2.79%**
0.00 1-Wk	0.00 1-Wk	0.07 1-Wk
1.02 1-Yr	0.93 1-Yr	0.57 1-Yr
0.7 Fees/Points	**0.6 Fees/Points**	**0.3 Fees/Points**



Freddie Mac House Price Index (FMHPI℠)

Explore House Price Trends

Review national housing statistics and compare to additional states or metros as of October, 2020

United States

Virginia

Add another state or metro

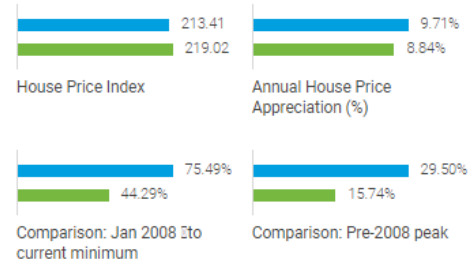
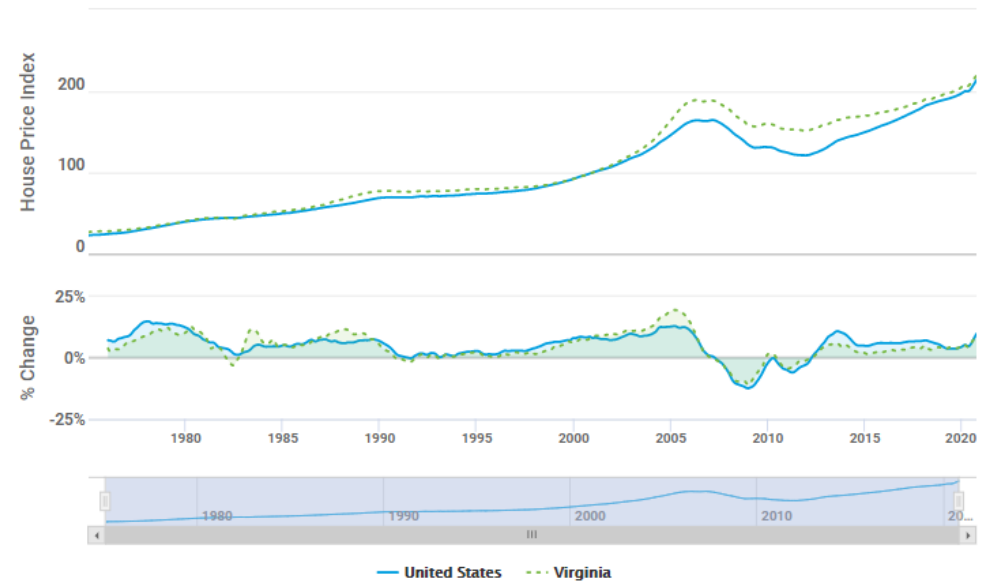


Chart Table



Monthly average mortgage rates by year*

U.S. average 30-year fixed mortgage rate (%)

year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2010	5.03	4.99	4.97	5.10	4.89	4.74	4.56	4.43	4.35	4.22	4.30	4.71
2011	4.75	4.95	4.84	4.84	4.64	4.51	4.54	4.27	4.11	4.07	3.99	3.96
2012	3.92	3.89	3.95	3.91	3.80	3.67	3.55	3.60	3.50	3.38	3.35	3.34
2013	3.41	3.53	3.56	3.45	3.54	4.07	4.37	4.46	4.49	4.19	4.25	4.46
2014	4.43	4.30	4.34	4.34	4.19	4.16	4.13	4.12	4.16	4.04	4.00	3.86
2015	3.67	3.71	3.77	3.67	3.84	3.98	4.05	3.91	3.89	3.80	3.94	3.96
2016	3.87	3.66	3.69	3.60	3.60	3.57	3.44	3.44	3.46	3.47	3.77	4.20
2017	4.15	4.17	4.20	4.04	4.01	3.90	3.97	3.88	3.80	3.90	3.92	3.95
2018	4.03	4.33	4.44	4.47	4.59	4.57	4.53	4.55	4.63	4.83	4.87	4.64
2019	4.46	4.37	4.26	4.14	4.07	3.80	3.77	3.62	3.60	3.69	3.70	3.72
2020	3.62	3.47	3.45	3.31	3.23	3.16	3.02	2.94	2.89	2.83	2.77	2.71

month

@lenkiefer Source: Freddie Mac Primary Mortgage Market Survey through December 10, 2020

Multiple record lows for the 30-year fixed mortgage rate in 2020

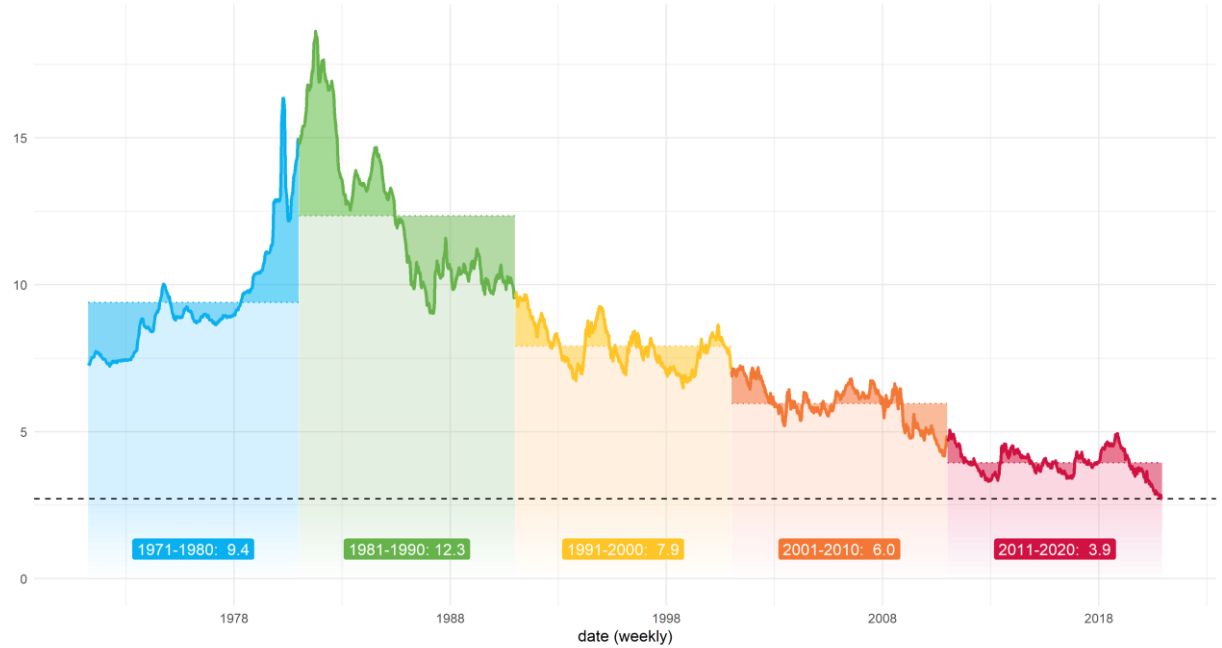
US weekly average 30-year fixed mortgage rate (%) dots indicate historical low (up to that week)

US weekly average 30-year fixed mortgage rate (%) dots indicate historical low (up to that week)

@lenkiefer Source: Freddie Mac Primary Mortgage Market Survey April 2, 1971 through December 10, 2020
Dotted line at 2.71% average for week of December 10, 2020

Mortgage rates over 5 decades

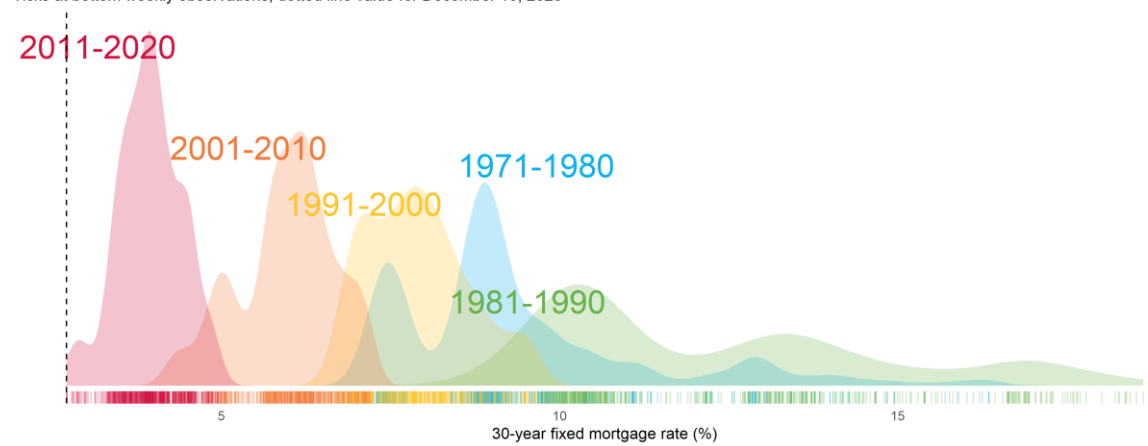
U.S. Weekly Average 30-year fixed mortgage rate April 2, 1971 to December 10, 2020
Line weekly value, dark shaded area from decade average to weekly value



@lenkiefer Source: Freddie Mac Primary Mortgage Market Survey

Estimated density over weekly values

Ticks at bottom weekly observations, dotted line value for December 10, 2020

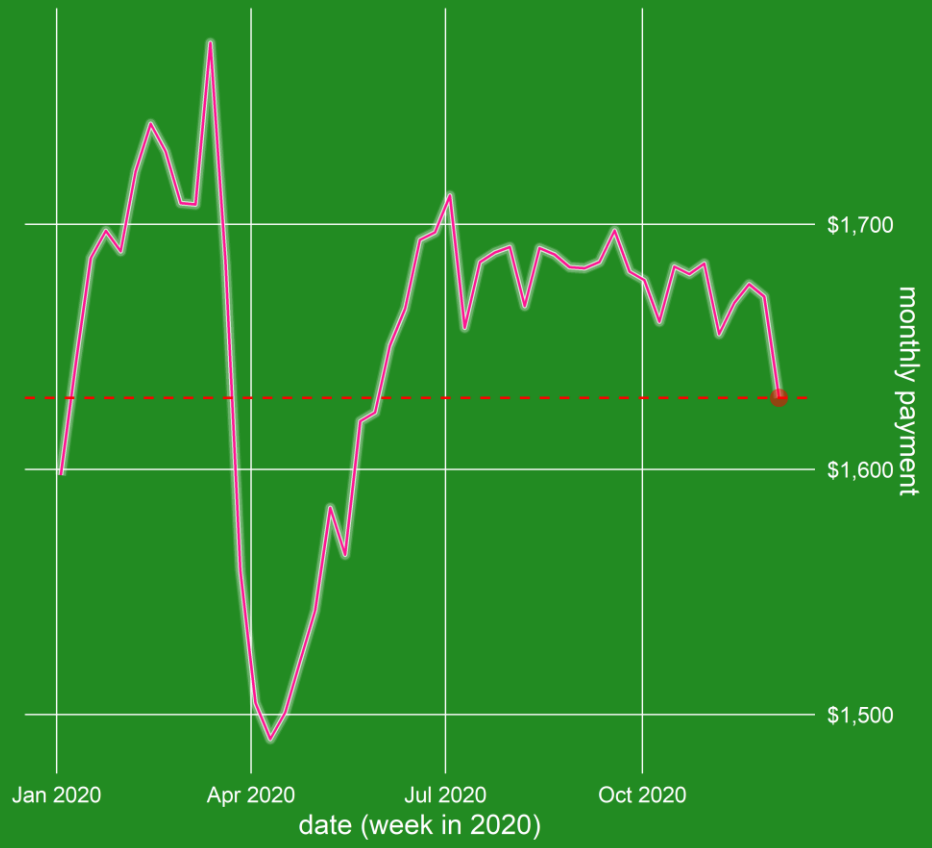


Lower rates offset higher home prices

Mortgage affordability for conventional loans

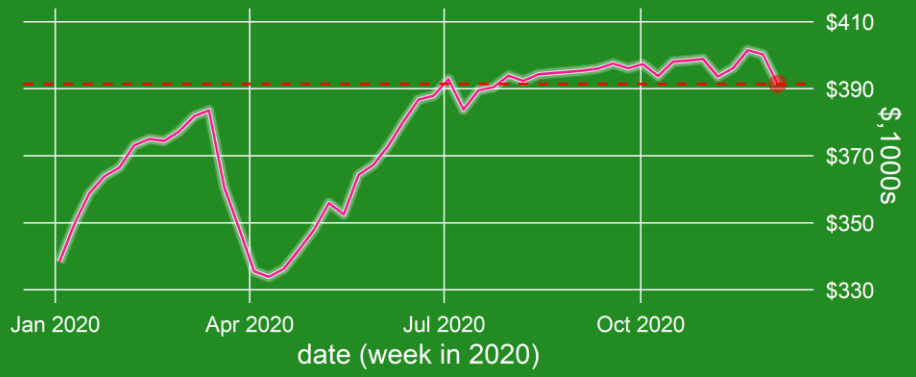
Monthly mortgage payment (P&I)

for average loan size, average rate

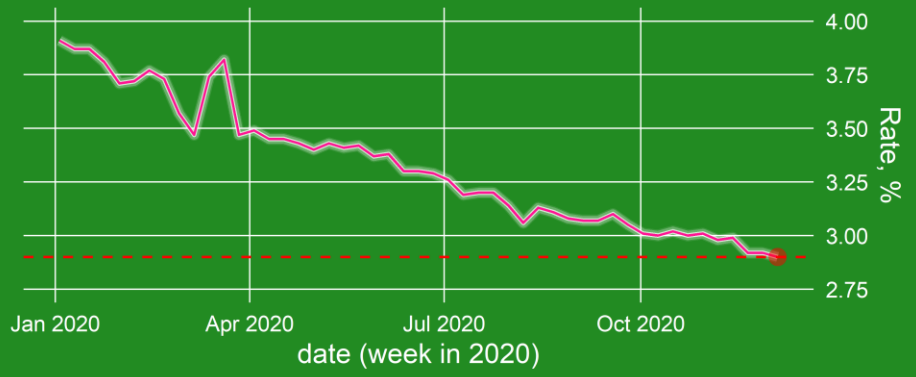


Principal and interest payment assuming 30-year fixed mortgage

Average conventional purchase mortgage loan size



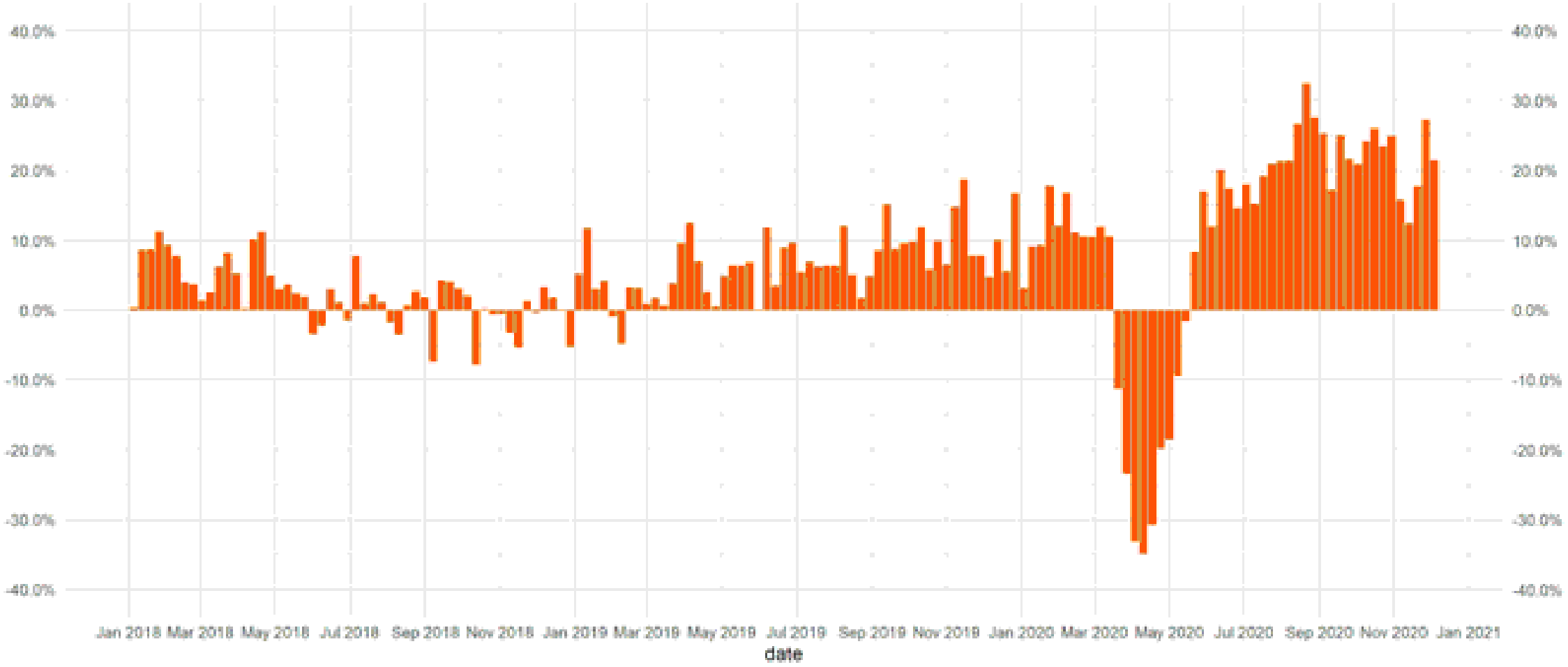
Average interest rate



@lenkiefer Source: Mortgage Bankers Association, Weekly Applications Survey data through December 04, 2020

U.S. Home Purchase Mortgage Applications

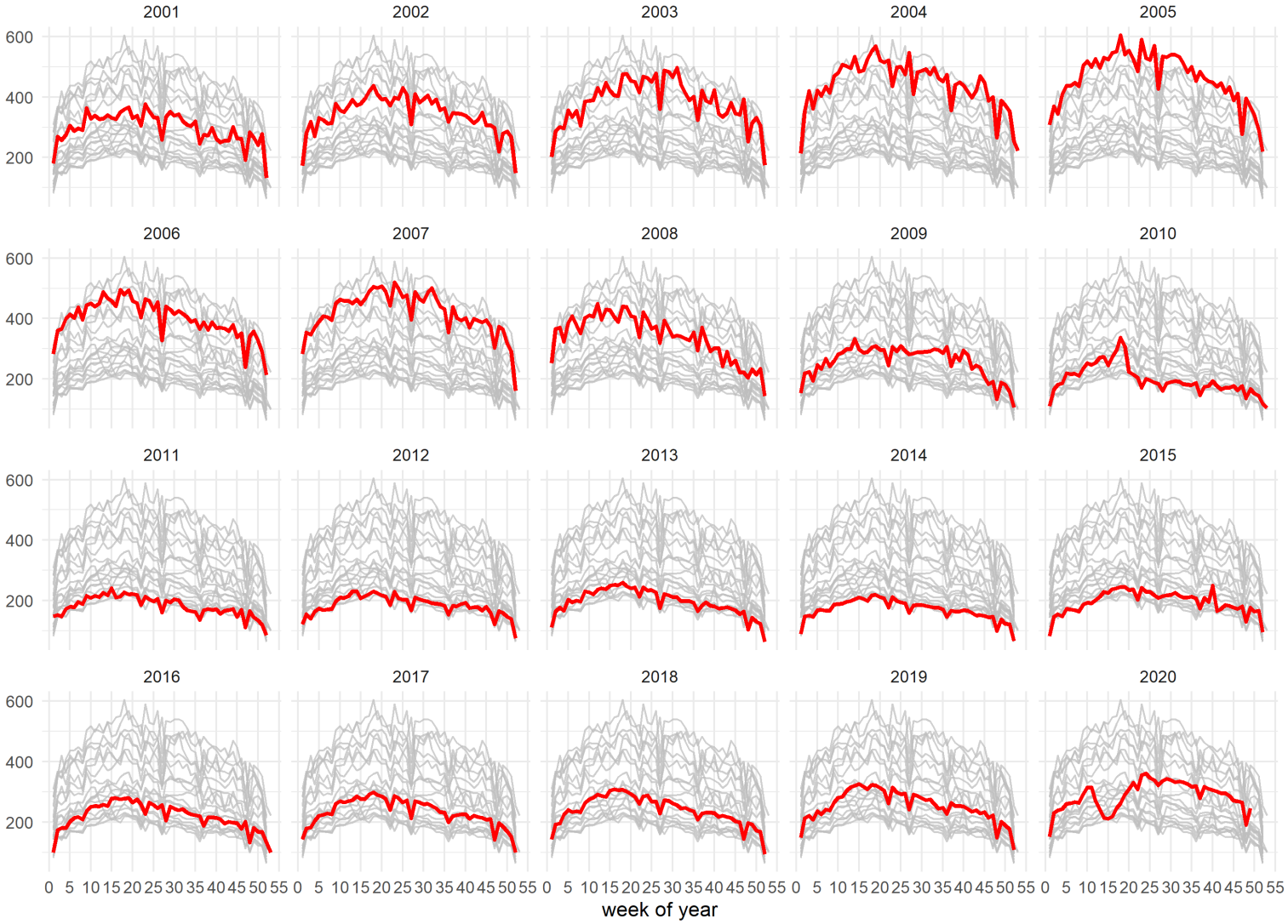
52-week percent change in seasonally adjusted purchase mortgage applications index



@lenkiefer Source: Mortgage Bankers Association, data through December 04, 2020

U.S. Mortgage Purchase Activity Rebounds

Purchase Application Index (Mar 16, 1990 =100, not seasonally adjusted)
Gray lines all years 2001-2020



@lenkiefer Source: Mortgage Bankers Association, data through December 04, 2020

U.S. Mortgage Purchase Activity Rebounds

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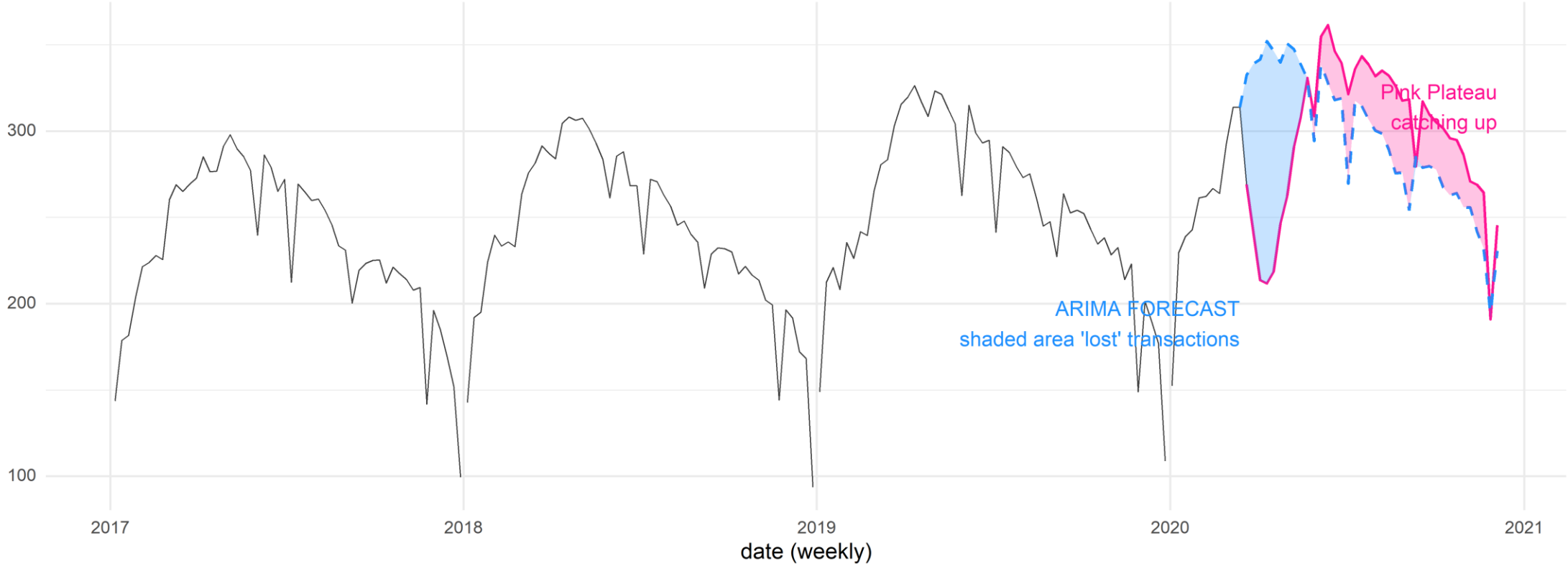
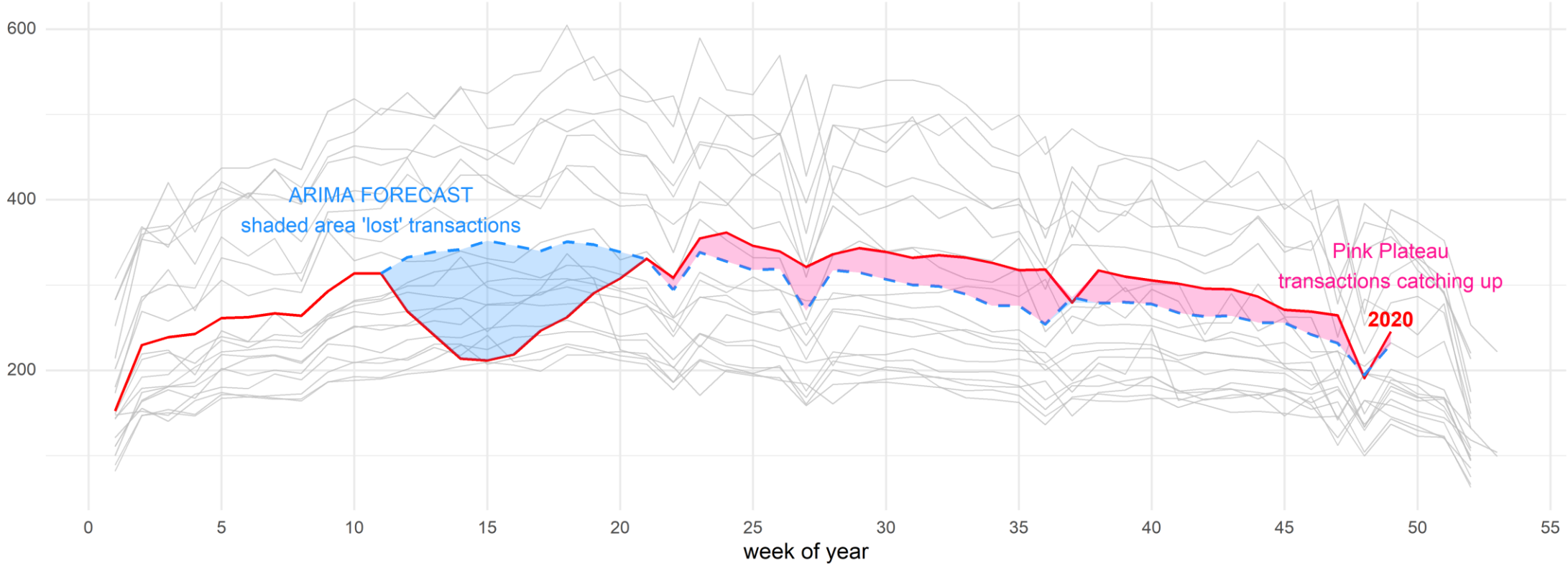


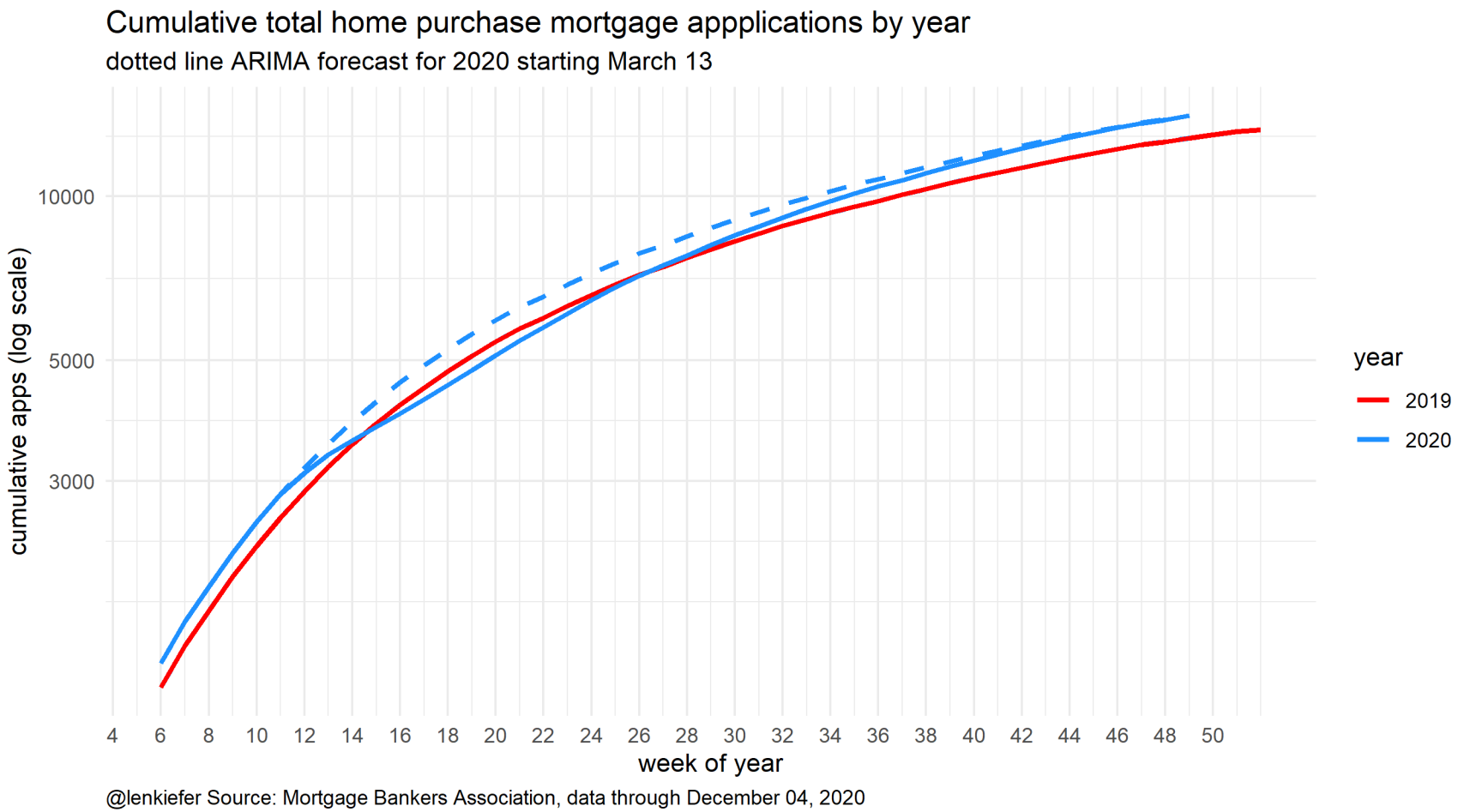
@lenkiefer Source: Mortgage Bankers Association, data through December 04, 2020
Seasonal autoregressive $(1,1,0)(1,1,0)_{52}$ Blue ARIMA forecast (extrapolated from 2020-03-13), orange actuals from 2020-03-13 forward.

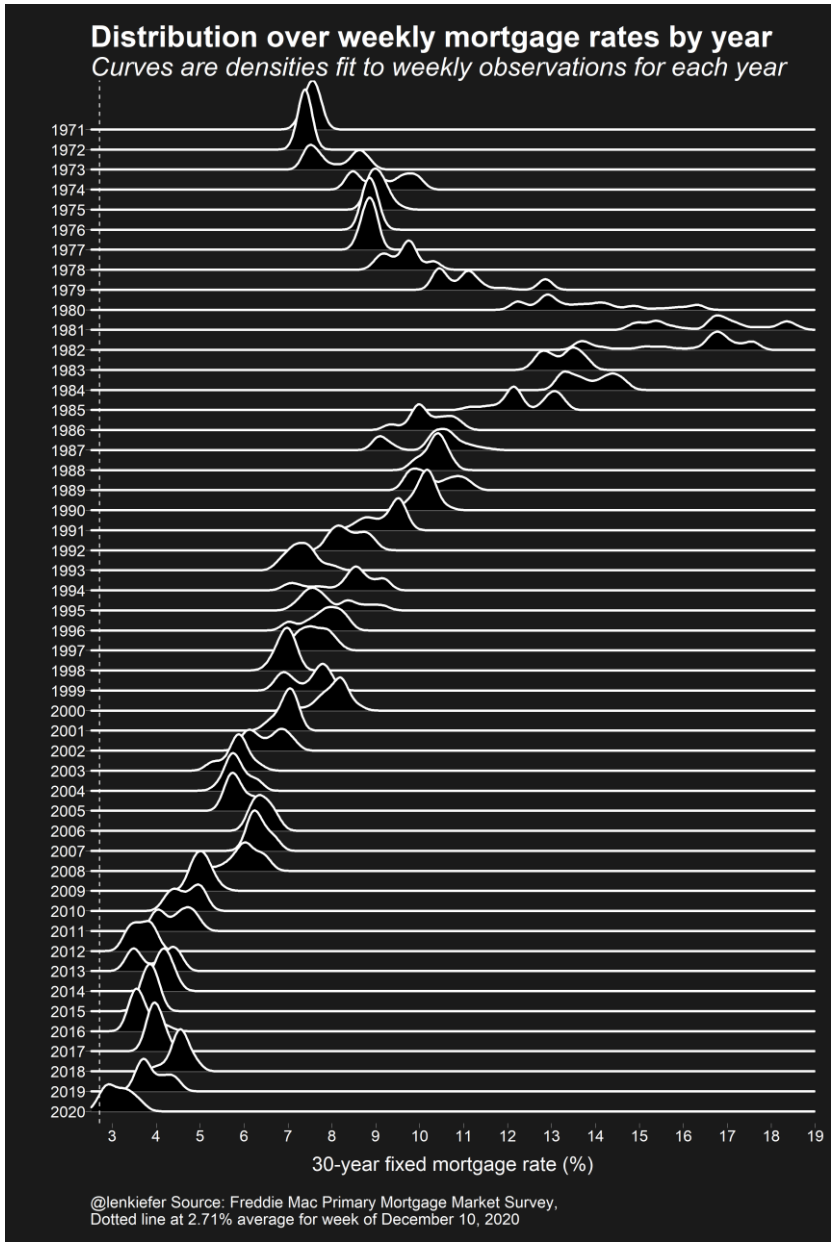
U.S. Mortgage Purchase Activity Rebounds

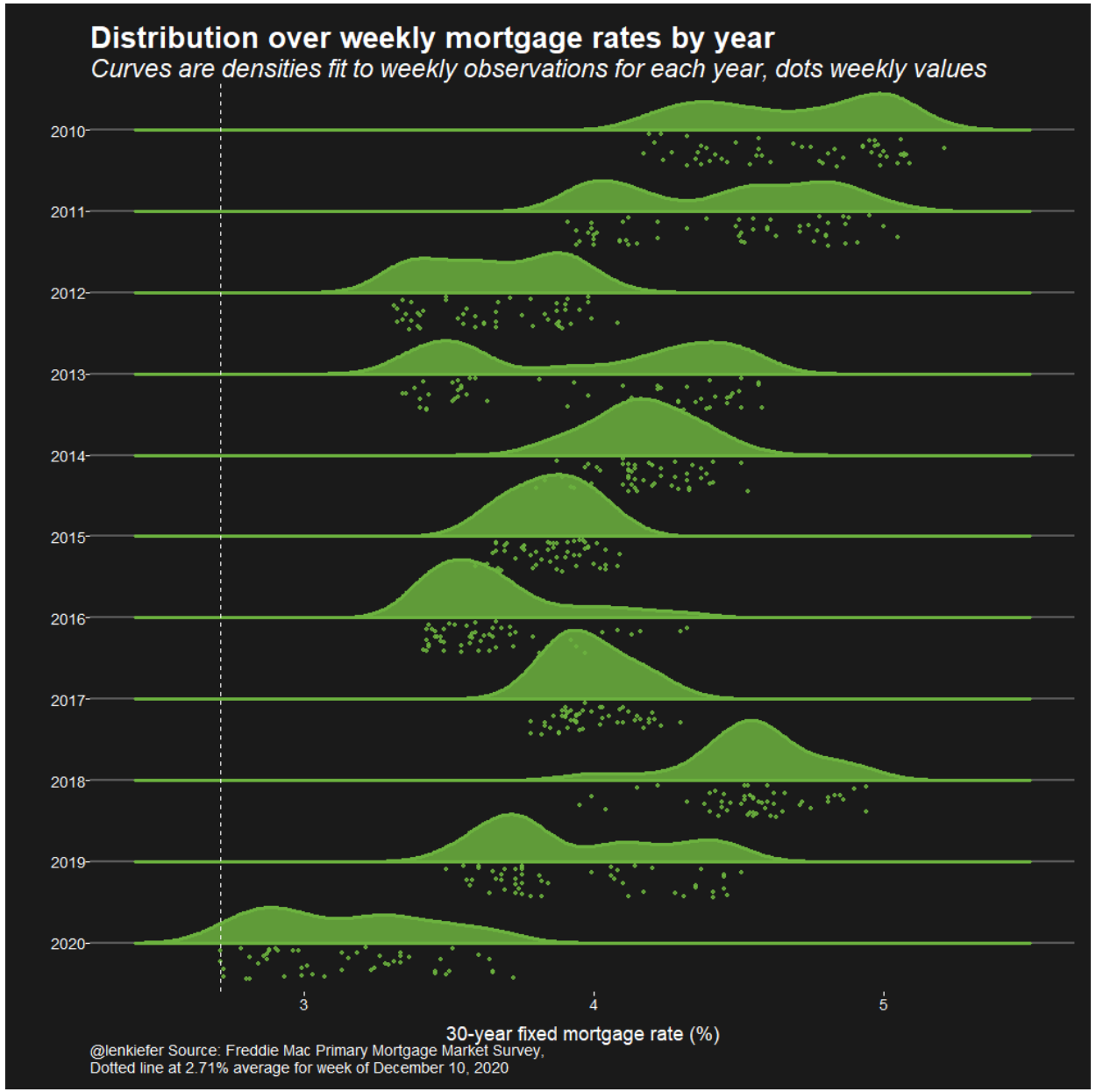
Purchase Application Index (Mar 16, 1990 =100, not seasonally adjusted) Gray lines all years 2001-2019



@lenkiefer Source: Mortgage Bankers Association, data through December 04, 2020
Seasonal autoregressive $(1,1,0)(1,1,0)_{52}$


Cumulative total home purchase mortgage appplications by year
dotted line ARIMA forecast for 2020 starting March 13
cumulative apps (log scale)
10000
5000
3000
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
week of year
year
2019
2020
@lenkiefer Source: Mortgage Bankers Association, data through December 04, 2020


Distribution over weekly mortgage rates by year
Curves are densities fit to weekly observations for each year
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
30-year fixed mortgage rate (%)
@lenkiefer Source: Freddie Mac Primary Mortgage Market Survey,
Dotted line at 2.71% average for week of December 10, 2020


Distribution over weekly mortgage rates by year
Curves are densities fit to weekly observations for each year, dots weekly values
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
3
4
5
30-year fixed mortgage rate (%)
@lenkiefer Source: Freddie Mac Primary Mortgage Market Survey,
Dotted line at 2.71% average for week of December 10, 2020

Visualizing Housing Data

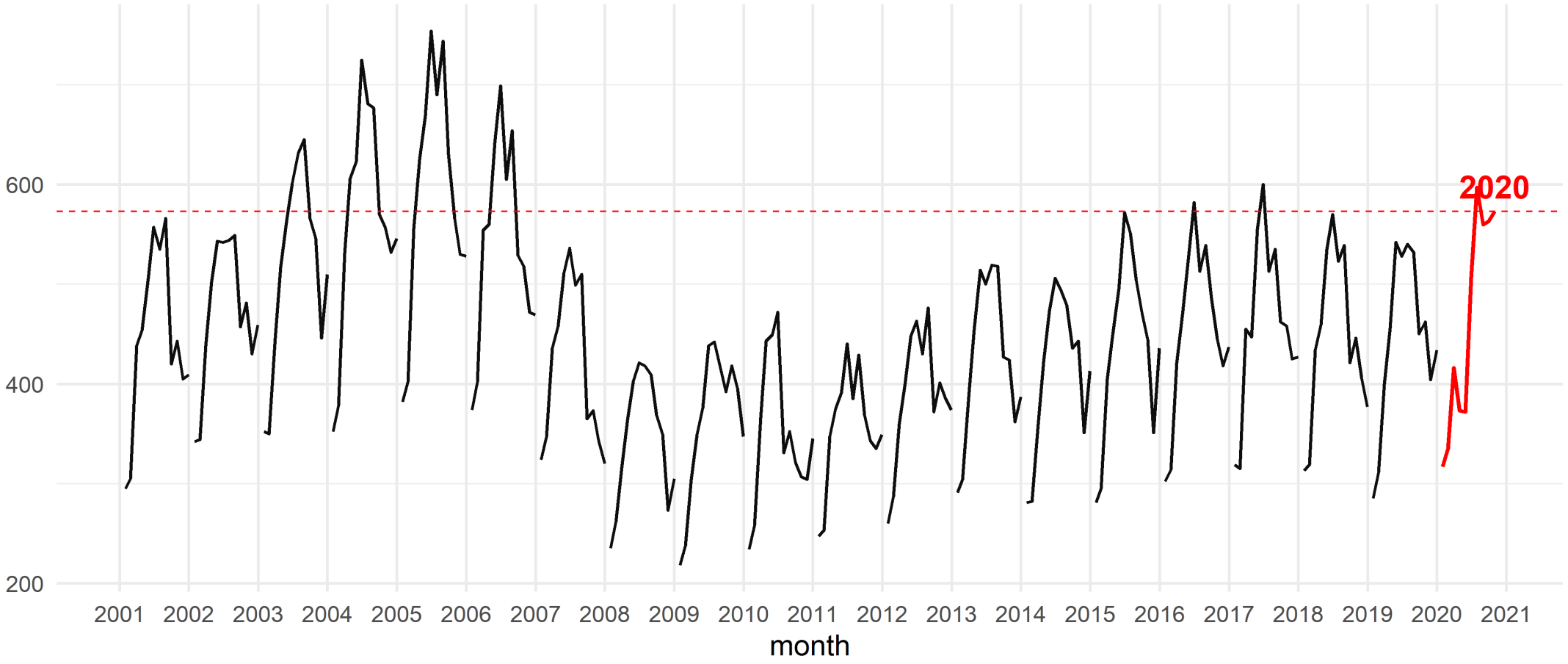
U.S. Existing Home Sales Inventory

Number of single-family homes available for sale (millions, not seasonally adjusted)

@lenkiefer Source: National Association of Realtors

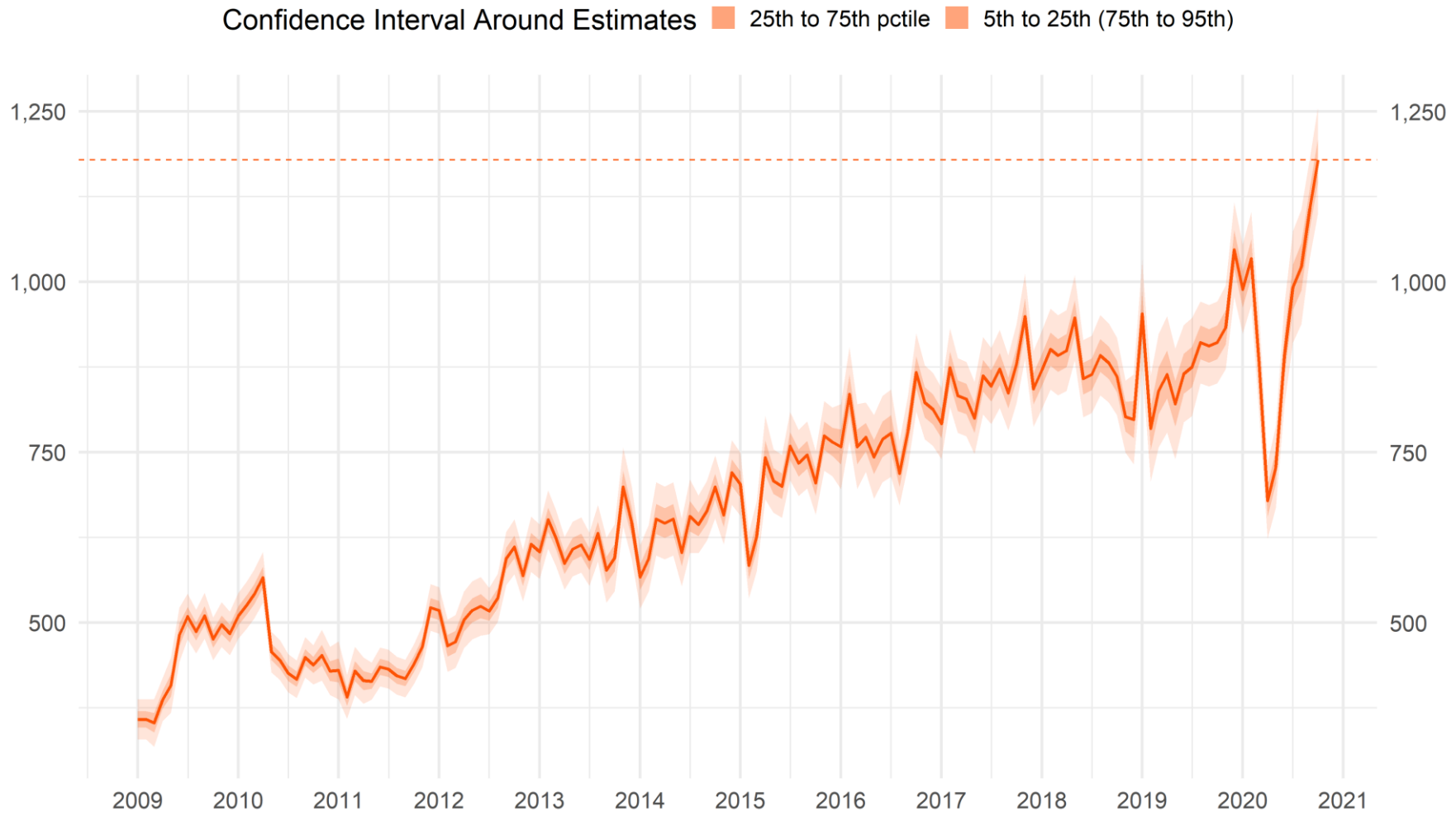
U.S. Existing Home Sales

Total existing home sales (thousands, not seasonally adjusted)



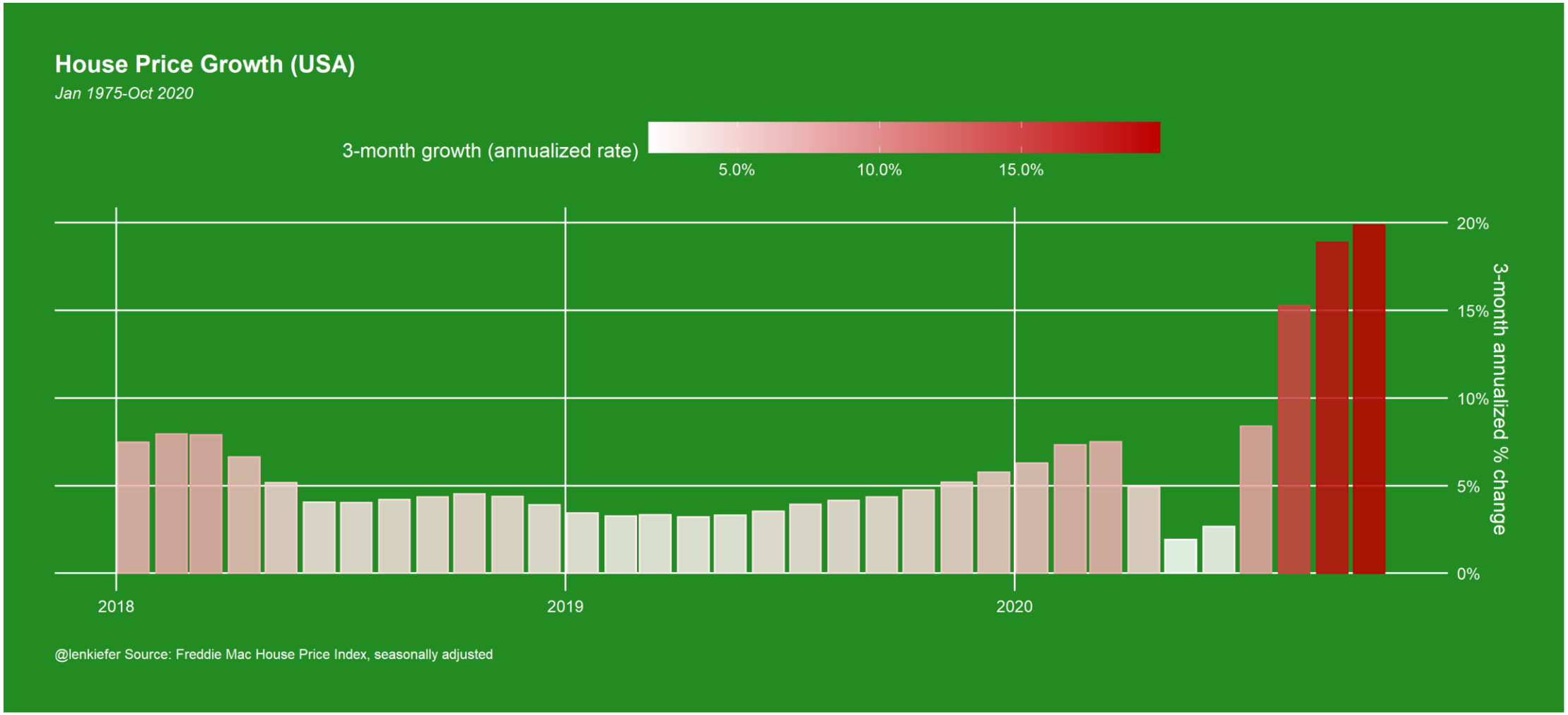
@lenkiefer Source: National Association of Realtors

U.S. Single-family Housing Starts (1000s, SAAR)

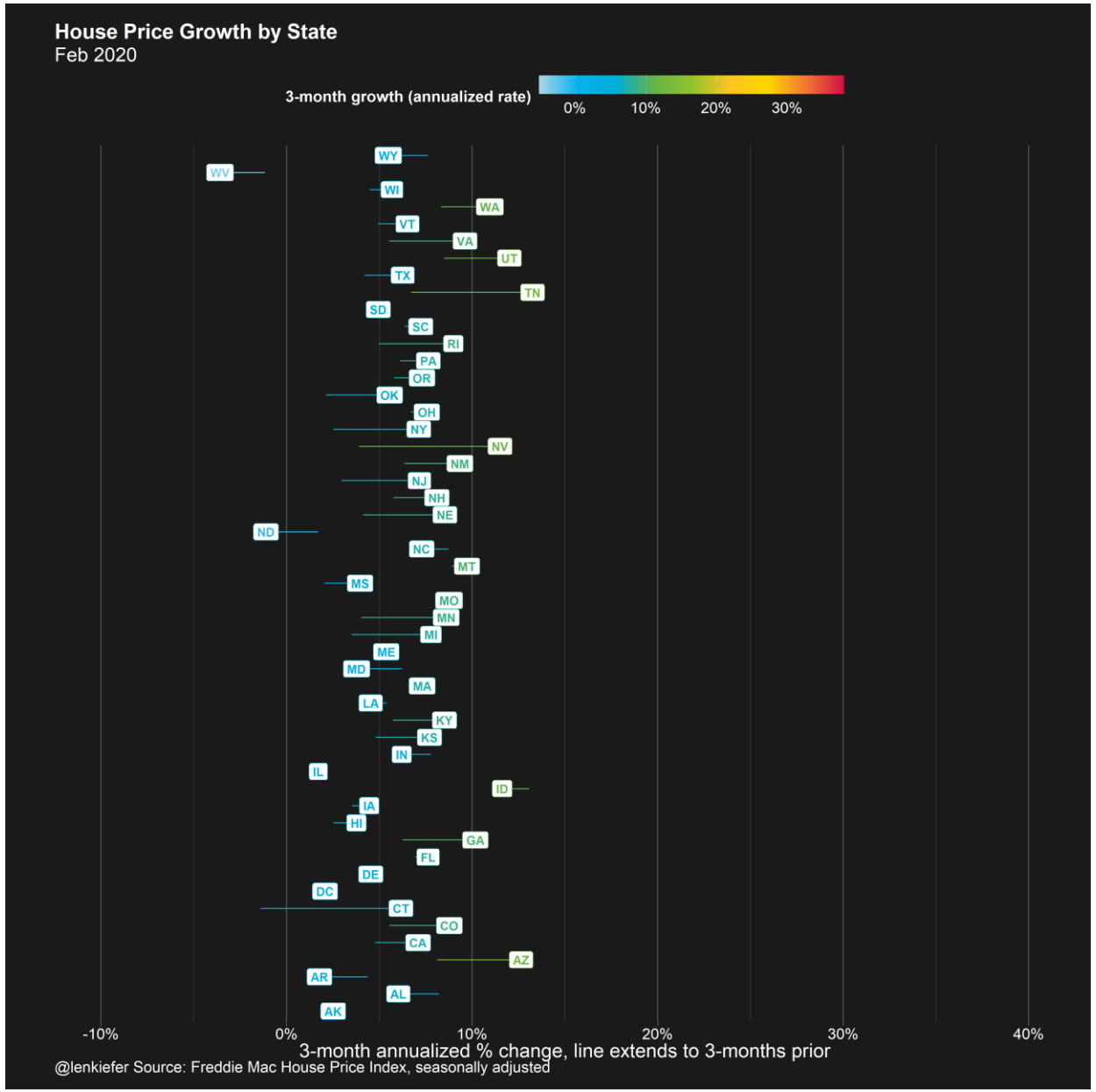


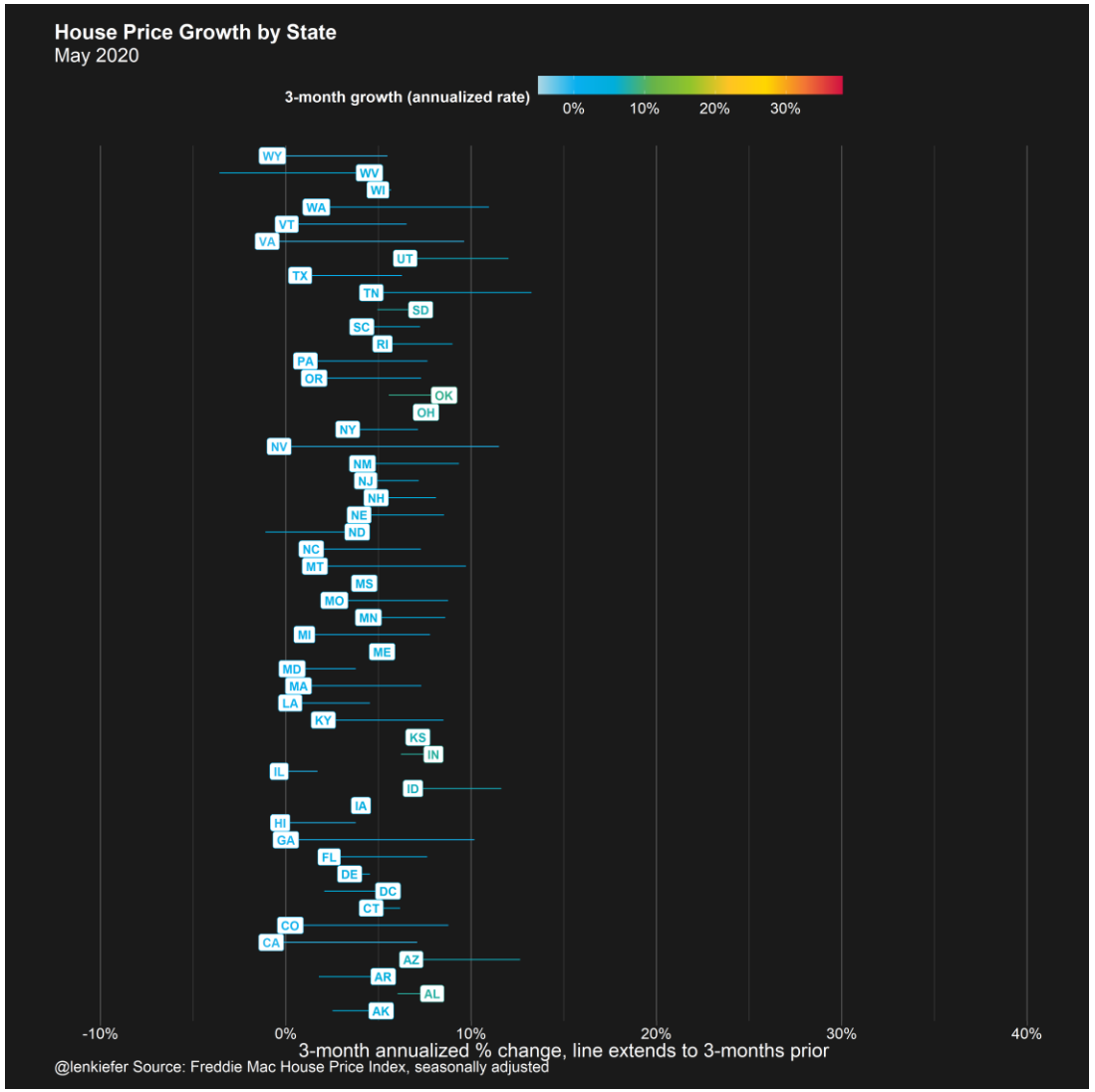
Source: U.S. Census Bureau and Department of Housing and Urban Development
Confidence interval based on normal distribution given relative standard error.
Dotted line at October 2020 estimate

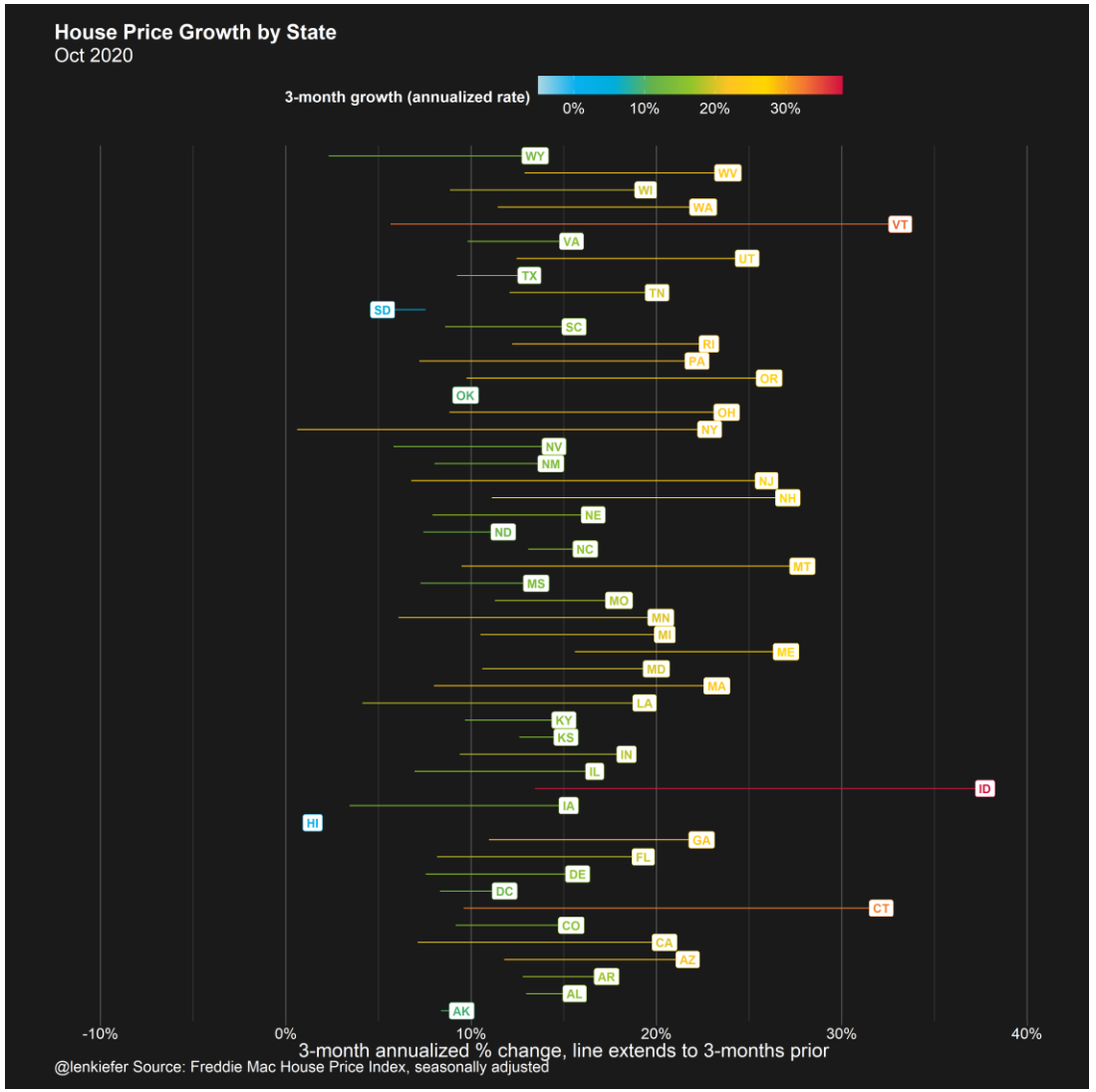

U.S. housing starts gaining momentum
year-to-date housing starts through October
Through October
<2020
>= 2020
Total
Single-family (1 unit)
Multifamily (5+ units)
year
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
1083
1078
1150
765
751
815
307
317
324
0
500
1000
1500
2000
1000s
@lenkiefer Source: U.S. Census Bureau and Department of Housing and Urban Development

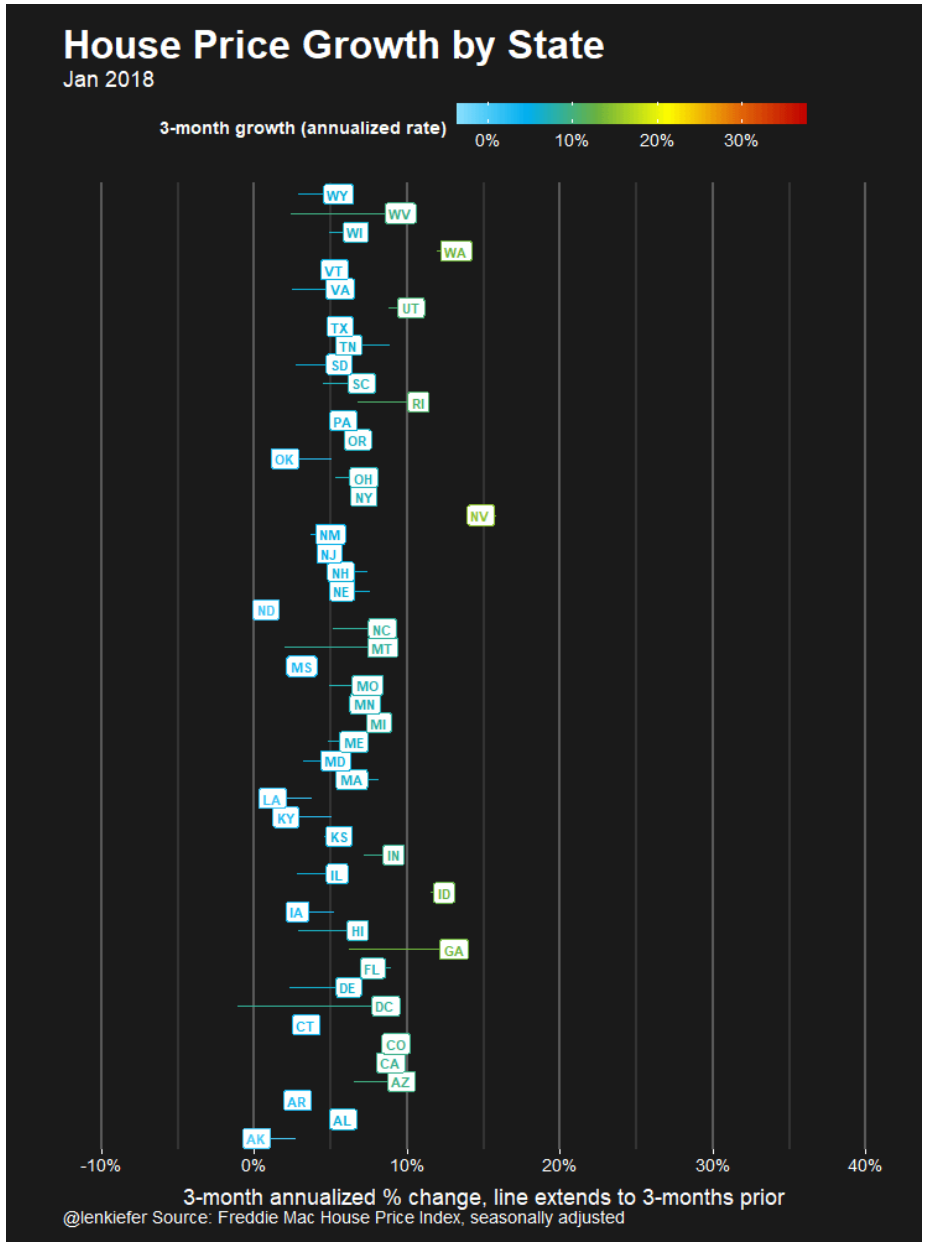

House Price Growth (USA)
Jan 1975-Oct 2020
3-month growth (annualized rate)
5.0%
10.0%
15.0%
20%
15%
10%
5%
0%
3-month annualized % change
2018
2019
2020
@lenkiefer Source: Freddie Mac House Price Index, seasonally adjusted

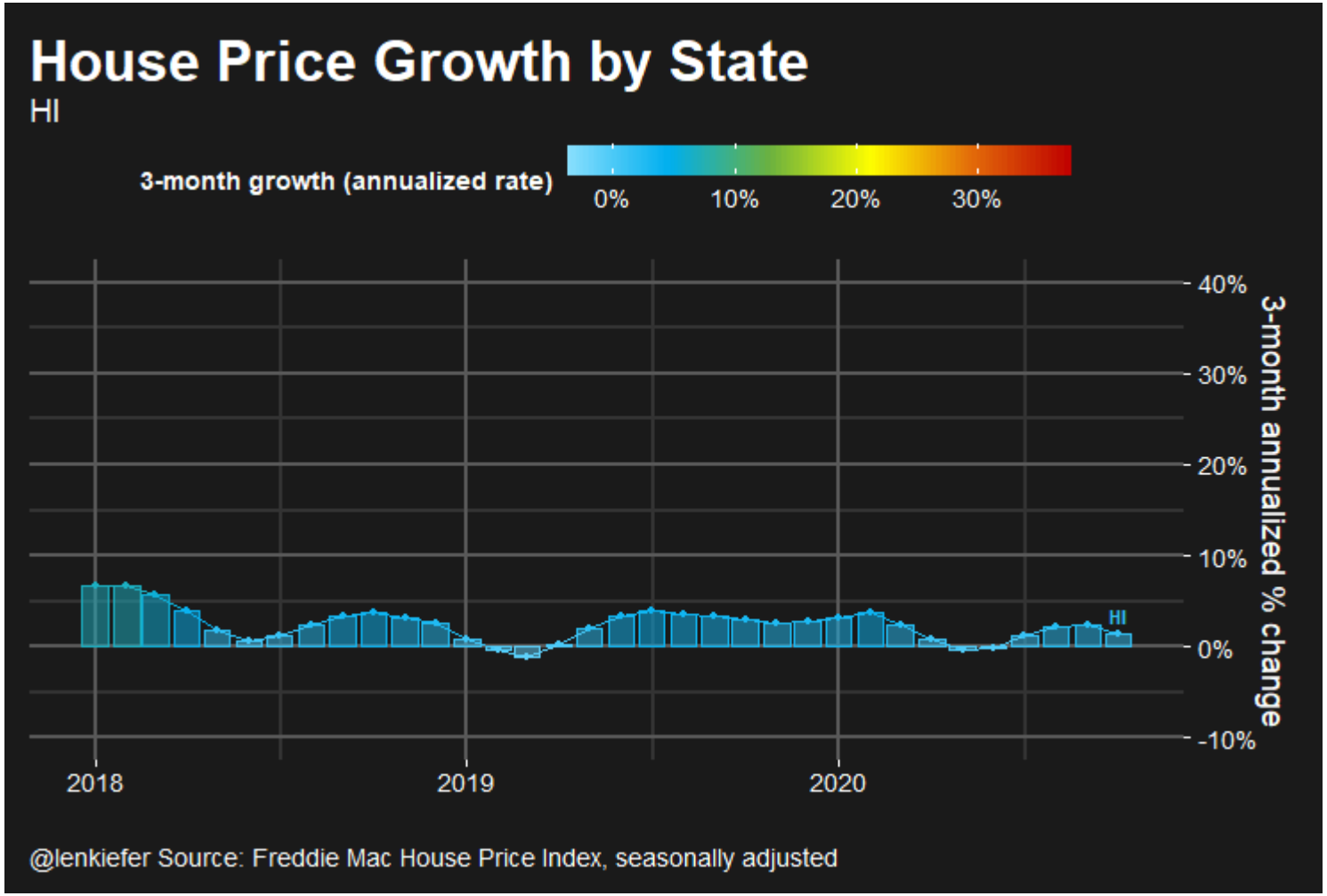

House Price Growth by State
Jan 2018-Oct 2020
3-month growth (annualized rate)
0%
10%
20%
30%
WI
VT
NH
ME
WA
ID
MT
ND
MN
IL
MI
NY
MA
OR
NV
WY
SD
IA
IN
OH
PA
NJ
CT
RI
CA
UT
CO
NE
MO
KY
WV
VA
MD
DE
AZ
NM
KS
AR
TN
NC
SC
DC
OK
LA
MS
AL
GA
HI
AK
TX
FL
40%
30%
20%
10%
0%
-10%
2018
2019
2020
3-month annualized % change
@lenkiefer Source: Freddie Mac House Price Index, seasonally adjusted


House Price Growth by State
Feb 2020
3-month growth (annualized rate)
0%
10%
20%
30%
WY
WV
WI
WA
VT
VA
UT
TX
TN
SD
SC
RI
PA
OR
OK
OH
NY
NV
NM
NJ
NH
NE
ND
NC
MT
MS
MO
MN
MI
ME
MD
MA
LA
KY
KS
IN
IL
ID
IA
HI
GA
FL
DE
DC
CT
CO
CA
AZ
AR
AL
AK
-10%
0%
10%
20%
30%
40%
3-month annualized % change, line extends to 3-months prior
@lenkiefer Source: Freddie Mac House Price Index, seasonally adjusted


House Price Growth by State
May 2020
3-month growth (annualized rate)
0%
10%
20%
30%
WY
WV
WI
WA
VT
VA
UT
TX
TN
SD
SC
RI
PA
OR
OK
OH
NY
NV
NM
NJ
NH
NE
ND
NC
MT
MS
MO
MN
MI
ME
MD
MA
LA
KY
KS
IN
IL
ID
IA
HI
GA
FL
DE
DC
CT
CO
CA
AZ
AR
AL
AK
-10%
0%
10%
20%
30%
40%
3-month annualized % change, line extends to 3-months prior
@lenkiefer Source: Freddie Mac House Price Index, seasonally adjusted


House Price Growth by State
Oct 2020
3-month growth (annualized rate)
0%
10%
20%
30%
WY
WV
WI
WA
VT
VA
UT
TX
TN
SD
SC
RI
PA
OR
OK
OH
NY
NV
NM
NJ
NH
NE
ND
NC
MT
MS
MO
MN
MI
ME
MD
MA
LA
KY
KS
IN
IL
ID
IA
HI
GA
FL
DE
DC
CT
CO
CA
AZ
AR
AL
AK
-10%
0%
10%
20%
30%
40%
3-month annualized % change, line extends to 3-months prior
@lenkiefer Source: Freddie Mac House Price Index, seasonally adjusted

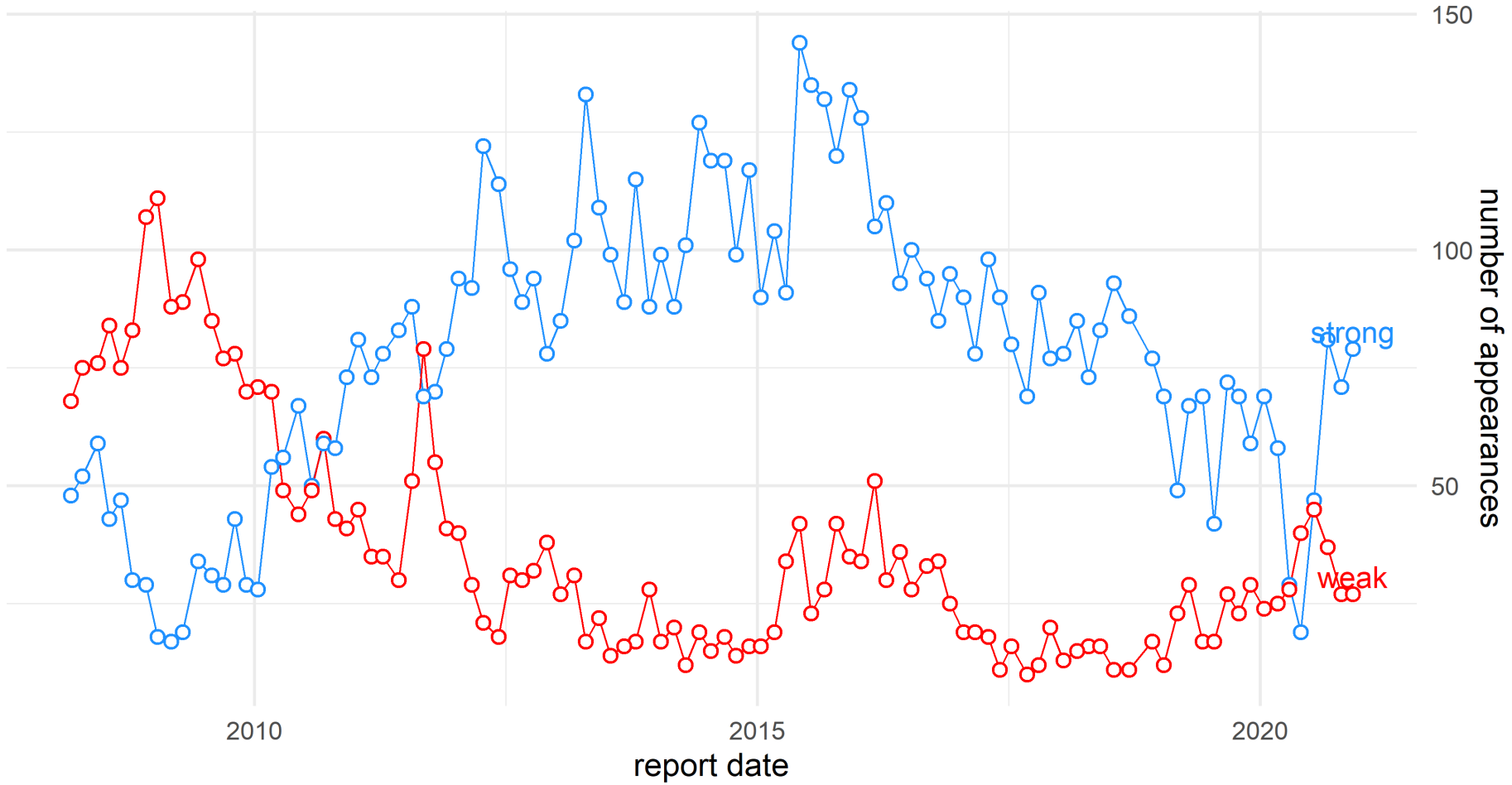

House Price Growth by State
Jan 2018
3-month growth (annualized rate)
0%
10%
20%
30%
WY
WV
WI
WA
VT
VA
UT
TX
TN
SD
SC
RI
PA
OR
OK
OH
NY
NV
NM
NJ
NH
NE
ND
NC
MT
MS
MO
MN
MI
ME
MD
MA
LA
KY
KS
IN
IL
ID
IA
HI
GA
FL
DE
DC
CT
CO
CA
AZ
AR
AL
AK
-10%
0%
10%
20%
30%
40%
3-month annualized % change, line extends to 3-months prior
@lenkiefer Source: Freddie Mac House Price Index, seasonally adjusted


House Price Growth by State
HI
3-month growth (annualized rate)
0%
10%
20%
30%
40%
30%
20%
10%
0%
-10%
3-month annualized % change
HI
2018
2019
2020
@lenkiefer Source: Freddie Mac House Price Index, seasonally adjusted

Visualizing Text

Number of times term appears in Beige Book

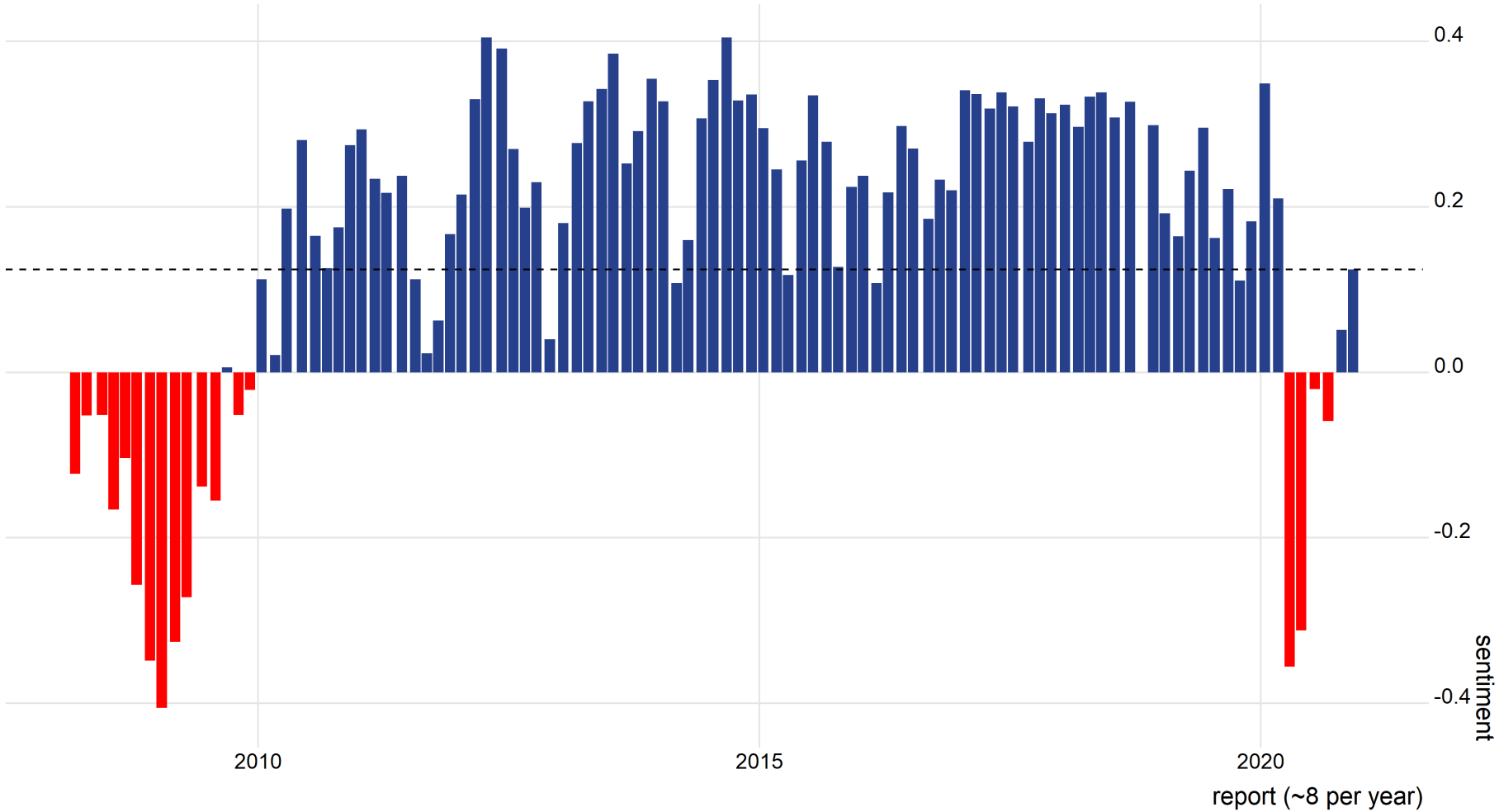
Beige Book Mar 2008-Dec 2020



@lenkiefer Source: Federal Reserve Board Beige Book
For details and R code see Beige-ian Statistics: http://lenkiefer.com/2018/07/29/beige-ian-statistics/
strong includes "strong","stronger","strongest","strengthen","strengthened","strengthening","strongly"
weak includes "weak","weaken","weakened","weaker","weakest","weakly","weakening"

Sentiment in Federal Reserve Beige Book

customized bing lexicon
sentiment = (positive-negative)/(positive+negative)
dotted line at December 2020 value

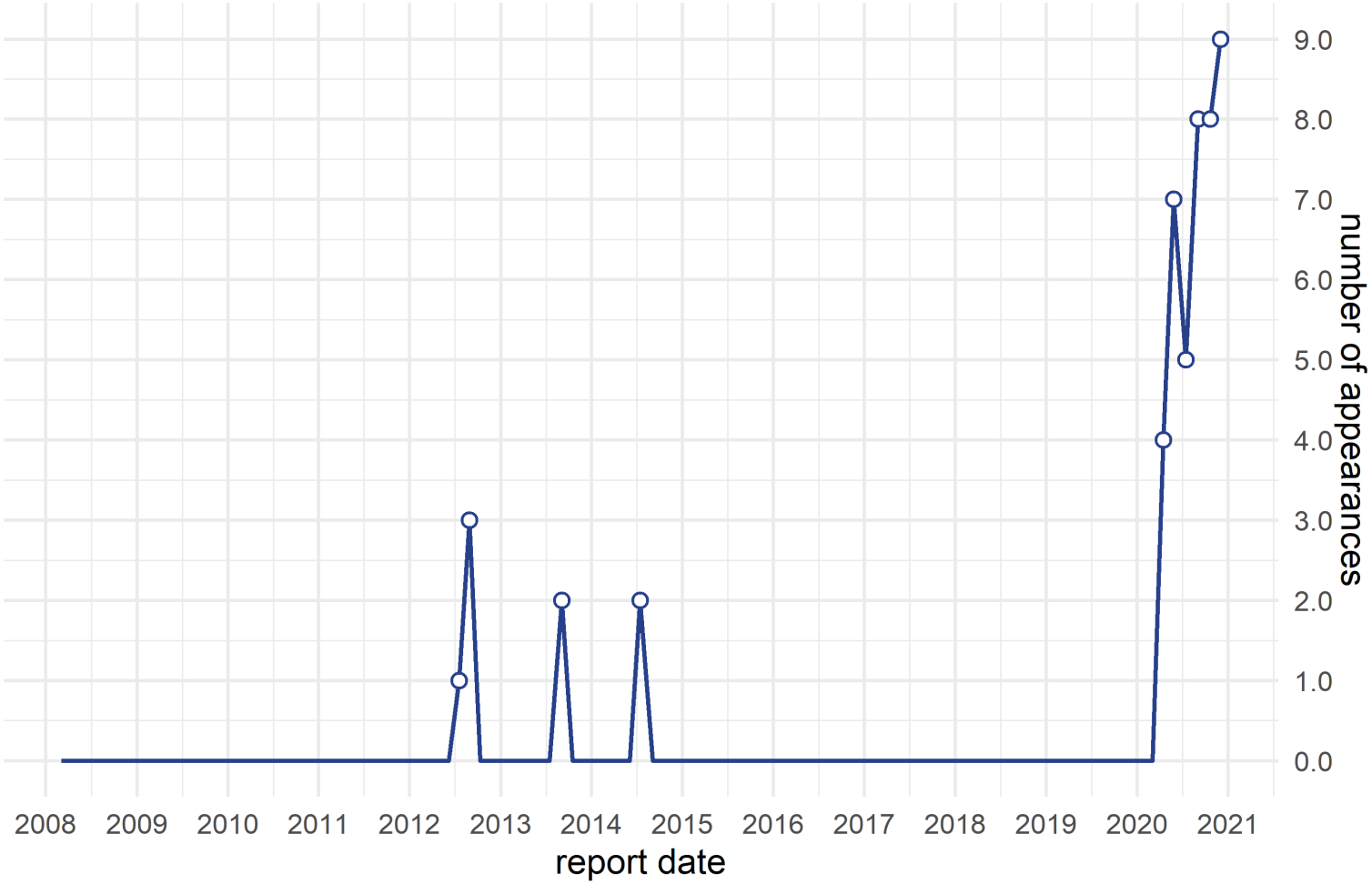


@lenkiefer
Source: Beige Book March 2008 - Dec 2020
For details and R code see Beige-ian Statistics: http://lenkiefer.com/2018/07/29/beige-ian-statistics/


Highest tf-idf words in Dec Federal Beige Book: 2008-2020
Top 10 terms by tf-idf statistic: term frequncy and inverse document frequency
Dec2008
told
bankruptcy
freezes
scaled
contracted
cutting
crisis
markdowns
norfolk
discount
Dec2009
tax
clunkers
homebuyer
extension
credits
deadline
depleted
excessively
ida
prolonged
Dec2010
tax
historic
returning
warmer
assessment
baltimore
poll
selected
directed
edging
Dec2013
shutdown
sequestration
partial
fiscal
affordable
brokers
launches
sandy
hopeful
aforementioned
Dec2014
brokers
christmas
geographic
harsh
monies
gasoline
cement
dairy
faster
pennsylvania
Dec2015
oversupply
role
motors
records
flooding
houston
craftsmen
forest
nontraditional
satisfactory
Dec2018
tariffs
visit
michael
hospitality
employ
nonlabor
pected
intensity
nonwage
retention
Dec2020
pandemic
covid
visit
virus
hospitality
infections
political
durables
indexes
moratoriums
tf-idf
@lenkiefer Source: Federal Reserve Board Beige Book
Note: omits stop words, date abbreviations and numbers.

Number of times "child","children" or "childcare" appears in report

Beige Book Mar 2008-Dec 2020



@lenkiefer Source: Federal Reserve Board Beige Book
For details and R code see Beige-ian Statistics: http://lenkiefer.com/2018/07/29/beige-ian-statistics/
Includes terms 'child','children','childcare'

Get more information

An excellent resource:

https://clauswilke.com/dataviz/

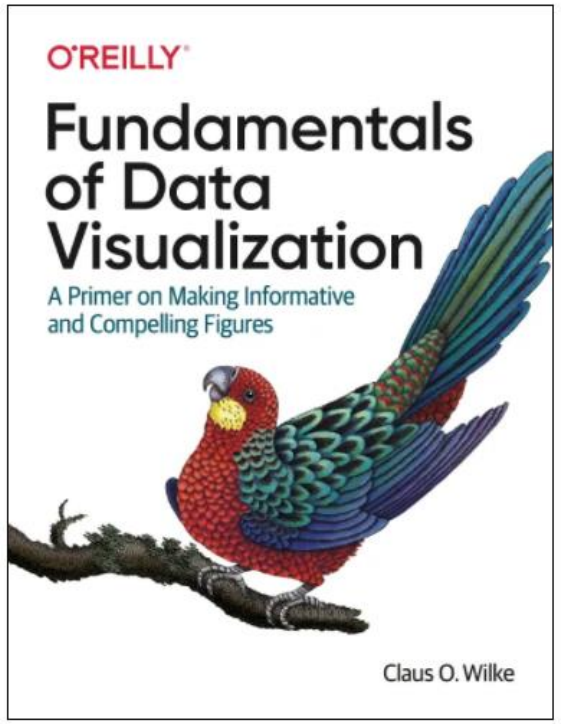
Fundamentals of Data Visualization

Claus O. Wilke

Welcome

This is the website for the book “Fundamentals of Data Visualization,” published by O’Reilly Media, Inc. The website contains the complete author manuscript before final copy-editing and other quality control. If you would like to order an official hardcopy or ebook, you can do so at various resellers, including Amazon, Barnes and Noble, Google Play, or Powells.

The book is meant as a guide to making visualizations that accurately reflect the data, tell a story, and look professional. It has grown out of my experience of working with students and postdocs in my laboratory on thousands of data visualizations. Over the years, I have noticed that the same issues arise over and over. I have attempted to collect my accumulated knowledge from these interactions in the form of this book.



Find reproducible R code at lenkiefer.com, or follow me on Twitter and LinkedIn

Built with Hugo
Theme Blackburn

Len Kiefer

Helping people understand the economy, housing and mortgage markets

Visual Meditations on House Prices 2020 Edition

2020/11/30

dataviz / house prices / R

VISUAL MEDITATIONS are the analysis of repeated graphs of the same data with variations on a graphical theme. When altering the mapping of data to aesthetics sometimes interesting patterns emerge. I find it a useful practice. I made a series of these a few years ago with different charts. The chart images have been lost to past blog migrations, but the code should still work. In this post, I want to consider several alternative ways to visualize house prices.

Read more »

New Research Paper Inequality During the COVID-19 Pandemic The Case of Savings from Mortgage Refinancing

2020/11/23

economy / mortgage / presentation / housing

For several months now, I've been working on a new research paper with Sumit Agarwal, Souphala Chomsisengphet, Hua Kiefer, and Paolina Medina studying refinance activity this year. When we started the