

# Visualizing Economic and Financial Market Trends in Volatile Times

JSM 2021  
**Time Series Analysis and Visualization**

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Len Kiefer

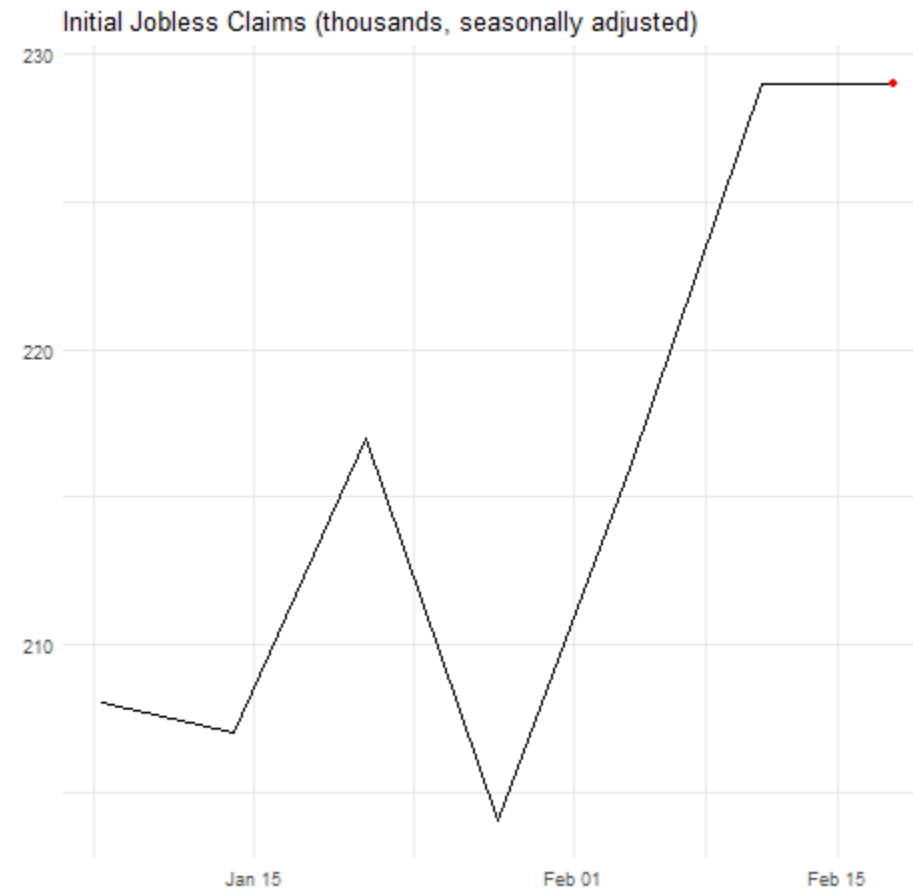
August 8, 2021

- The COVID-19 pandemic and associated economic slowdown has led to unprecedented volatility in many economic and financial time series. With swings well outside of historical ranges, many forecasting models break down. Data visualization techniques are a powerful tool to help the analyst understand evolving economic and financial market trends.
- In this talk I will discuss various data visualization methods that help track economic and financial market trends in real time. I will give examples of economic and financial market data, showing how traditional visualizations may falter when faced with extreme values, and explore how alternative visualizations may give new insights.
- We will also discuss how these visualizations can assist in modeling time series. Using the example of weekly home purchase mortgage applications in United States, we will consider how activity contracted sharply in the spring of 2020 but then rebounded over summer and fall. We'll then consider how a traditional univariate forecasting model can interact with alternative data visualization techniques to help the analyst understand evolving trends in real time.

# Shock and response

# A $30\sigma$ event

*US initial jobless claims (as of March 26, 2020)*

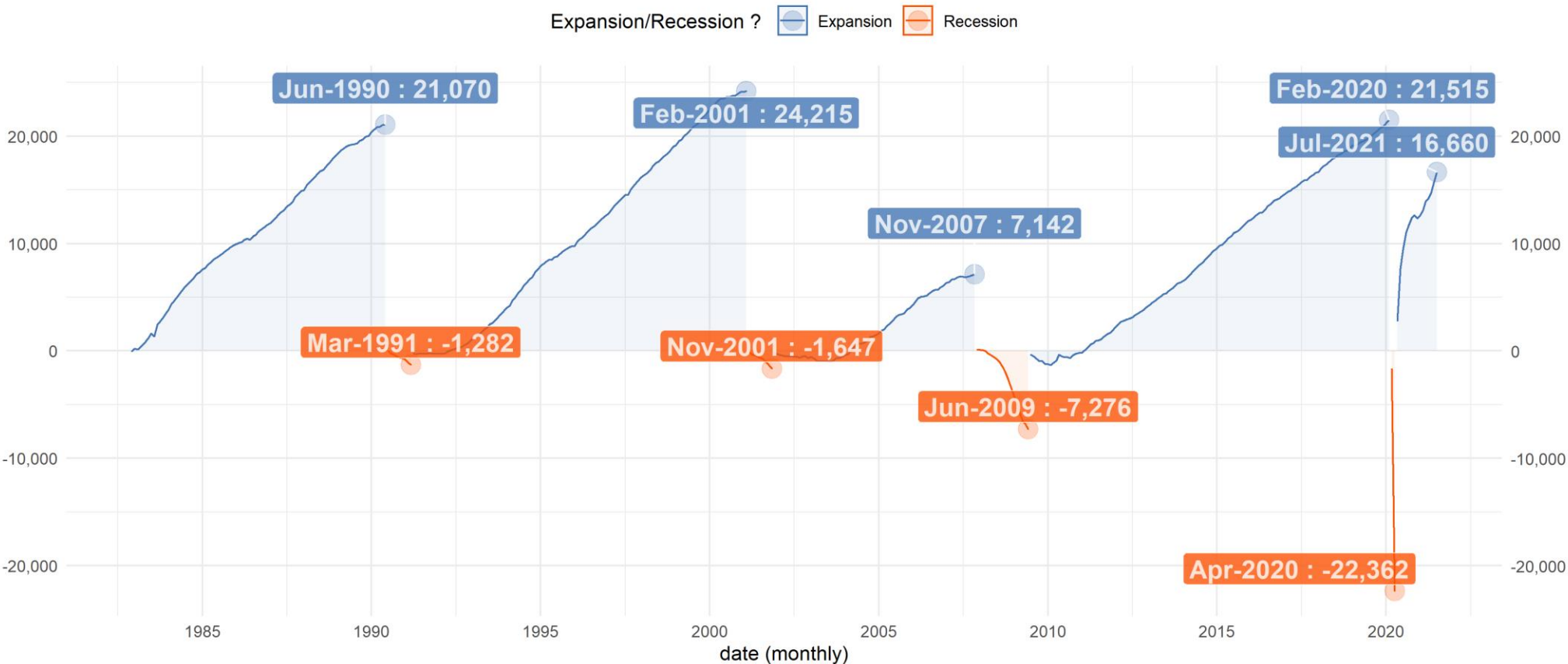


@lenkiefier: Source U.S. Department of Labor

<https://twitter.com/lenkiefier/status/1243166718924554240>

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

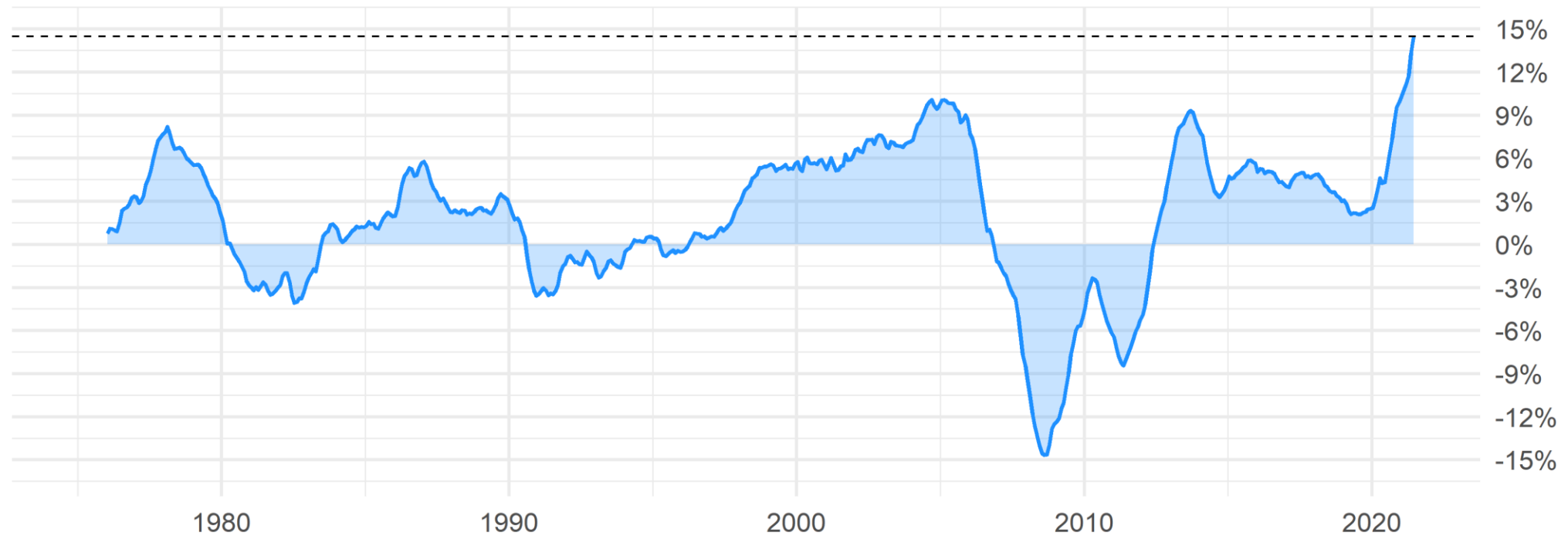
labels indicate cumulative growth through end of expansion/recession



@lenkier Source: U.S. Bureau of Labor Statistics All Employees: Total Nonfarm Payrolls, retrieved from BLS, August 6, 2021. NBER recession dates

## 12-month real house price growth January 1976 through June 2021

12-month percent change since January 1976



@lenkieferr

Sources: House Price Index: Freddie Mac House Price Index,  
deflated by PCE: U.S. Bureau of Economic Analysis, Personal Consumption Expenditures: Chain-type Price Index

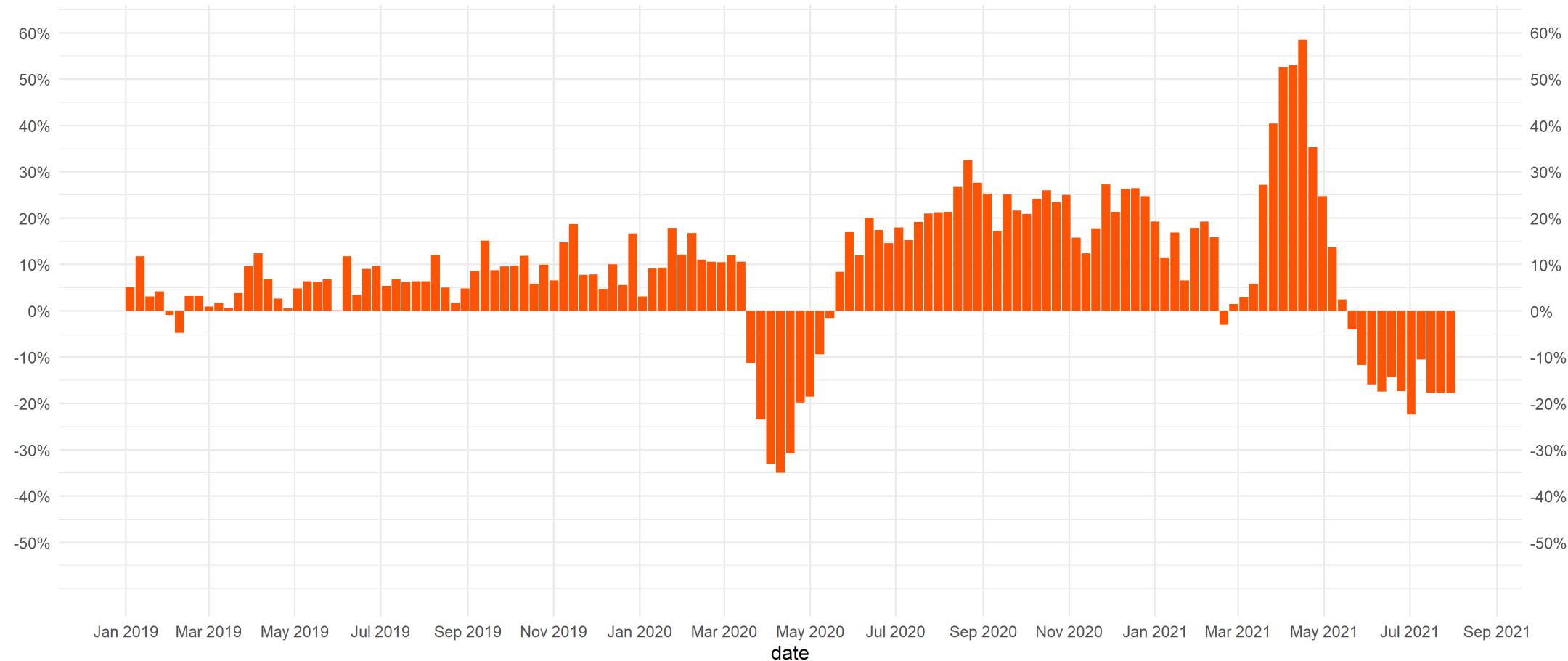
# A case study of home purchase mortgage demand

# House super-hot house price growth cooled housing demand?



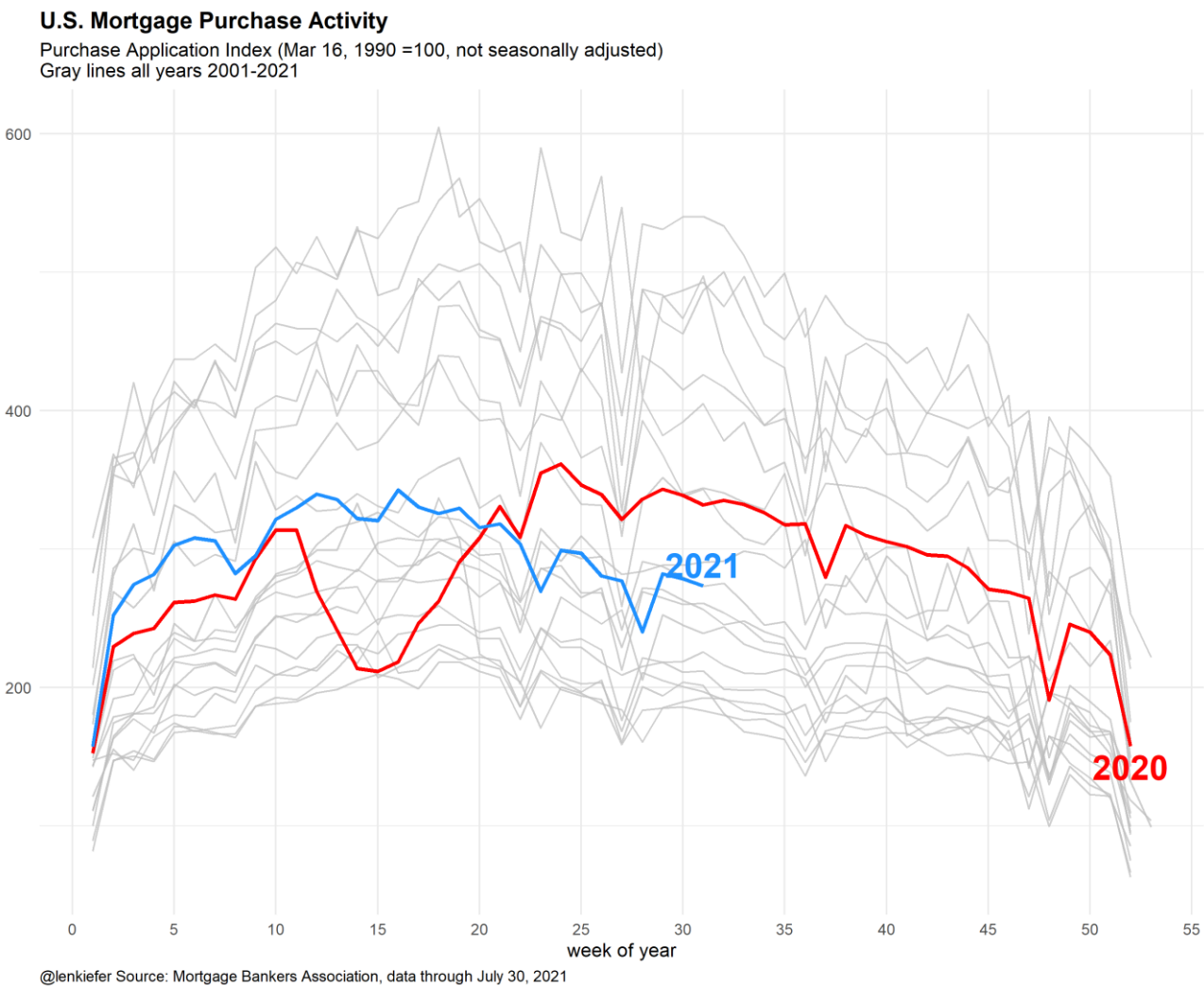
## U.S. Home Purchase Mortgage Applications

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



@lenkier Source: Mortgage Bankers Association, data through July 30, 2021

# The atypical seasonal pattern in 2020 vs prior years

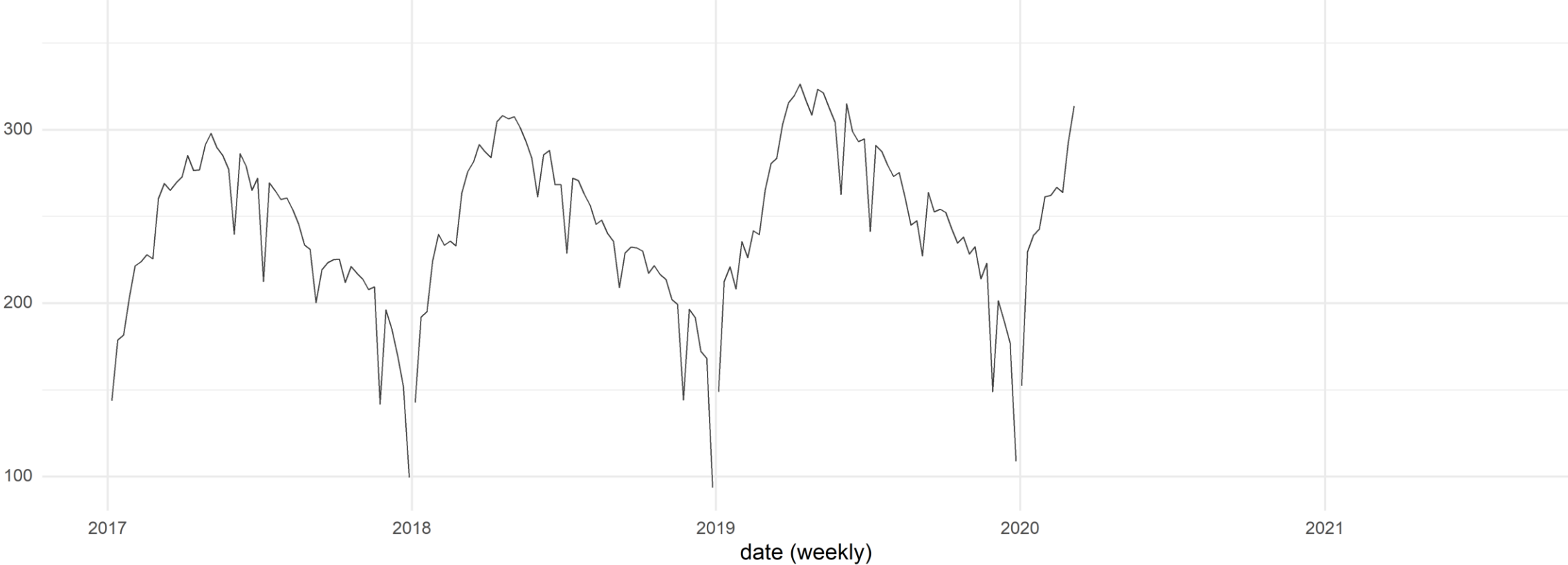




@lenkiefier Source: Mortgage Bankers Association, data through July 30, 2021

## U.S. Mortgage Purchase Activity Falls Behind Pre-Pandemic Trend

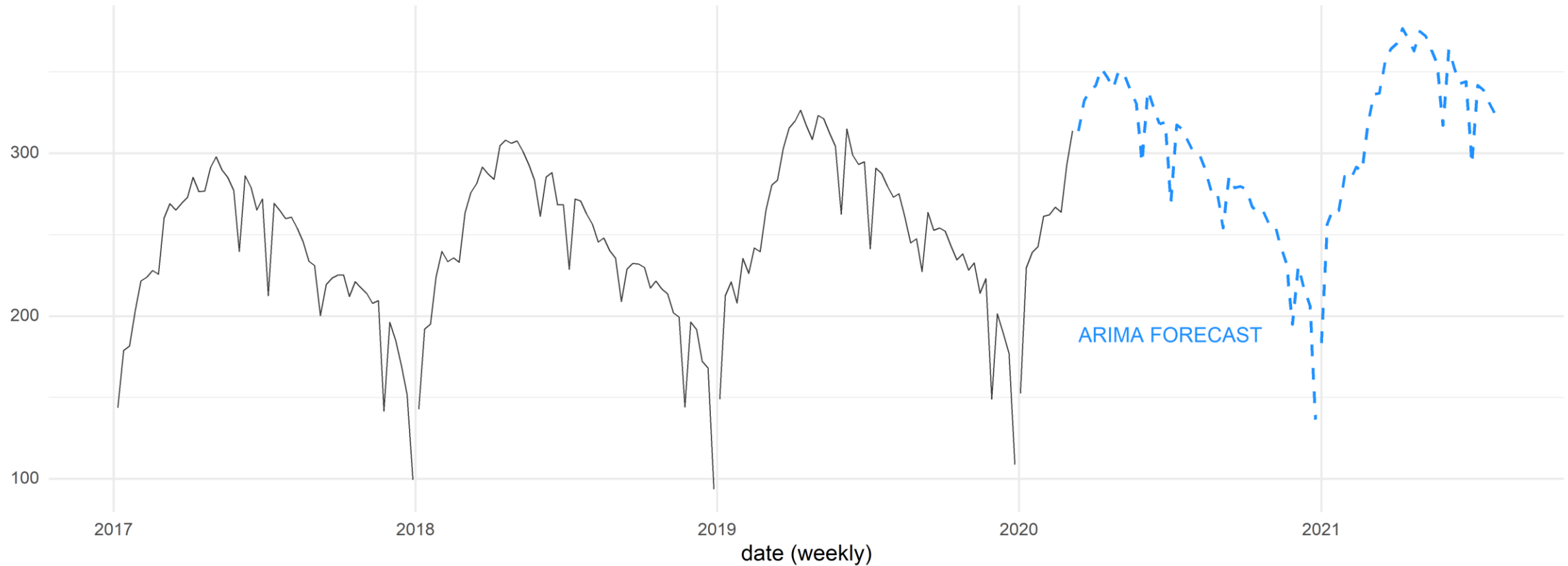
Purchase Application Index (Mar 16, 1990 =100, not seasonally adjusted)



@lenkier Source: Mortgage Bankers Association, data through July 30, 2021  
Seasonal autoregressive (1,1,0)(1,1,0)<sub>52</sub> Blue ARIMA forecast (extrapolated from model fit from 1990-01-05 through 2020-03-13), orange actuals from 2020-03-13 forward.

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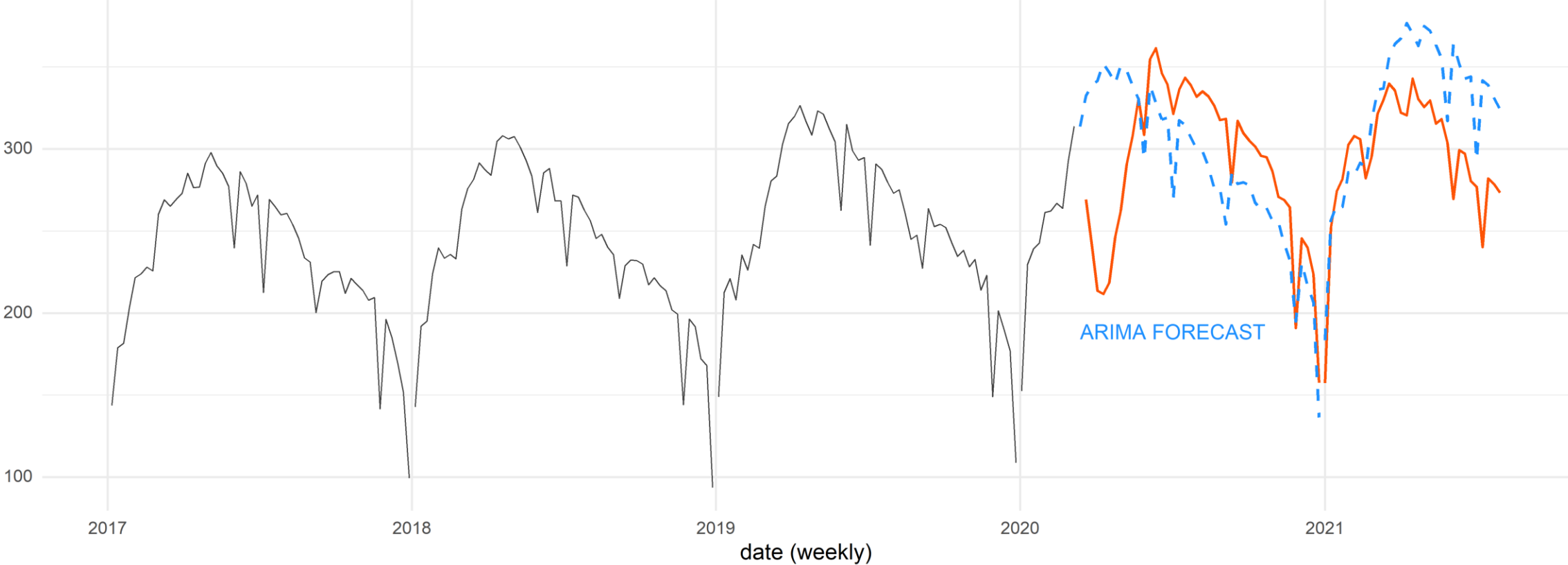


@lenkier Source: Mortgage Bankers Association, data through July 30, 2021

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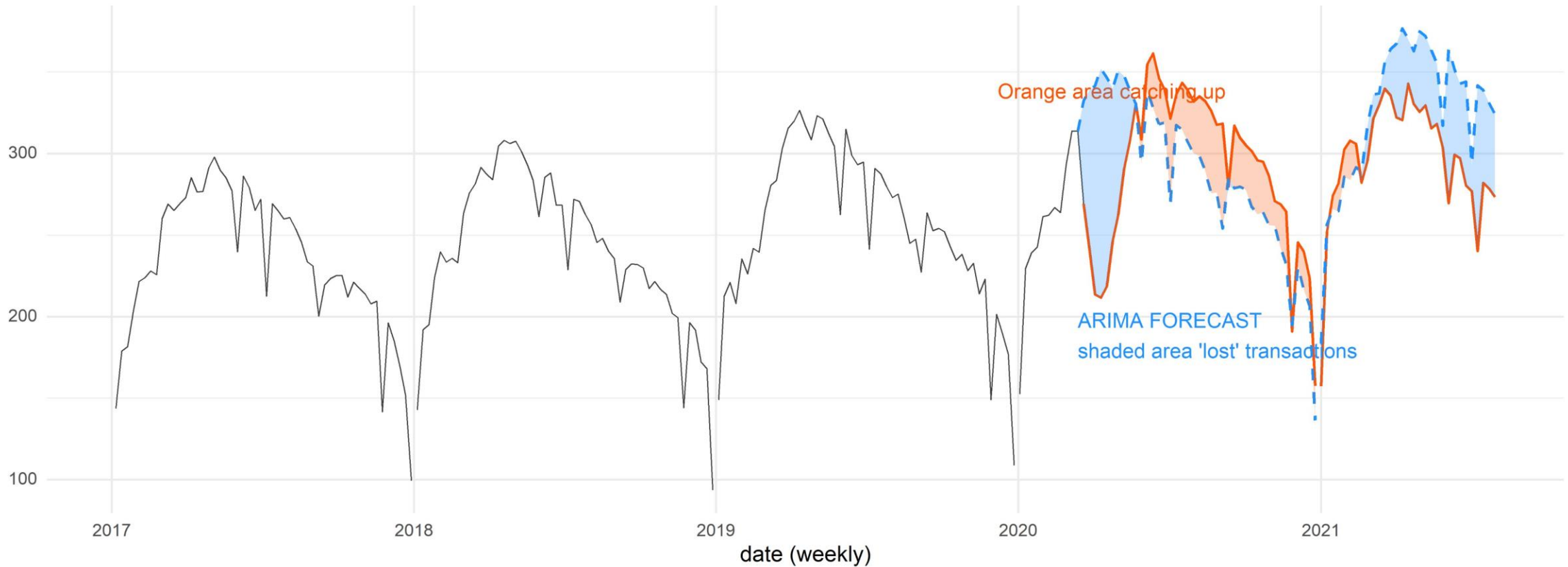
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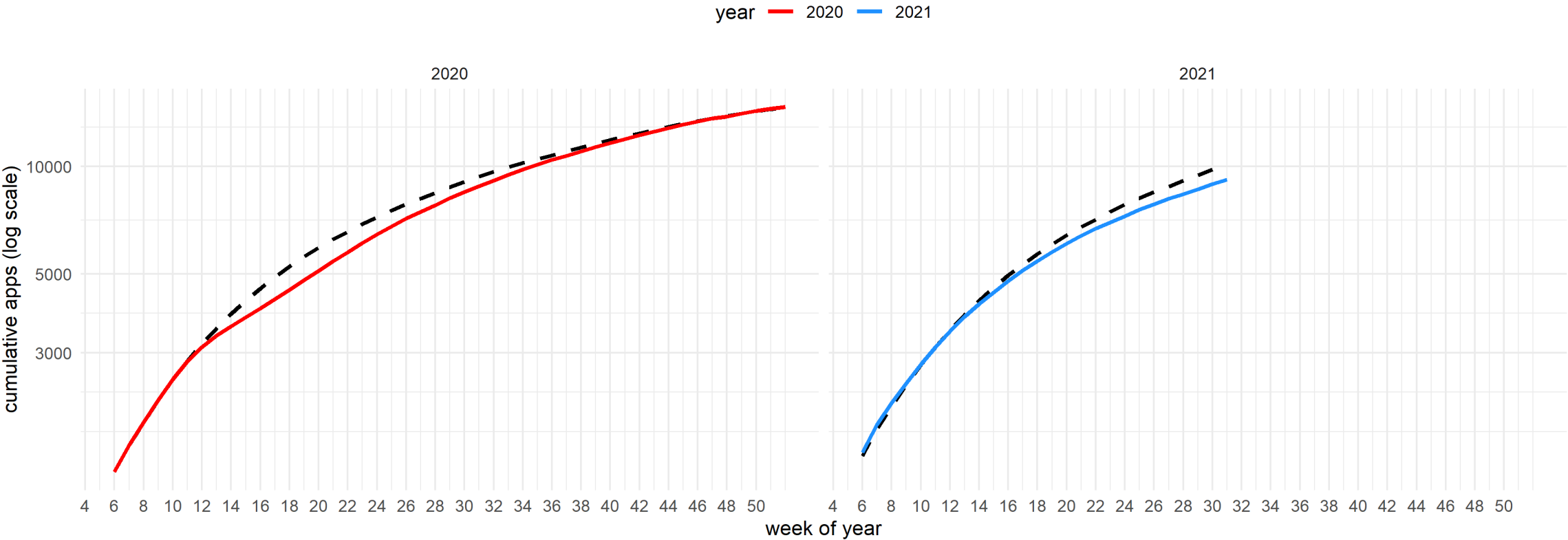
@lenkier Source: Mortgage Bankers Association, data through July 30, 2021

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# Cumulative applications fall below the pre-pandemic trend



Cumulative total home purchase mortgage applications by year  
dotted line ARIMA forecast starting March 13, 2020



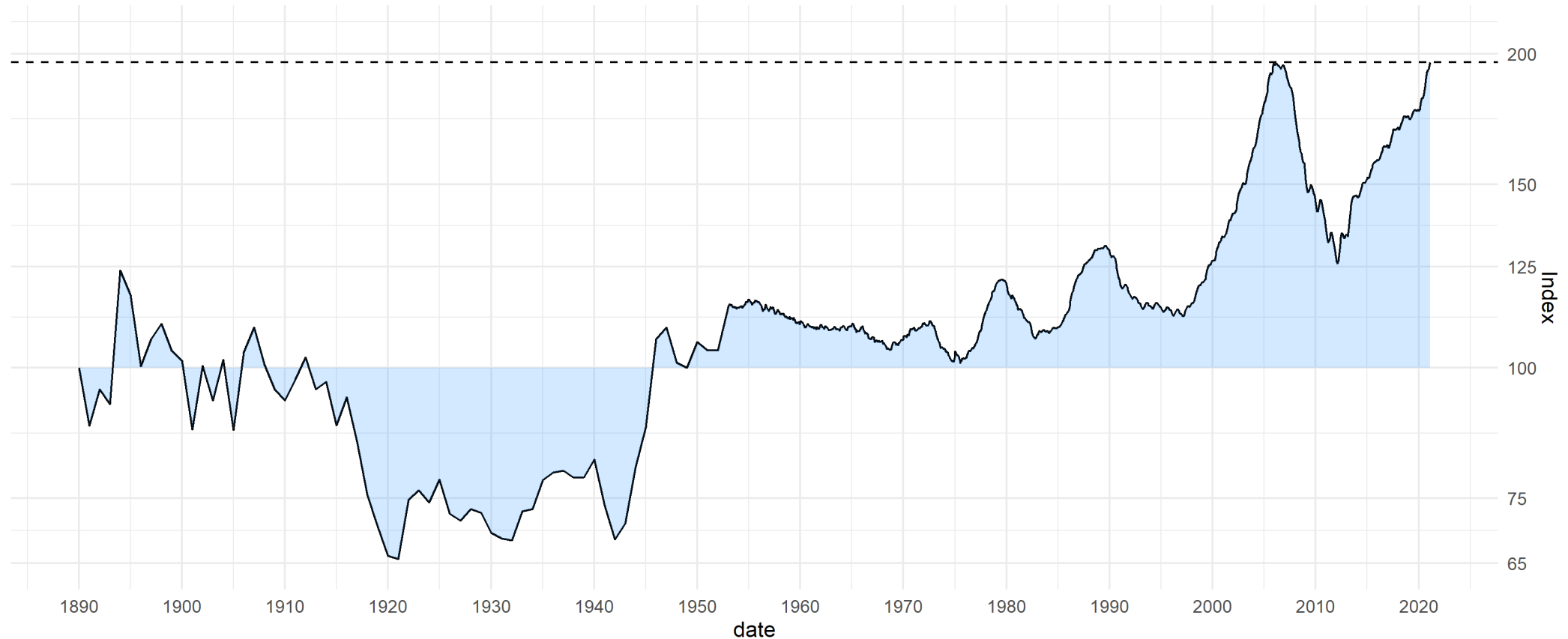
@lenkieferr Source: Mortgage Bankers Association, data through July 30, 2021

# Transitory shocks vs secular trends

# After adjusting for inflation, US house prices are as high as they have ever been (going back 131 years)

## U.S. real house prices at a 131-year record high

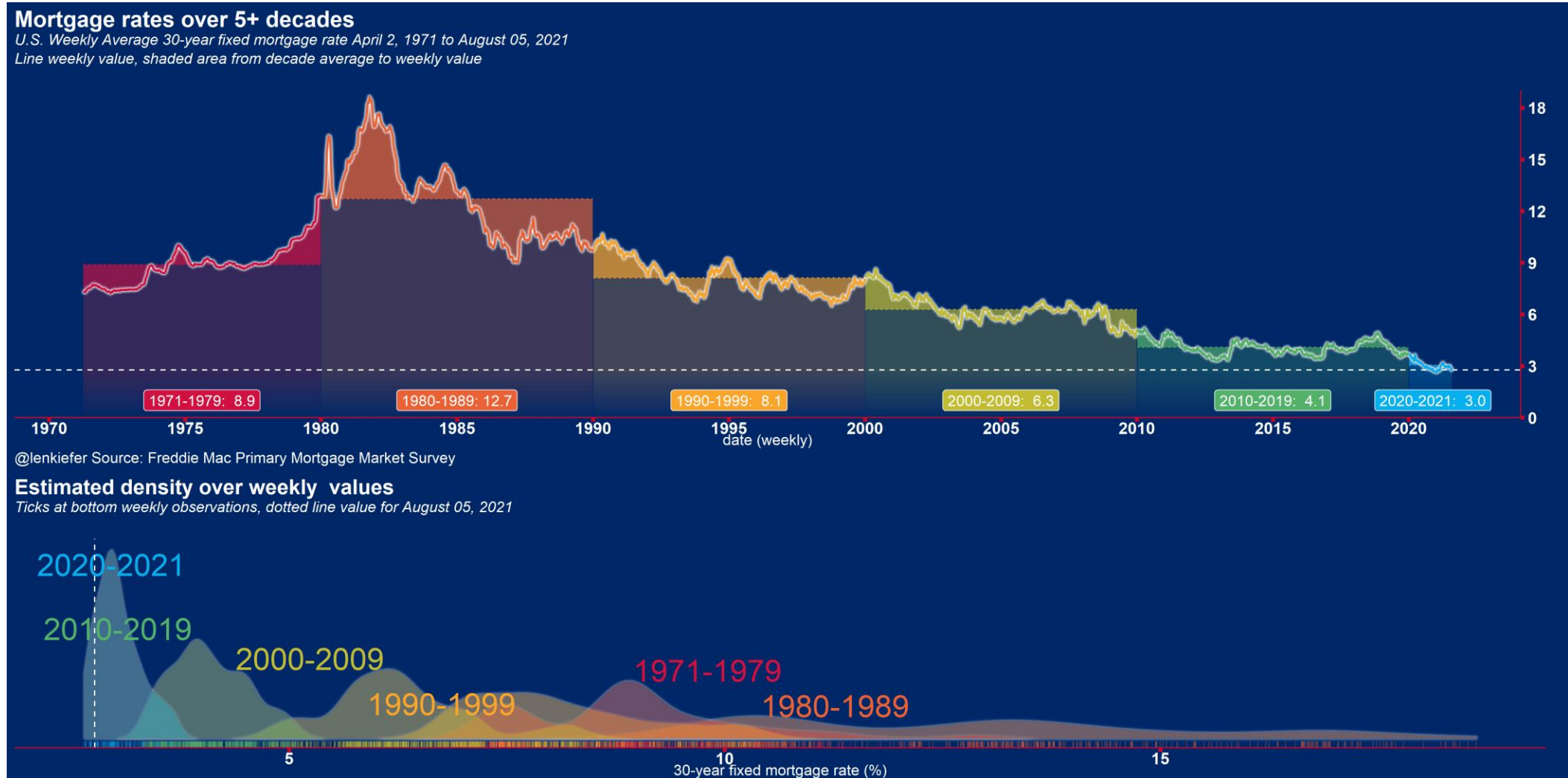
Real house price index (1890=100, log scale)



@lenkier Data source: U.S. Home Price and Related data, for Figure 3.1 in Robert J. Shiller, *Irrational Exuberance*, 3rd. Edition, Princeton University Press, 2015, as updated by author

# Extraordinary events may mask long-term secular trends

## Secular decline in mortgage rates

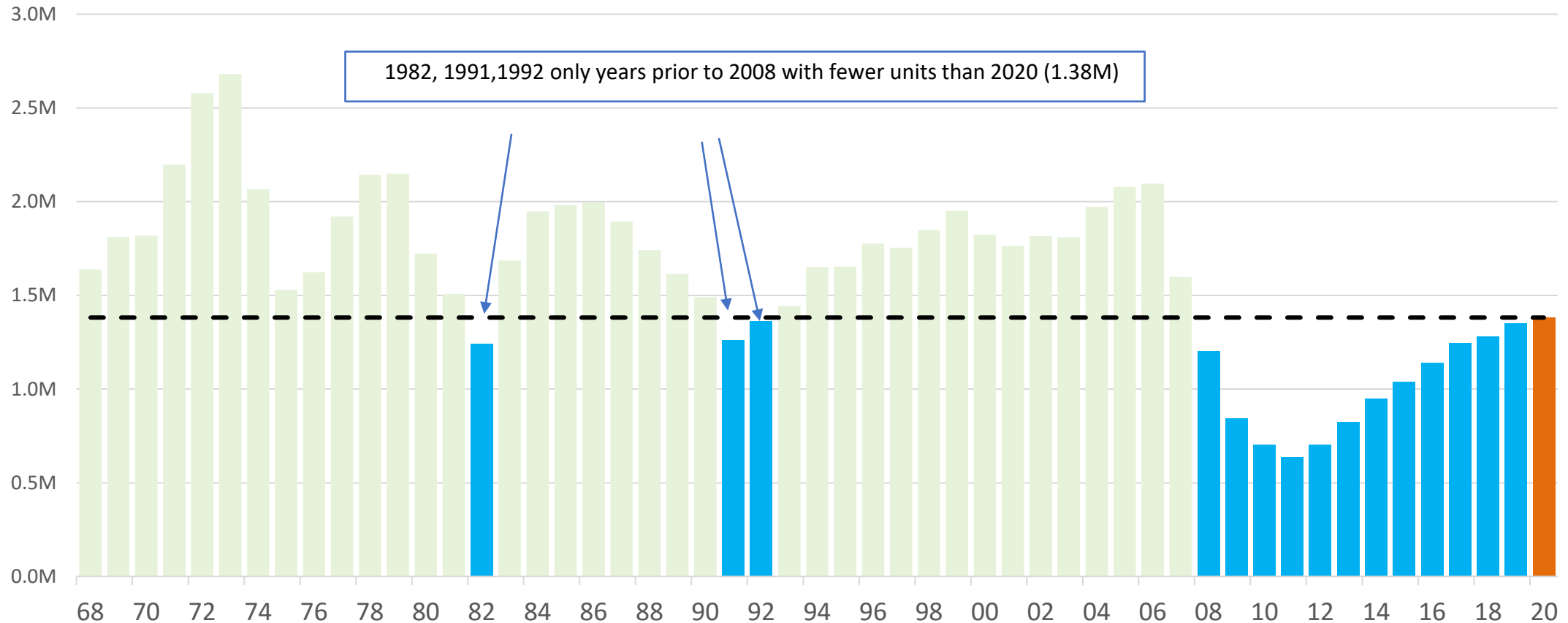


# Extraordinary events may mask long-term secular trends

*Years of low levels of building leave buyers scrambling for dwindling inventory*

## U.S. new housing supply low relative to history

U.S. annual housing completions and manufactured home shipments (1000s)



Source: US Census Bureau and Department of Housing and Urban Development, Institute for Building Technology & Safety

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