Housing market at a glance

Suggested answers

APPLICATION EXERCISE ANSWERS

MODIFIED
April 17, 2025

We will create a dashboard to visualize the housing market in the United States. We will use data on mortgage rates, household income, and mortgage origination rates.

Revisions to the dashboard

Your turn:

- [x] Examine the structure of the dashboard. What are the major components? How are the graphs defined? The table? The valueboxes?
- [x] Test out the static {ggplot2} charts in the dashboard. How effective are they? Do they look good at different browser window sizes? Can you change the figure dimensions to improve the readability?
- [x] Adjust the dashboard to use the Atkinson Hyperlegible font for the plots. Make that the default font for the dashboard.[1]
- [x] Which chart is more useful in the context of the dashboard: mortgage origination rates by state over time, or the map of mortgage origination rates by state for 2023? Why?
- [x] Convert the {ggplot2} plots to {plotly} interactive plots. Make sure to adjust the {plotly} output as necessary to look the same as the original plots and also leverage the interactivity effectively. Update the tooltips so they all are directly usable by the reader.
- [x] Render, commit, and push your changes to GitHub. Your dashboard will be published using GitHub Pages at the URL

  https://pages.github.coecis.cornell.edu/info3312-sp25/ae-21-NETID/

Source code for the final dashboard

```
---
title: "Housing Market at a Glance"
format:
  dashboard:
    theme: [litera, custom.scss]
```

```
    orientation: columns
    mainfont: Atkinson Hyperlegible
logo: logo.png
---

```{r}
#| label: setup
#| include: false

# import packages
library(tidyverse)
library(scales)
library(plotly)
library(sf)
library(tigris)
library(gt)
library(geofacet)
library(colorspace)

# set default ggplot2 theme
theme_set(theme_minimal(base_family = "Atkinson Hyperlegible", base_size = 14))

# import weekly mortgage interest rates
mortgages <- read_csv("data/weekly_mortgage_rates.csv") |>
  # clean columns for consistency
  mutate(
    fixed_30 = fixed_30 / 100,
    fixed_15 = fixed_15 / 100
  ) |>
  select(date, fixed_30, fixed_15)

# import median sale price and income gap
median_housing <- read_csv("data/price_to_income.csv")

# import mortgage origination rate
origin <- read_csv("data/mortgage-origination-state.csv")

# join with states sf data frame for mapping
origin_sf <- states() |>
  shift_geometry() |>
  filter(STUSPS %in% state.abb) |>
  left_join(y = origin)
```
```

```{r}
#| label: create-graphs
#| include: false

# mortgage rates over time
mortgage_p <- mortgages |>
  pivot_longer(
    cols = starts_with("fixed"),
    names_to = "type",
    values_to = "rate"
  ) |>
  mutate(
    type = case_match(
      .x = type,
      "fixed_30" ~ "Fixed 30-year",
      "fixed_15" ~ "Fixed 15-year"
    ),
    tooltip = str_glue("Date: {label_date(format = '%B %d, %Y')(date)}<br>Rate:
          {label_percent(accuracy = 0.1)(rate)}<br>Type: {type}")
  ) |>
  ggplot(mapping = aes(x = date, y = rate, color = type)) +
  geom_line(mapping = aes(text = tooltip, group = type)) +
  scale_y_continuous(labels = label_percent()) +
  scale_color_viridis_d(end = 0.8, guide = guide_legend(reverse = TRUE)) +
  labs(
    title = "Interest Rates 15- and 30-Year",
    x = NULL, y = NULL, color = NULL
  ) +
  theme(legend.position = "top")

# mortgage origination by state over time using geofacet
origin_state <- ggplot(data = origin, mapping = aes(x = date, y = mort_adj)) +
  geom_line() +
  scale_x_continuous(breaks = c(2000, 2020), labels = c("'00", "'20")) +
  facet_geo(facets = vars(NAME), labeller = label_wrap_gen(width = 15)) +
  labs(
    title = "Mortgage Originations per Capita",
    subtitle = "Mortgages originated per 1,000 residents",
    x = NULL,
    y = NULL
  ) +
  theme(
    strip.text = element_text(size = rel(0.6))
  )
```

```
# mortgage origination by state - ggplot2 and sf map
origin_map <- origin_sf |>
  filter(date == max(date)) |>
  ggplot(mapping = aes(fill = mort_adj)) +
  geom_sf() +
  scale_fill_continuous_sequential(
    palette = "viridis",
    labels = label_comma(accuracy = 0.1),
    rev = FALSE
  ) +
  labs(
    title = "Mortgage Originations per Capita",
    subtitle = "Mortgages originated per 1,000 residents",
    fill = NULL
  )

# mortgage origination by state - plotly map
origin_map_plotly <- origin |>
  # add hover text strings
  mutate(hover = str_glue("{NAME}: {label_number(accuracy = 0.1)(mort_adj)} per thousand
         residents in {date}")) |>
  # use built-in geographic data
  plot_geo(locationmode = "USA-states") |>
  # add choropleth layer
  add_trace(
    # type of chart
    type = "choropleth",
    # 2 letter abbreviations for each state
    locations = ~STUSPS,
    # variable to use for color shading
    z = ~mort_adj,
    # variable to use for animation
    frame = ~date,
    # tooltip text
    text = ~hover,
    # type of info to use for tooltip hover
    hoverinfo = "text",
    # choose a color scale
    colorscale = "Viridis",
    # fix the minimum and maximum of the colorbar to the entire time period
    zmin = min(origin$mort_adj),
    zmax = max(origin$mort_adj),
    # no separate borders between states
```

```
    marker = list(line = list(
      width = 0
    ))
  ) |>
  # set layout options
  layout(
    # plot title
    title = "Mortgages originated per thousand residents",
    # geographic info
    geo = list(
      scope = "usa",
      projection = list(type = "albers usa")
    ),
    # adjust font to match rest of site
    font = list(
      family = "Atkinson Hyperlegible"
    )
  ) |>
  colorbar(title = "") |>
  # animation options
  animation_opts(
    # frame duration in milliseconds
    frame = 1000,
  ) |>
  animation_slider(
    currentvalue = list(prefix = "Year: ")
  )

# median home prices
median_home_p <- median_housing |>
  drop_na() |>
  mutate(tooltip_house = str_glue("Year: {label_date_short()(date)}<br>Median home sales
          price: {label_currency(accuracy = 1)(med_sales_price)}<br>Price-to-income ratio:
          {label_comma(accuracy = 0.1)(price_to_income)}"),
         tooltip_inc = str_glue("Year: {label_date_short()(date)}<br>Median household
          income: {label_currency(accuracy = 1)(med_income)}<br>Price-to-income ratio:
          {label_comma(accuracy = 0.1)(price_to_income)}")) |>
  ggplot(mapping = aes(x = date)) +
  # housing price
  geom_line(mapping = aes(y = med_sales_price, text = tooltip_house, color = "sales_price",
          group = 1)) +
  # median income
  geom_line(mapping = aes(y = med_income, text = tooltip_inc, color = "income", group = 1))
          +
  # shading between the two
```

```
  # geom_ribbon(mapping = aes(ymin = med_income, ymax = med_sales_price), alpha = 0.2) +
  scale_y_continuous(labels = label_currency()) +
  scale_color_discrete_qualitative() +
  labs(
    title = "Price-to-income ratio for home purchases",
    x = NULL, y = NULL, color = NULL
  ) +
  theme(legend.position = "none")
```

Stats

Column {width="20%"}

```{r}
#| include: false

# get most recent records for mortgage rates and home sale prices
last_row <- slice_tail(mortgages, n = 1)
last_home_price <- slice_tail(median_housing, n = 1)
```

```{r}
#| content: valuebox
#| title: !expr str_glue('Average annual rate for a 30-year fixed mortgage in {last_row |>
          pull(date) |> format(format = "%b. %Y")}')
#| icon: house-door
#| color: info

list(
  value = label_percent(accuracy = 0.1)(last_row |> pull(fixed_30))
)
```

```{r}
#| content: valuebox
#| title: !expr str_glue('Average annual rate for a 15-year fixed mortgage in {last_row |>
          pull(date) |> format(format = "%b. %Y")}')
#| icon: house-door
#| color: info

list(
  value = label_percent(accuracy = 0.1)(last_row |> pull(fixed_15))
)
```

```{r}
#| content: valuebox
#| title: !expr str_glue('National median home price in {last_home_price |> pull(date) |>
          format(format = "%b. %Y")}')
#| icon: currency-dollar
#| color: info

list(
  value = label_dollar(scale_cut = cut_short_scale())(last_home_price |>
          pull(med_sales_price))
)
```

Column

```{r}
#| title: "Mortgage Originations per Capita"
#| height: 50%

# plotly map
origin_map_plotly
```

```{r}
#| title: Mortgage Interest Rates
#| height: 50%

# formatted table of weekly mortgage rates
mortgages |>
  gt() |>
  cols_label(
    date = "Date",
    fixed_30 = "Fixed 30-year rate",
    fixed_15 = "Fixed 15-year rate"
  ) |>
  fmt_percent(
    columns = starts_with("fixed")
  ) |>
  fmt_date(
    columns = date,
    date_style = "month_day_year"
  ) |>
  sub_missing() |>
  opt_interactive(
```

```
    use_search = TRUE,
    use_compact_mode = TRUE,
    pagination_type = "jump"
  )
```

Column

```{r}
#| title: "Housing Economics"

# interest rates
mortgage_p |>
  # ensure correct column is used for tooltips
  ggplotly(tooltip = "text") |>
  # move legend - doesn't accept theme() values
  layout(legend = list(orientation = "v", x = 0.95, y = 0.95, traceorder = "reversed",
         xanchor = "right"))

# income-housing gap
ggplotly(median_home_p, tooltip = "text")
```

Data

- [Mortgage Interest Rates 15- and 30-Year](https://www.nahb.org/news-and-economics/housing-economics/national-statistics/weekly-mortgage-rates-15-and-30-year)
- [Median Home Prices](https://fred.stlouisfed.org/series/MSPUS)
- [Median Household Income](https://fred.stlouisfed.org/series/MEHOINUSA646N)

Acknowledgments

- Housing market dashboard is adapted from Housing Market at a Glance by Isabella Velásquez.

> **Session information**

Footnotes

1. This should be applied whenever the dashboard uses a **sans-serif** font. You will still see the default serif font for items such as the value cards. ↩