



Consumer Sentiments VS. Economy Realities

Longitudinal Analysis of Changing Consumer Perceptions in Relation to
Employment

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Socio-Economic Background

Exploratory Data Analysis Executive Summary

- Project Objective
- Data Source
- Data Reliability
- THEME FOUND123
- Limitations of the Analysis

Research Questions

-
-

Data Source and Assumptions

Data Cleaning Process

Notable Findings

Finding 1. Finding Theme

State the finding in a few lines (See Visualization 1).

Finding 2. (See Visualization 2).

Finding 3. (See Visualization 3).

Visualizations

Working repo could be fount at:

<https://github.com/zzeng05/ZENG1-LIU2-727FINAL-scaVSepl.git>

```
# Fetch SCA Data

cs_url <- "https://data.sca.isr.umich.edu/data-archive/mine.php#"

#function to fetch any sca table from data site
get_sca_table <- function(table_num,
                           from_year = 2008,
                           to_year   = 2025,
                           freq       = "monthly") {

  body_list <- list(
    table = as.character(table_num),
    format = "html",
    from   = as.character(from_year),
    to     = as.character(to_year),
    freq   = freq
  )

  res <- POST(cs_url, body = body_list, encode = "form")
  stop_for_status(res)

  page <- read_html(res)
```

```

page %>%
  html_node("div.output table") %>%
  html_table(fill = TRUE)
}

#fetch & clean table1: Consumer Sentiment Index
CS <- get_sca_table(1) %>%
  # same logic as your cs_tables[[2]] cleaning
  rename(
    month_chr = X1,
    year_chr = X2,
    cs_chr     = X3
  ) %>%
  slice(-1) %>% # drop the header row inside the table
  mutate(
    month = as.integer(month_chr),
    year  = as.integer(year_chr),
    cs    = as.numeric(cs_chr),
    date  = ymd(sprintf("%04d-%02d-01", year, month))
  ) %>%
  arrange(date) %>%
  select(date, cs, year, month)

head(CS)

# A tibble: 6 x 4
date      cs   year month

```

```

<date>      <dbl> <int> <int>
1 2008-01-01  78.4   2008     1
2 2008-02-01  70.8   2008     2
3 2008-03-01  69.5   2008     3
4 2008-04-01  62.6   2008     4
5 2008-05-01  59.8   2008     5
6 2008-06-01  56.4   2008     6

```

```

#fetch & clean table30: Expected Change in Unemployment During the Next Year
UNEPLY1 <- get_sca_table(30) %>%
  { setNames(., as.character(unlist(.[1, ]))) } %>%
  slice(-1) %>%
  mutate(
    Month = as.integer(Month),
    Year  = as.integer(Year)
  ) %>%
  mutate(
    across(
      -c(Month, Year),
      ~ suppressWarnings(as.numeric(.))
    ),
    date = as.Date(sprintf("%04d-%02d-01", Year, Month))
  ) %>%
  relocate(date)

head(UNEPLY1)

```

```
# A tibble: 6 x 8
  date      Month Year Less Same More `DK; NA` Relative
  <date>     <int> <int> <dbl> <dbl> <dbl> <dbl> <dbl>
1 2008-01-01     1 2008     6    46    47      1     59
2 2008-02-01     2 2008     9    41    50      0     59
3 2008-03-01     3 2008     7    38    55      0     52
4 2008-04-01     4 2008     5    36    59      0     46
5 2008-05-01     5 2008     3    41    56      0     47
6 2008-06-01     6 2008     5    31    64      0     41
```

```
UNEPLY_supp <- UNEPLY1 %>%
  transmute(
    date,
    less_unemp = Less,
    same_unemp = Same,
    more_unemp = More,
    dk_unemp = `DK; NA`,
    rel_unemp = Relative,
    net_unemp_expect = less_unemp - more_unemp
  )

head(UNEPLY_supp)
```

```
# A tibble: 6 x 7
  date      less_unemp same_unemp more_unemp dk_unemp rel_unemp
  <date>     <dbl>       <dbl>       <dbl>       <dbl>       <dbl>
1 2008-01-01        6         46         47         1         59
```

```

2 2008-02-01         9       41      50      0      59
3 2008-03-01         7       38      55      0      52
4 2008-04-01         5       36      59      0      46
5 2008-05-01         3       41      56      0      47
6 2008-06-01         5       31      64      0      41

```

```
# i 1 more variable: net_unemp_expect <dbl>
```

```

UNEPLY_long <- UNEPLY_supp %>%
  select(date, less_unemp, same_unemp, more_unemp) %>%
  pivot_longer(
    cols = -date,
    names_to = "expectation",
    values_to = "share"
  )

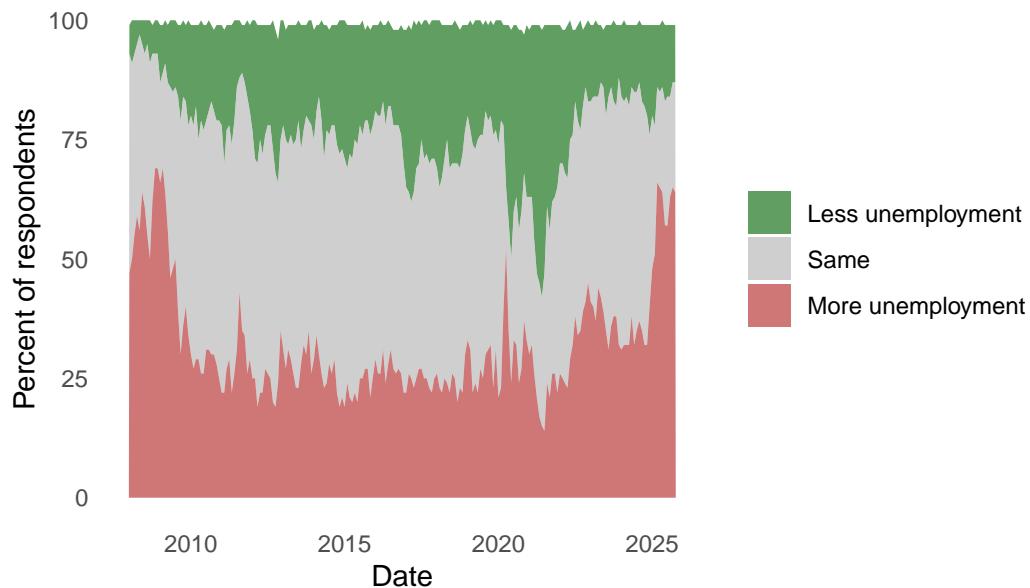
UNEPLY_long <- UNEPLY_long |>
  dplyr::mutate(
    expectation = factor(
      expectation,
      levels = c("less_unemp", "same_unemp", "more_unemp"),
      labels = c("Less unemployment", "Same", "More unemployment")
    )
  )

ggplot(UNEPLY_long, aes(x = date, y = share, fill = expectation)) +
  geom_area(alpha = 0.618) +
  scale_fill_manual(

```

```
values = c(
  "Less unemployment" = "darkgreen",
  "Same"              = "grey70",
  "More unemployment" = "firebrick"
),
guide = guide_legend(reverse = FALSE)
) +
labs(
  title = "Expected change in unemployment over the next year",
  x      = "Date",
  y      = "Percent of respondents",
  fill   = NULL
) +
theme_minimal() +
theme(
  panel.grid = element_blank()
)
```

Expected change in unemployment over the next year



```
# Fetch BLS Data

bls_key <- "554489bce3f14059aaa2dbb976d62372" #need to change back to path before submission

# BLS series IDs:
# - LNS14000000: Unemployment rate (CPS, seasonally adjusted)
# - CES0000000001: All employees, total nonfarm (CES, thousands, SA)
series_ids <- c("LNS14000000", "CES0000000001")

# Request monthly data from 2008 to latest
res <- POST(
  url    = "https://api.bls.gov/publicAPI/v2/timeseries/data/",
  body   = list(
    seriesid      = series_ids,
```

```

startyear      = "2008",
endyear       = "2025",
registrationkey = bls_key),
encode = "json"
)

stop_for_status(res)

bls_list <- fromJSON(content(res, as = "text", encoding = "UTF-8"), simplifyDataFrame = TRUE)

# Transform BLS data to long format
series_tbl <- bls_list$Results$series

bls_long <- map_dfr(seq_len(nrow(series_tbl)), function(i) {
  series_id <- series_tbl$seriesID[i]
  dat        <- series_tbl$data[[i]]    #data.frame for the series
  as_tibble(dat) %>%
    transmute(
      series_id = series_id,
      year       = as.integer(year),
      period,
      value      = as.numeric(value)
    ) %>%
    # keep monthly observations (M01-M12)
    filter(str_starts(period, "M")) %>%

```

```

    mutate(
      month = as.integer(str_remove(period, "M")),
      date   = ymd(sprintf("%04d-%02d-01", year, month))
    )
  }

head(bls_long)

```

```

# A tibble: 6 x 6
  series_id     year period value month date
  <chr>        <int> <chr>  <dbl> <int> <date>
1 LNS14000000  2025 M09     4.4     9 2025-09-01
2 LNS14000000  2025 M08     4.3     8 2025-08-01
3 LNS14000000  2025 M07     4.2     7 2025-07-01
4 LNS14000000  2025 M06     4.1     6 2025-06-01
5 LNS14000000  2025 M05     4.2     5 2025-05-01
6 LNS14000000  2025 M04     4.2     4 2025-04-01

```

```

# CPS unemployment rate

UNEploy_R <- bls_long %>%
  filter(series_id == "LNS14000000") %>%
  arrange(date) %>%
  transmute(
    date,
    unrate = value
  )

```

```

# CES total nonfarm employment & monthly job change

Job_V <- bls_long %>%
  filter(series_id == "CES0000000001") %>%
  arrange(date) %>%
  transmute(
    date,
    nonfarm_emp = value,
    job_change = nonfarm_emp - lag(nonfarm_emp)
  )

head(UNEploy_R)

```

```

# A tibble: 6 x 2
  date      unrated
  <date>     <dbl>
1 2008-01-01     5
2 2008-02-01    4.9
3 2008-03-01    5.1
4 2008-04-01     5
5 2008-05-01    5.4
6 2008-06-01    5.6

```

```
head(Job_V)
```

```

# A tibble: 6 x 3
  date      nonfarm_emp job_change
  <date>     <dbl>      <dbl>
1 2008-01-01     5        -0.1
2 2008-02-01    4.9       0.1
3 2008-03-01    5.1       0.2
4 2008-04-01     5        -0.1
5 2008-05-01    5.4       0.3
6 2008-06-01    5.6       0.2

```

	<date>	<dbl>	<dbl>
1	2008-01-01	138391	NA
2	2008-02-01	138327	-64
3	2008-03-01	138257	-70
4	2008-04-01	138038	-219
5	2008-05-01	137851	-187
6	2008-06-01	137698	-153

Visualization 1. Lagged Time-Series of Consumer Sentiment and Unemployment Rate/Job Change

```
# A tibble: 6 x 5
  date          cs unrate nonfarm_emp job_change
  <date>      <dbl>   <dbl>     <dbl>      <dbl>
1 2008-01-01  78.4     5       138391      NA
2 2008-02-01  70.8    4.9      138327     -64
3 2008-03-01  69.5    5.1      138257     -70
4 2008-04-01  62.6     5       138038     -219
5 2008-05-01  59.8    5.4      137851     -187
6 2008-06-01  56.4    5.6      137698     -153

# Function to plot Consumer Sentiment vs Unemployment Rate with dual y-axes
cs_vs_unemp <- function(data,
                         lag_months = 3,
                         cs_limits = c(30, 120), # left y-axis
                         unemp_limits = c(0, 15)) { # right y-axis
```

```

df <- data %>%
  arrange(date) %>%
  mutate(unrate_lead = lead(unrate, lag_months)) %>%
  filter(!is.na(cs), !is.na(unrate_lead))

# unpack limits
cs_min    <- cs_limits[1]
cs_max    <- cs_limits[2]
ur_min    <- unemp_limits[1]
ur_max    <- unemp_limits[2]

cs_range <- cs_max - cs_min
ur_range <- ur_max - ur_min

# scale unemployment into CS scale for plotting
df <- df %>%
  mutate(
    unrate_scaled = cs_min + (unrate_lead - ur_min) * (cs_range / ur_range)
  )

# dynamic label for the legend
unemp_label <- paste0("Unemp (t + ", lag_months, "m)")

ggplot(df, aes(x = date)) +
  geom_line(aes(y = cs, color = "Consumer Sentiment")) +
  geom_line(aes(y = unrate_scaled, color = unemp_label)) +

```

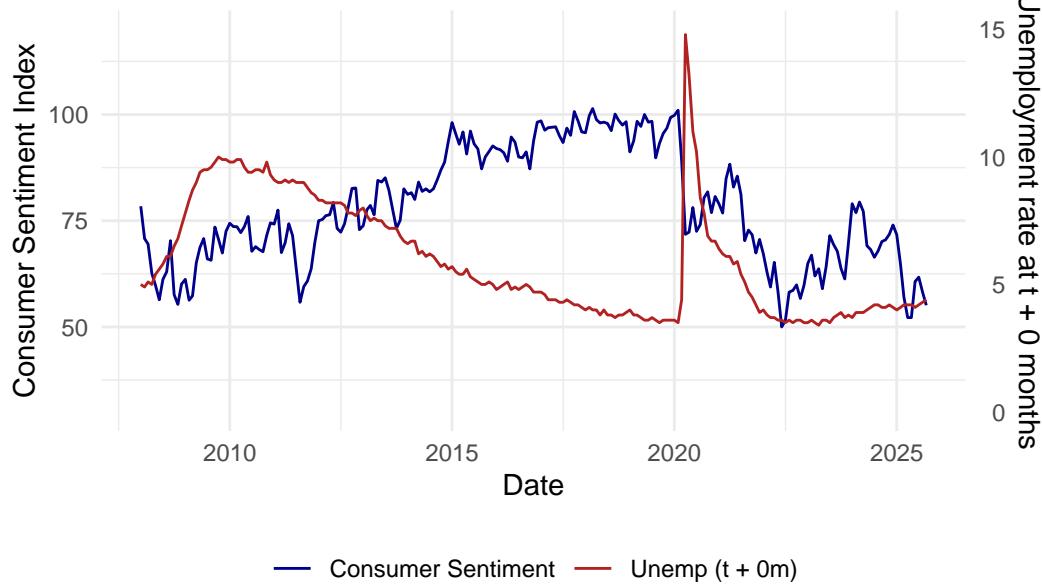
```

scale_y_continuous(
  name    = "Consumer Sentiment Index",
  limits = cs_limits,
  sec.axis = sec_axis(
    trans = ~ (.- cs_min) * (ur_range / cs_range) + ur_min,
    name  = paste0("Unemployment rate at t + ", lag_months, " months")
  )
) +
scale_color_manual(
  values = setNames(
    c("darkblue", "firebrick"),
    c("Consumer Sentiment", unemp_label)
  )
) +
labs(
  title = paste0("Consumer Sentiment vs Future Unemployment (", lag_months, "-month lead"),
  x      = "Date",
  color = NULL
) +
theme_minimal() +
theme(
  legend.position = "bottom"
)
}

cs_vs_unemp (macro, lag_months = 0)

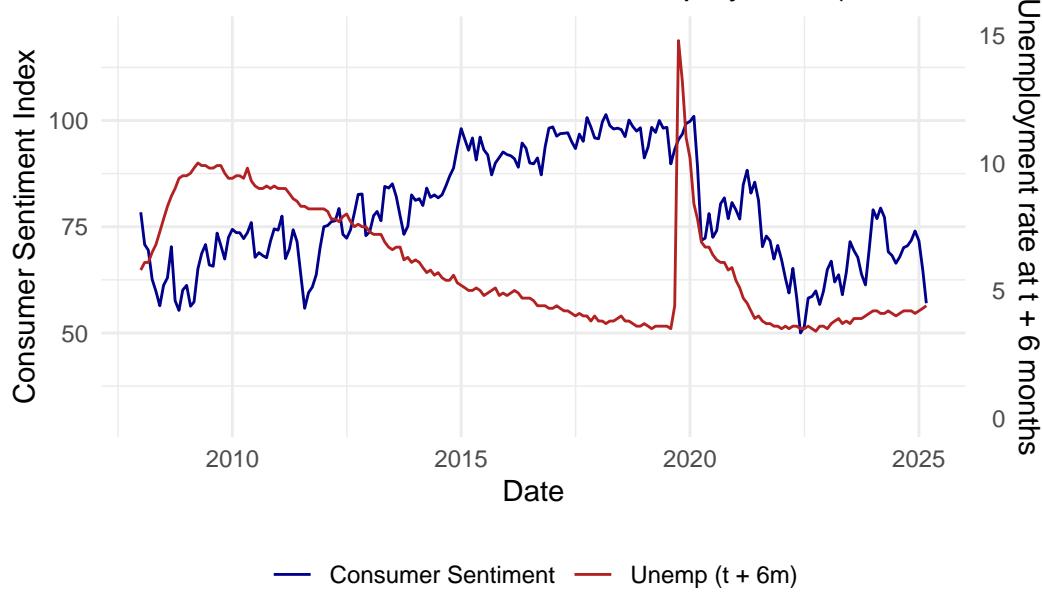
```

Consumer Sentiment vs Future Unemployment (0-month lead)

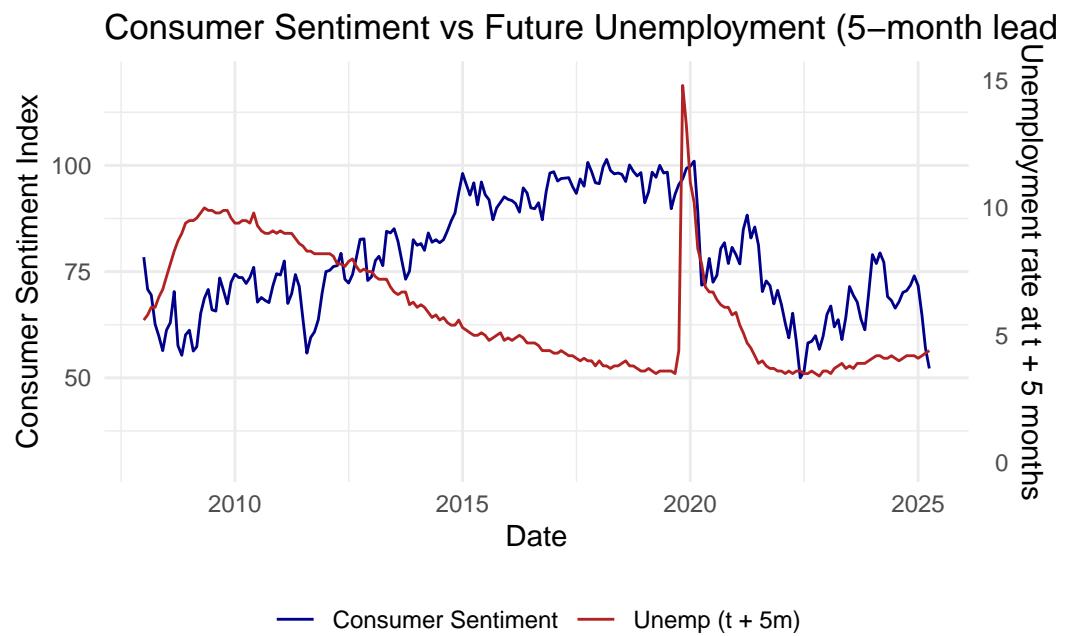


```
cs_vs_unemp (macro, lag_months = 6)
```

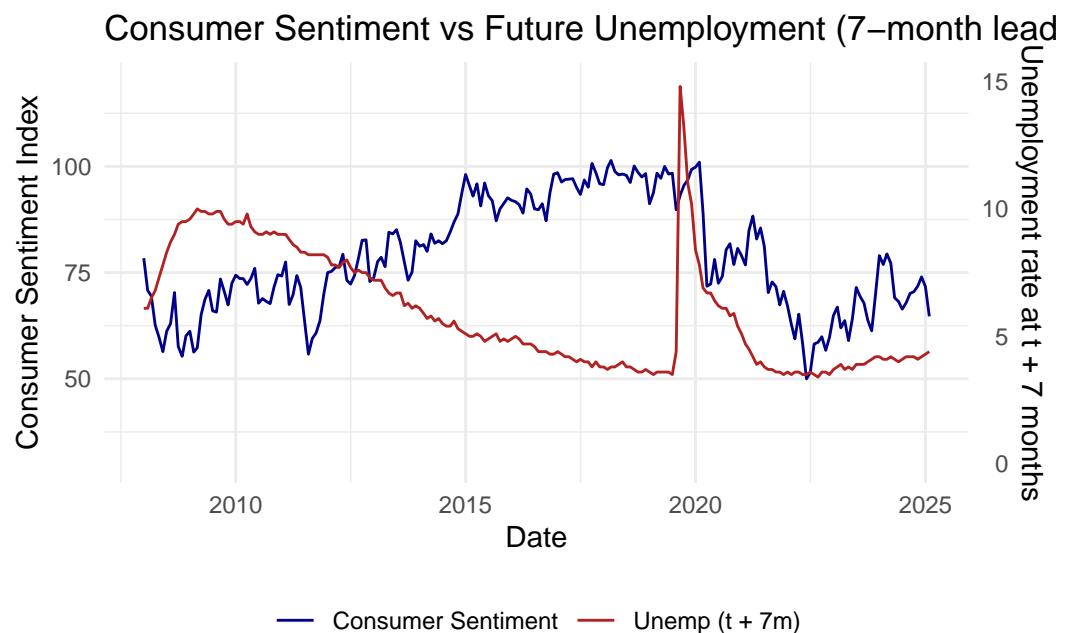
Consumer Sentiment vs Future Unemployment (6-month lead)



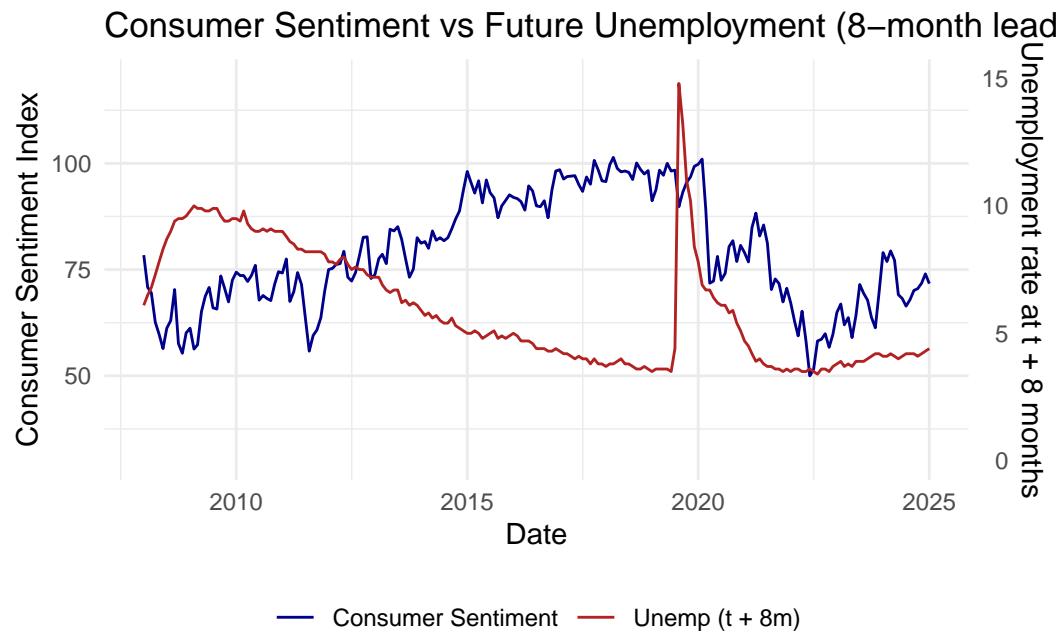
```
cs_vs_unemp (macro, lag_months = 5)
```



```
cs_vs_unemp (macro, lag_months = 7)
```



```
cs_vs_unemp (macro, lag_months = 8)
```



```
cs_vs_unemp <- function(data,  
                          lag_months = 3,  
                          cs_limits = c(30, 120), # left y-axis  
                          unemp_limits = c(0, 15)) { # right y-axis  
  
  df <- data %>%  
    arrange(date) %>%  
    mutate(unrate_lead = lead(unrate, lag_months)) %>%  
    filter(!is.na(cs), !is.na(unrate_lead))  
  
  # unpack limits  
  cs_min <- cs_limits[1]  
  cs_max <- cs_limits[2]
```

```

ur_min    <- unemp_limits[1]
ur_max    <- unemp_limits[2]

cs_range <- cs_max - cs_min
ur_range <- ur_max - ur_min

# scale unemployment into CS scale for plotting
df <- df %>%
  mutate(
    unrate_scaled = cs_min + (unrate_lead - ur_min) * (cs_range / ur_range)
  )

# dynamic label for the legend
unemp_label <- paste0("Unemp (t + ", lag_months, "m)")

ggplot(df, aes(x = date)) +
  # raw lines (lighter)
  geom_line(aes(y = cs, color = "Consumer Sentiment"), alpha = 0.4) +
  geom_line(aes(y = unrate_scaled, color = unemp_label), alpha = 0.4) +
  # smoothed lines (highlighted)
  geom_smooth(aes(y = cs, color = "Consumer Sentiment"),
              se = FALSE, span = 0.2, linewidth = 0.9) +
  geom_smooth(aes(y = unrate_scaled, color = unemp_label),
              se = FALSE, span = 0.2, linewidth = 0.9) +

```

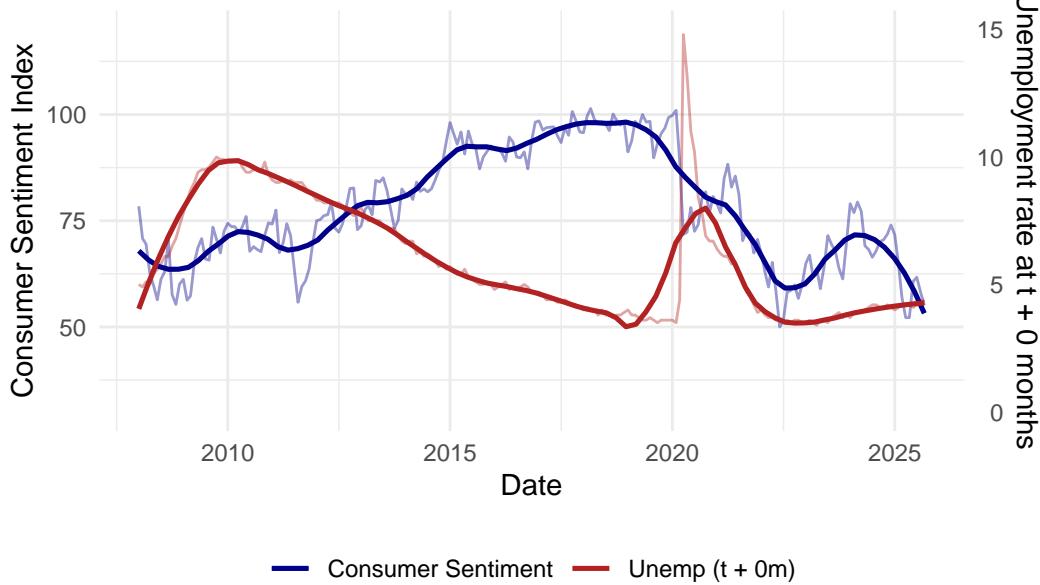
```

scale_y_continuous(
  name    = "Consumer Sentiment Index",
  limits = cs_limits,
  sec.axis = sec_axis(
    trans = ~ (.- cs_min) * (ur_range / cs_range) + ur_min,
    name  = paste0("Unemployment rate at t + ", lag_months, " months")
  )
) +
scale_color_manual(
  values = setNames(
    c("darkblue", "firebrick"),
    c("Consumer Sentiment", unemp_label)
  )
) +
labs(
  title = paste0("Consumer Sentiment vs Future Unemployment (", lag_months, "-month lead"),
  x      = "Date",
  color = NULL
) +
theme_minimal() +
theme(
  legend.position = "bottom"
)
}

cs_vs_unemp (macro, lag_months = 0)

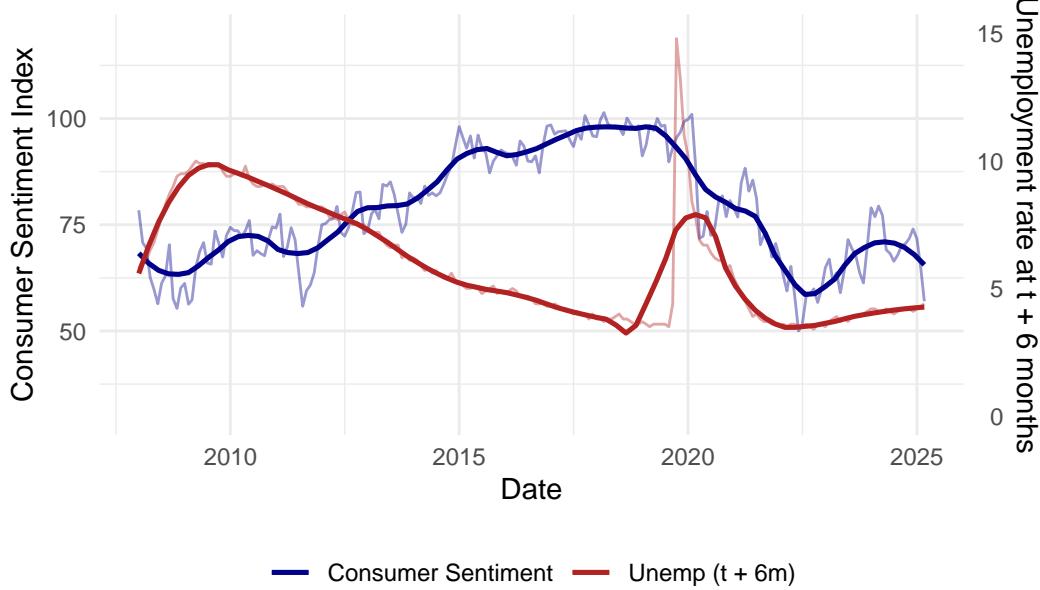
```

Consumer Sentiment vs Future Unemployment (0-month lead)

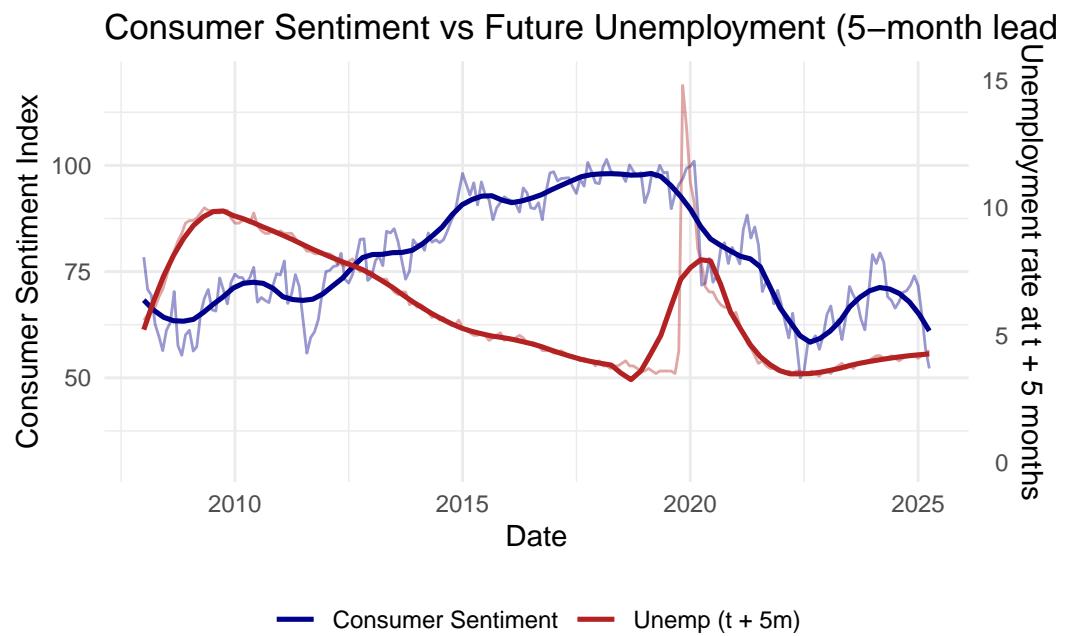


```
cs_vs_unemp (macro, lag_months = 6)
```

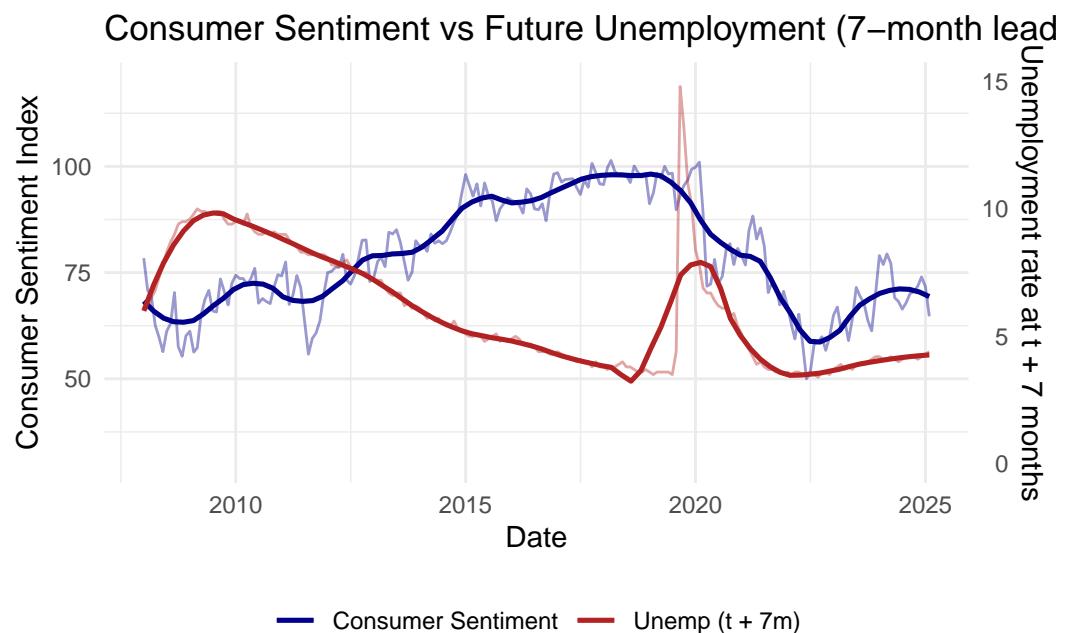
Consumer Sentiment vs Future Unemployment (6-month lead)



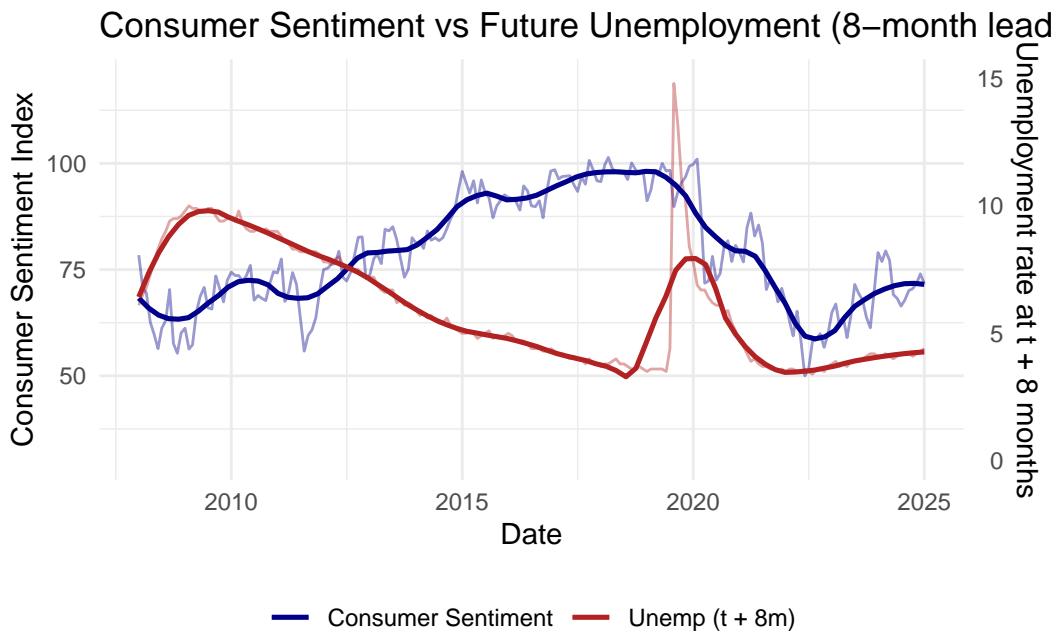
```
cs_vs_unemp (macro, lag_months = 5)
```



```
cs_vs_unemp (macro, lag_months = 7)
```



```
cs_vs_unemp (macro, lag_months = 8)
```



```
# function to plot Consumer Sentiment vs Job Change with dual y-axes
cs_vs_jobs <- function(data,
                        lag_months = 3,
                        cs_limits = c(40, 120), # left y-axis
                        jobs_limits = c(-1500, 1500)) {# right y-axis (thousands)

  df <- data %>%
    arrange(date) %>%
    mutate(jobchg_lead = lead(job_change, lag_months)) %>%
    filter(!is.na(cs), !is.na(jobchg_lead))

  cs_min   <- cs_limits[1]
  cs_max   <- cs_limits[2]
```

```

jb_min    <- jobs_limits[1]
jb_max    <- jobs_limits[2]

cs_range <- cs_max - cs_min
jb_range <- jb_max - jb_min

df <- df %>%
  mutate(
    jobchg_scaled = cs_min + (jobchg_lead - jb_min) * (cs_range / jb_range)
  )

jobs_label <- paste0("Job change (t + ", lag_months, "m)")

ggplot(df, aes(x = date)) +
  geom_line(aes(y = cs, color = "Consumer Sentiment")) +
  geom_line(aes(y = jobchg_scaled, color = jobs_label)) +
  scale_y_continuous(
    name    = "Consumer Sentiment Index",
    limits = cs_limits,
    sec.axis = sec_axis(
      trans = ~ (.- cs_min) * (jb_range / cs_range) + jb_min,
      name  = paste0("Added Job (thousands) at t + ",
                     lag_months, " months")
    )
  ) +
  scale_color_manual(

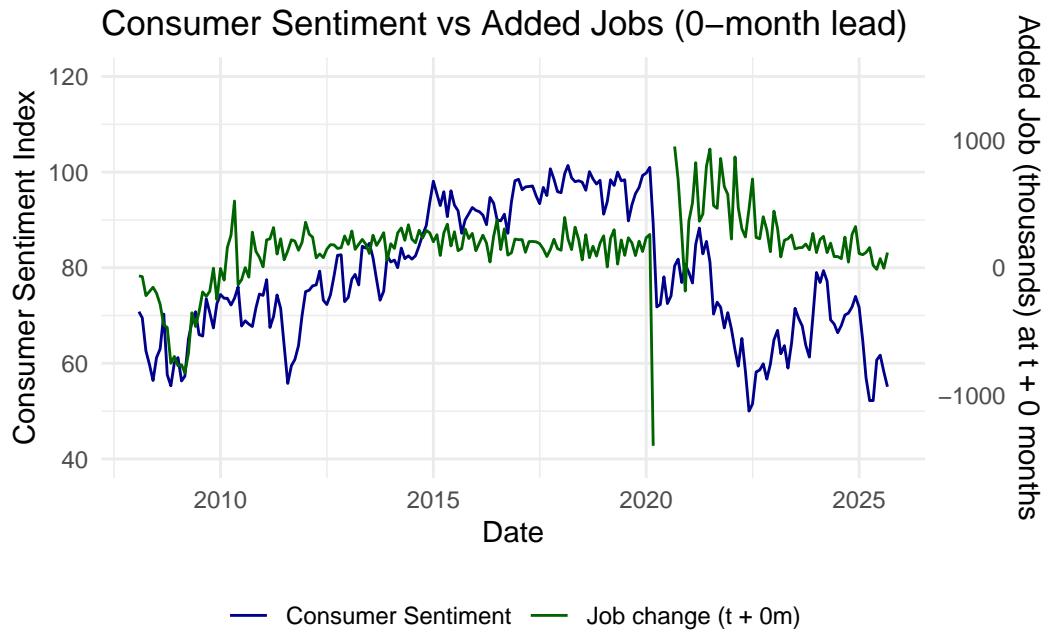
```

```

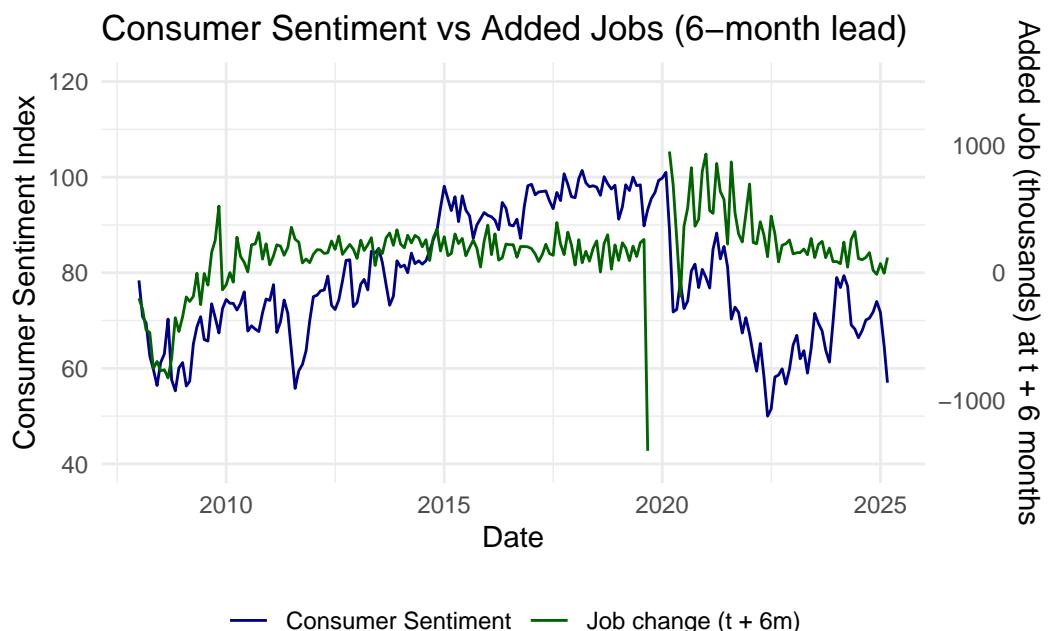
values = setNames(
  c("darkblue", "darkgreen"),
  c("Consumer Sentiment", jobs_label)
)
) +
labs(
  title = paste0("Consumer Sentiment vs Added Jobs (", lag_months, "-month lead)"),
  x      = "Date",
  color = NULL
) +
theme_minimal() +
theme(
  legend.position = "bottom"
)
}

cs_vs_jobs(macro, lag_months =0)

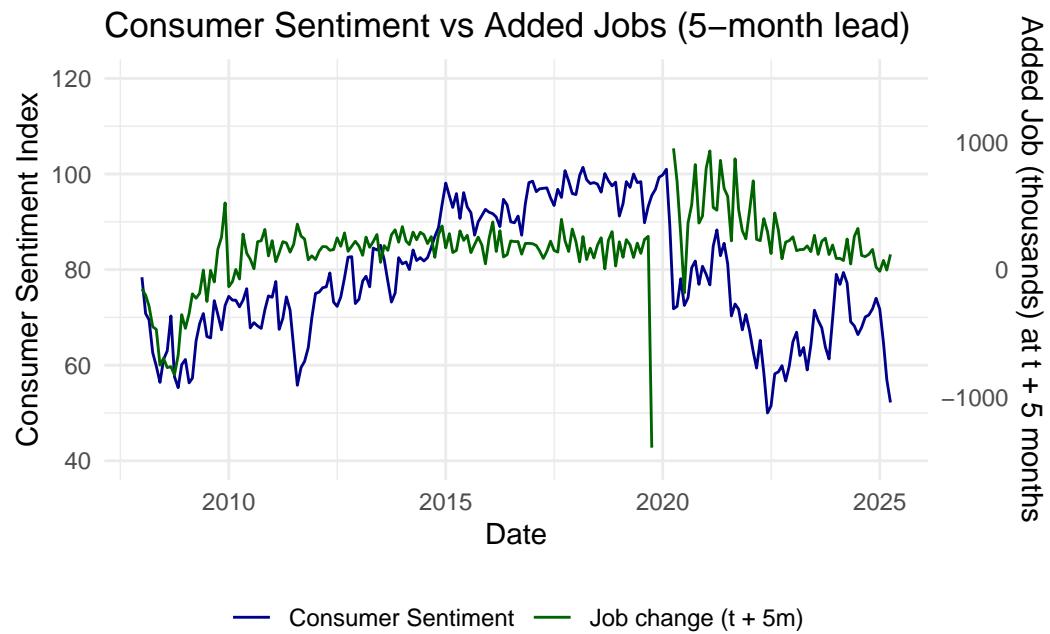
```



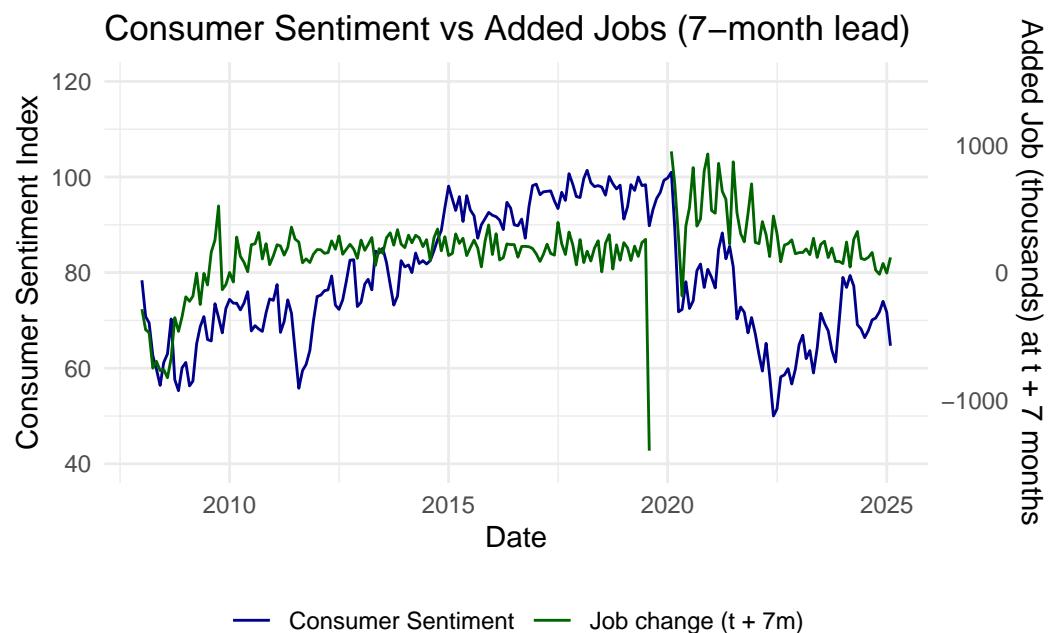
```
cs_vs_jobs(macro, lag_months = 6)
```



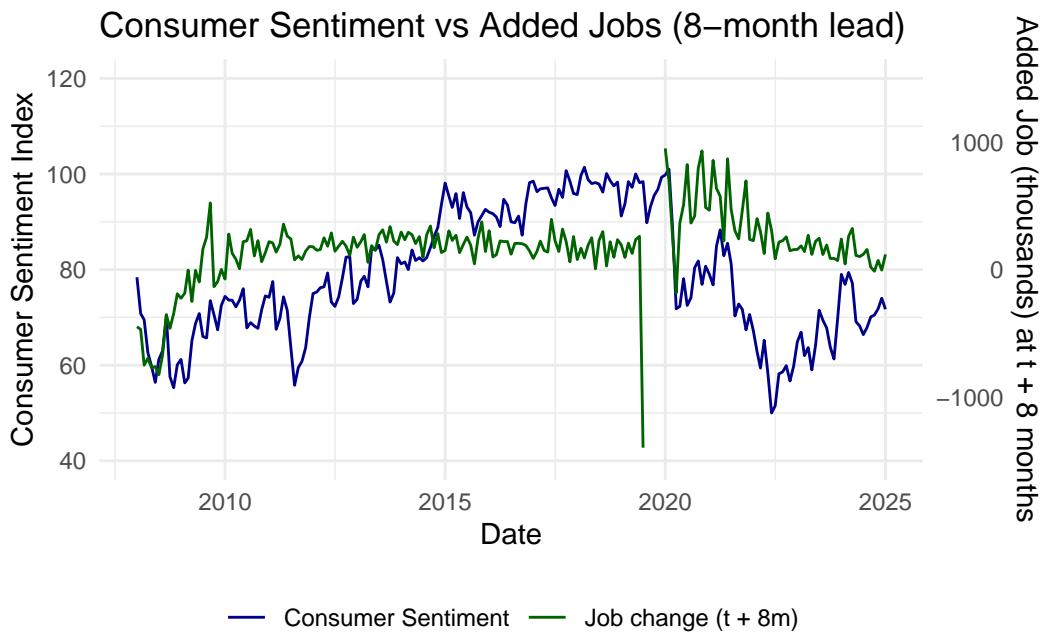
```
cs_vs_jobs(macro, lag_months =5)
```



```
cs_vs_jobs(macro, lag_months =7)
```



```
cs_vs_jobs(macro, lag_months =8)
```



```
# function to plot Consumer Sentiment vs Job Change with dual y-axes + smoothing
cs_vs_jobs <- function(data,
  lag_months = 3,
  cs_limits = c(40, 120),    # left y-axis
  jobs_limits = c(-1500, 1500)) { # right y-axis (thousands)

  df <- data %>%
    arrange(date) %>%
    mutate(jobchg_lead = lead(job_change, lag_months)) %>%
    filter(!is.na(cs), !is.na(jobchg_lead))

  cs_min   <- cs_limits[1]
  cs_max   <- cs_limits[2]
```

```

jb_min    <- jobs_limits[1]
jb_max    <- jobs_limits[2]

cs_range <- cs_max - cs_min
jb_range <- jb_max - jb_min

df <- df %>%
  mutate(
    jobchg_scaled = cs_min + (jobchg_lead - jb_min) * (cs_range / jb_range)
  )

jobs_label <- paste0("Job change (t + ", lag_months, "m)")

ggplot(df, aes(x = date)) +
  # raw lines (lighter)
  geom_line(aes(y = cs, color = "Consumer Sentiment"), alpha = 0.4) +
  geom_line(aes(y = jobchg_scaled, color = jobs_label), alpha = 0.4) +
  # smoothed lines (highlighted)
  geom_smooth(aes(y = cs, color = "Consumer Sentiment"),
              se = FALSE, span = 0.2, linewidth = 0.9) +
  geom_smooth(aes(y = jobchg_scaled, color = jobs_label),
              se = FALSE, span = 0.2, linewidth = 0.9) +
  scale_y_continuous(
    name    = "Consumer Sentiment Index",

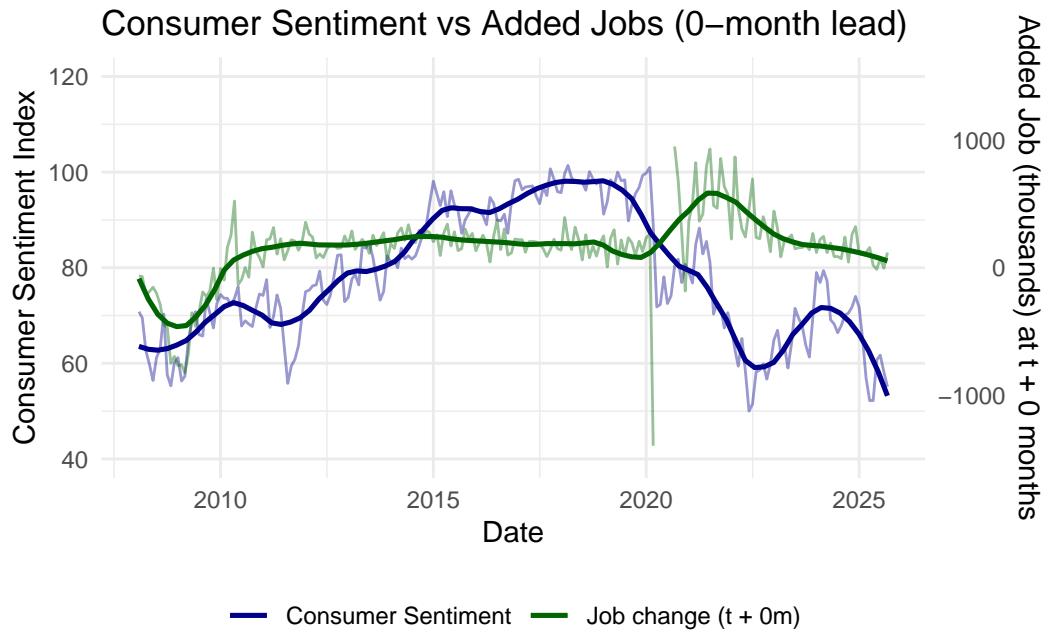
```

```

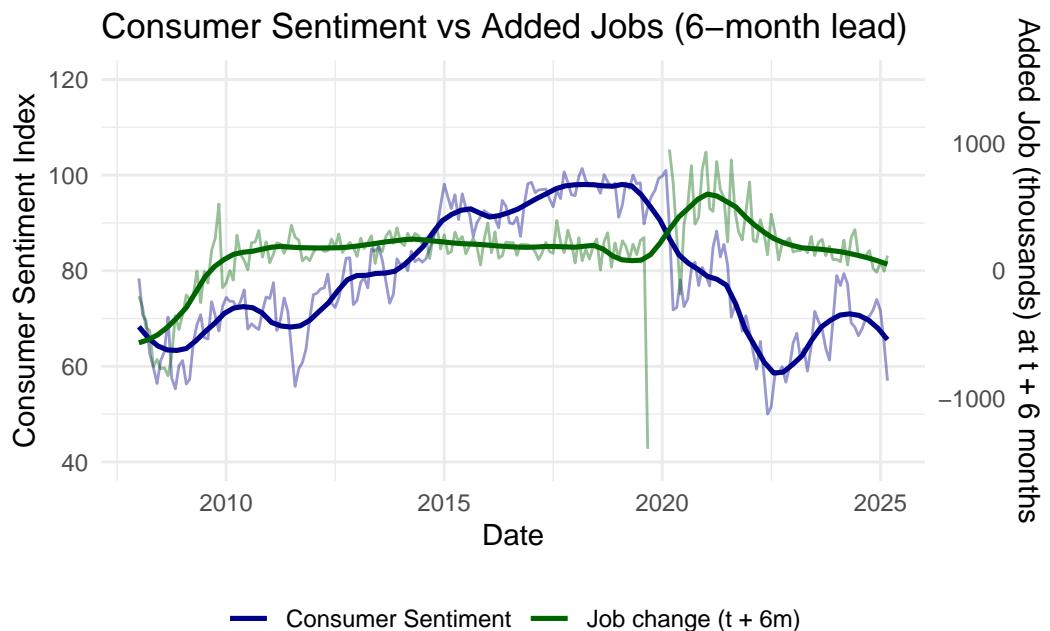
limits = cs_limits,
sec.axis = sec_axis(
  trans = ~ (.- cs_min) * (jb_range / cs_range) + jb_min,
  name  = paste0("Added Job (thousands) at t + ",
                 lag_months, " months")
)
) +
scale_color_manual(
  values = setNames(
    c("darkblue", "darkgreen"),
    c("Consumer Sentiment", jobs_label)
)
) +
labs(
  title = paste0("Consumer Sentiment vs Added Jobs (", lag_months, "-month lead)"),
  x      = "Date",
  color = NULL
) +
theme_minimal() +
theme(
  legend.position = "bottom"
)
}

cs_vs_jobs(macro, lag_months =0)

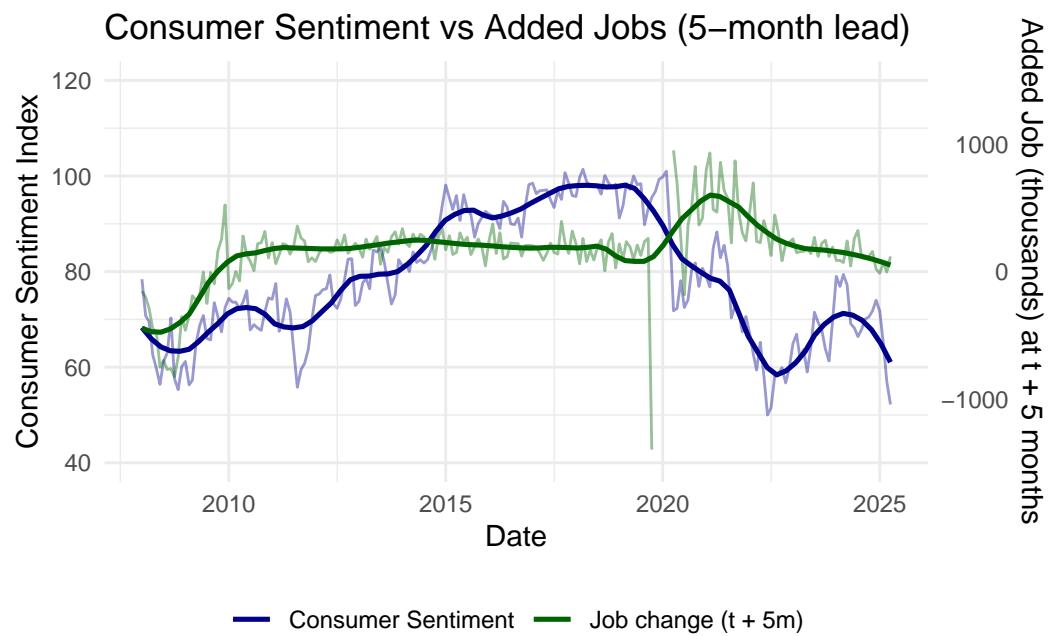
```



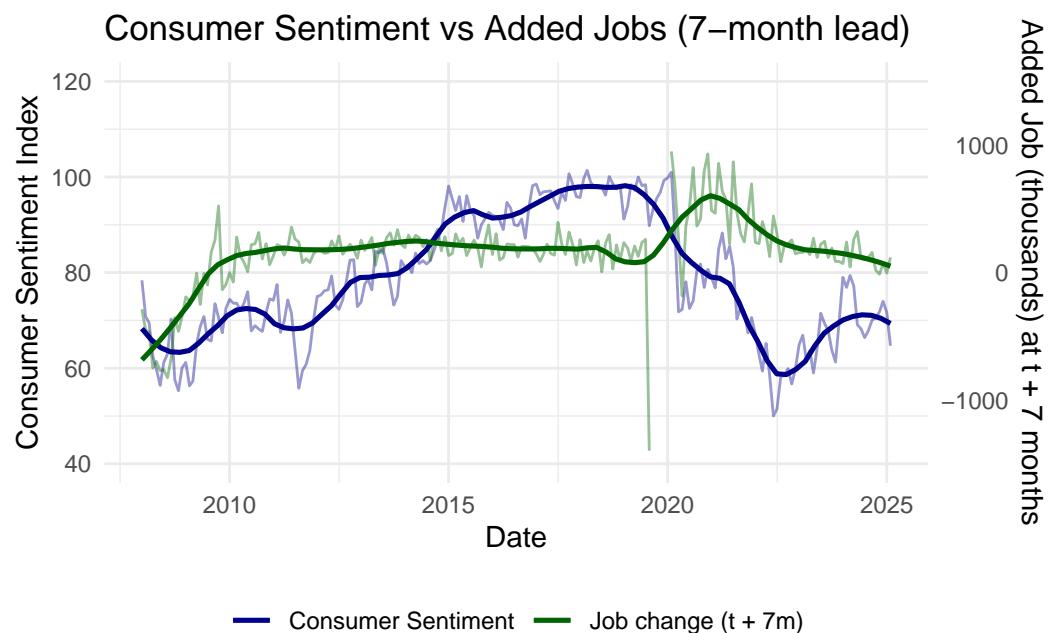
```
cs_vs_jobs(macro, lag_months = 6)
```



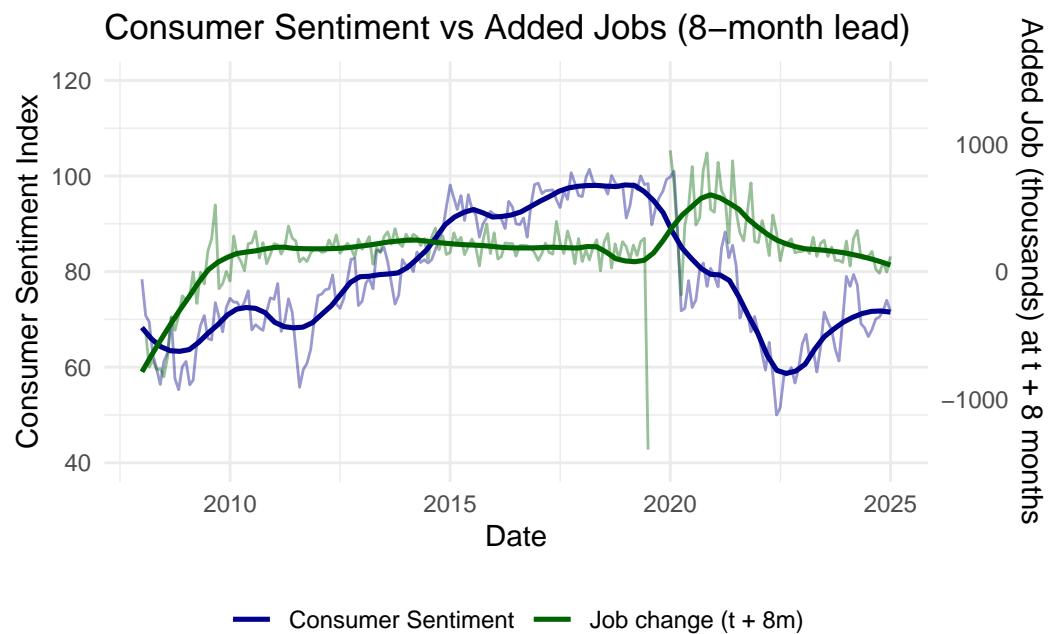
```
cs_vs_jobs(macro, lag_months =5)
```



```
cs_vs_jobs(macro, lag_months =7)
```



```
cs_vs_jobs(macro, lag_months =8)
```



Visualization 2. Scatter: net expectations vs subsequent unemployment change

```
macro2 <- macro %>%
  left_join(UNEPLY_supp, by = "date") %>%
  arrange(date)

expect_vs_unemp_scatter <- function(data,
                                      horizon_months = 3,
                                      x_limits = c(-60, 60),
                                      y_limits = c(-3, 3)) {

  df <- data %>%
    mutate(
      unrate_delta = lead(unrate, horizon_months) - unrate
    ) %>%
    filter(!is.na(net_unemp_expect), !is.na(unrate_delta))

  # correlation and regression
  cor_val <- cor(df$net_unemp_expect, df$unrate_delta)

  lm_fit <- lm(unrate_delta ~ net_unemp_expect, data = df)
  lm_sum <- summary(lm_fit)

  slope    <- coef(lm_fit)[["net_unemp_expect"]]
  r2       <- lm_sum$r.squared
```

```

# print a brief statistical summary in the console
cat("\nHorizon:", horizon_months, "months\n")
cat("Correlation (net expectations, future Δunemp):",
    round(cor_val, 3), "\n")
cat("Slope (OLS):", round(slope, 4),
    "pp change in unemp per 1-pt net expectation\n")
cat("R-squared:", round(r2, 3), "\n\n")

# scatter plot with tuned aesthetics
ggplot(df, aes(x = net_unemp_expect, y = unrate_delta)) +
  geom_hline(yintercept = 0, linetype = "dashed", color = "grey") +
  geom_vline(xintercept = 0, linetype = "dashed", color = "grey") +
  geom_point(alpha = 0.382, size = 1.618) +
  geom_smooth(method = "lm", se = FALSE, color = "firebrick", linewidth = 1) +
  scale_x_continuous(
    limits = x_limits,
    breaks = seq(x_limits[1], x_limits[2], by = 20)
  ) +
  scale_y_continuous(
    limits = y_limits,
    breaks = seq(y_limits[1], y_limits[2], by = 1)
  ) +
  labs(
    title = paste0(
      "Net unemployment expectations vs. ",
      horizon_months, "-month change in unemployment"
    )
  )

```

```

) ,
subtitle = paste0(
  "Slope  ", round(slope, 3),
  " pp / 1-pt net expectation,  R2  ", round(r2, 2)
) ,
x = "Net % expecting less minus more unemployment (t)",
y = paste0("Change in unemployment over next ",
           horizon_months, " months (percentage points)")
) +
theme_minimal() +
theme(
  plot.title.position = "plot",
  legend.position = "none"
)
}

# explore horizons from 1 to 12 months
horizons <- 0:12

plots_set <- vector("list", length(horizons))
names(plots_set) <- paste0("h_", horizons, "m")

for (i in seq_along(horizons)) {
  plots_set[[i]] <- expect_vs_unemp_scatter(
    macro2,horizons[i])
}

```

Horizon: 0 months
Correlation (net expectations, future Δ unemp): NA
Slope (OLS): 0 pp change in unemp per 1-pt net expectation
R-squared: NaN

Horizon: 1 months
Correlation (net expectations, future Δ unemp): -0.169
Slope (OLS): -0.0069 pp change in unemp per 1-pt net expectation
R-squared: 0.029

Horizon: 2 months
Correlation (net expectations, future Δ unemp): -0.19
Slope (OLS): -0.0111 pp change in unemp per 1-pt net expectation
R-squared: 0.036

Horizon: 3 months
Correlation (net expectations, future Δ unemp): -0.206
Slope (OLS): -0.0144 pp change in unemp per 1-pt net expectation
R-squared: 0.042

Horizon: 4 months

Correlation (net expectations, future Δ unemp): -0.249
Slope (OLS): -0.0197 pp change in unemp per 1-pt net expectation
R-squared: 0.062

Horizon: 5 months
Correlation (net expectations, future Δ unemp): -0.279
Slope (OLS): -0.0239 pp change in unemp per 1-pt net expectation
R-squared: 0.078

Horizon: 6 months
Correlation (net expectations, future Δ unemp): -0.323
Slope (OLS): -0.0296 pp change in unemp per 1-pt net expectation
R-squared: 0.104

Horizon: 7 months
Correlation (net expectations, future Δ unemp): -0.365
Slope (OLS): -0.0354 pp change in unemp per 1-pt net expectation
R-squared: 0.134

Horizon: 8 months
Correlation (net expectations, future Δ unemp): -0.398
Slope (OLS): -0.0401 pp change in unemp per 1-pt net expectation

R-squared: 0.158

Horizon: 9 months

Correlation (net expectations, future Δ unemp): -0.412

Slope (OLS): -0.0431 pp change in unemp per 1-pt net expectation

R-squared: 0.17

Horizon: 10 months

Correlation (net expectations, future Δ unemp): -0.42

Slope (OLS): -0.0455 pp change in unemp per 1-pt net expectation

R-squared: 0.176

Horizon: 11 months

Correlation (net expectations, future Δ unemp): -0.419

Slope (OLS): -0.0467 pp change in unemp per 1-pt net expectation

R-squared: 0.175

Horizon: 12 months

Correlation (net expectations, future Δ unemp): -0.416

Slope (OLS): -0.0477 pp change in unemp per 1-pt net expectation

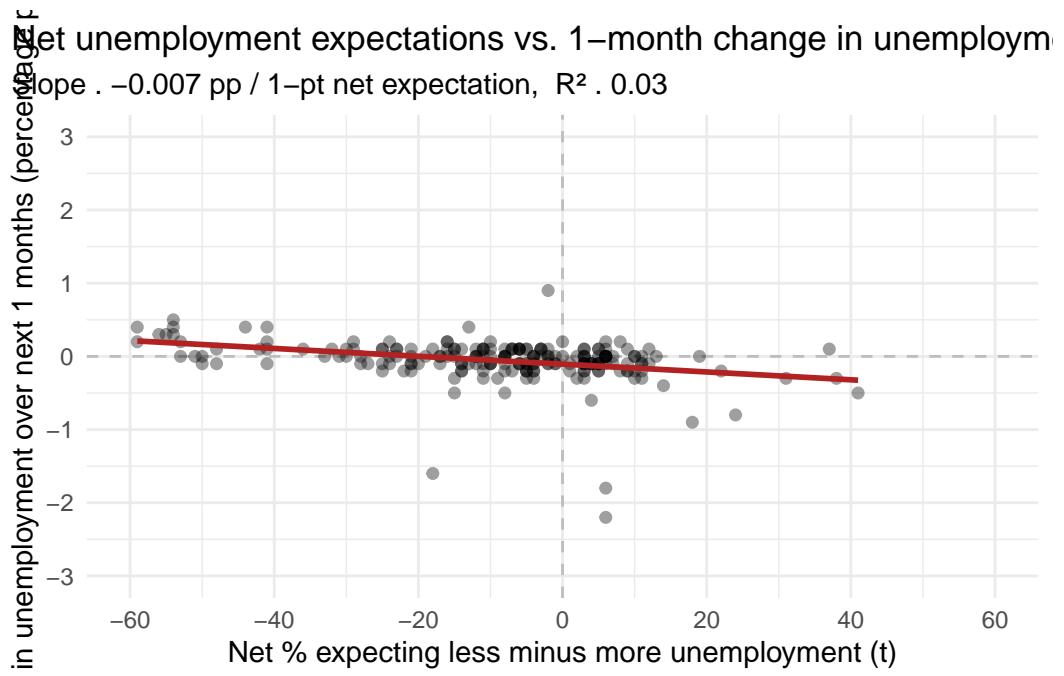
R-squared: 0.173

```
plots_set
```

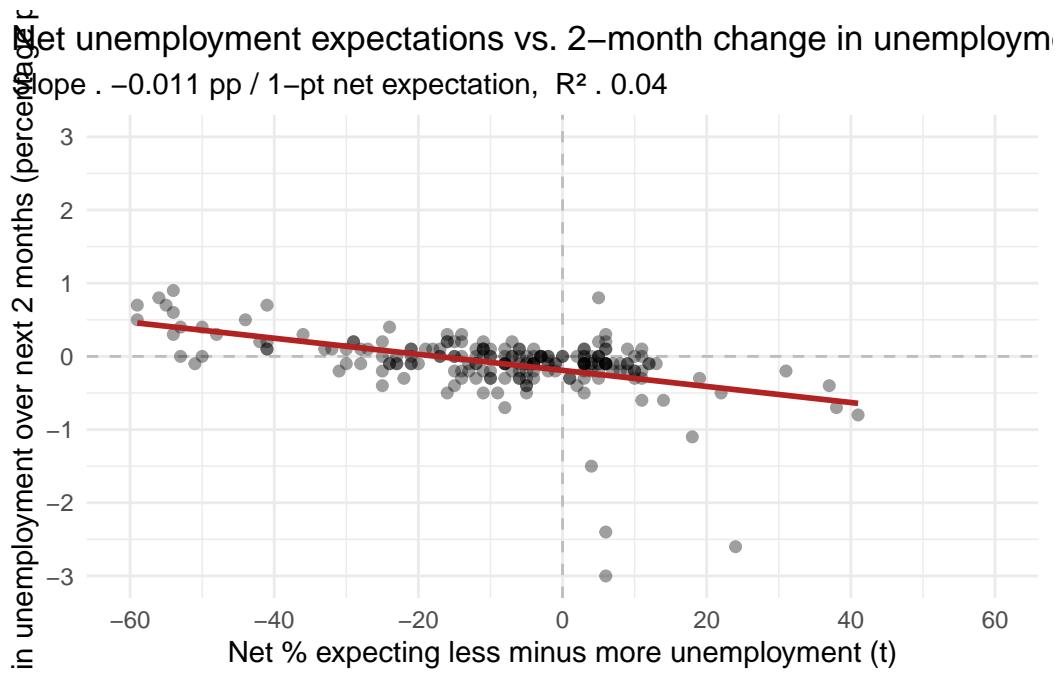
```
$h_0m
```



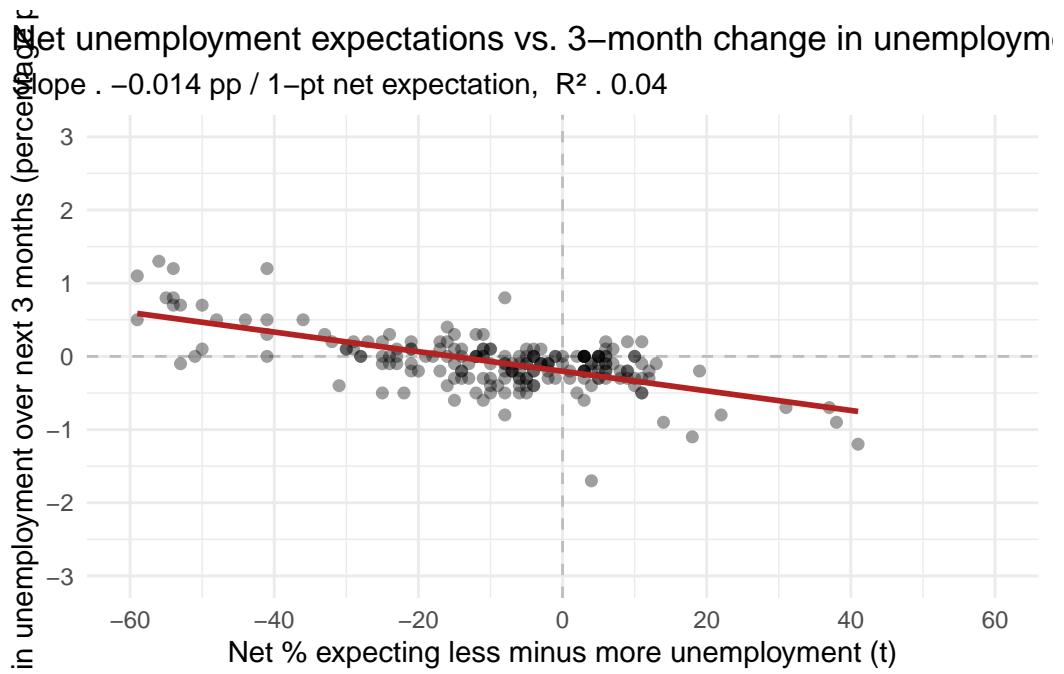
```
$h_1m
```



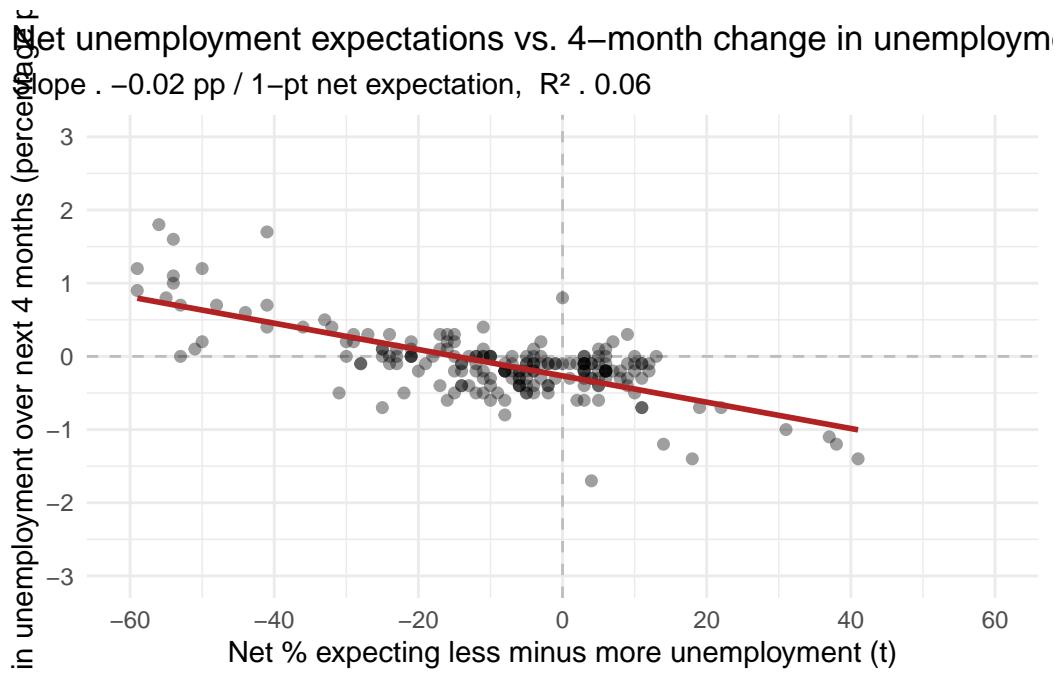
\$h_2m



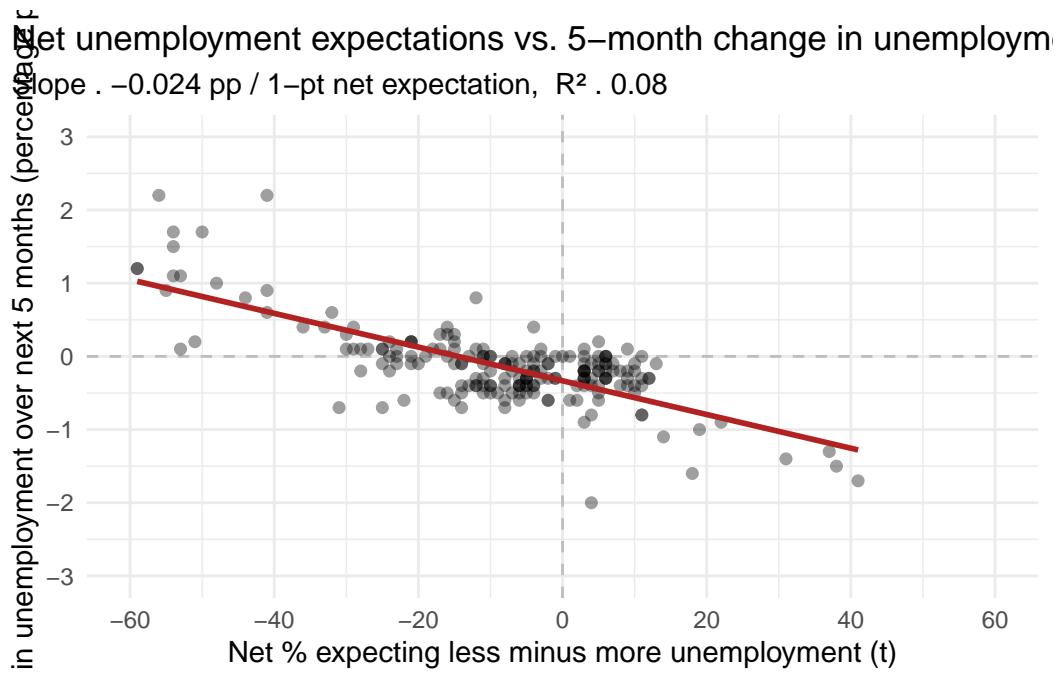
\$h_3m



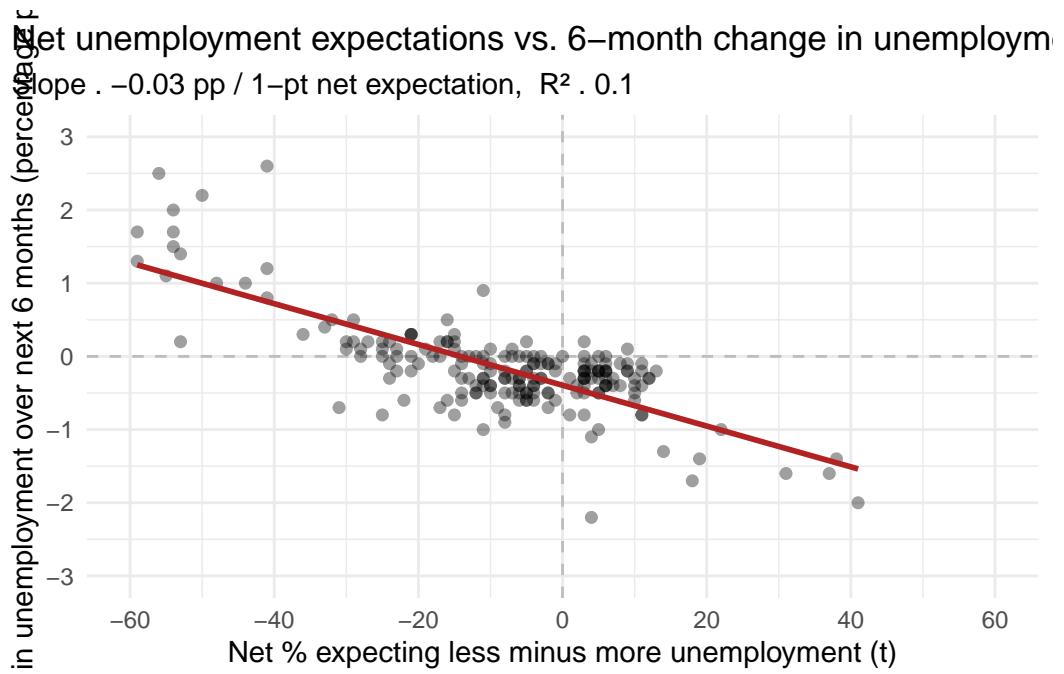
\$h_4m



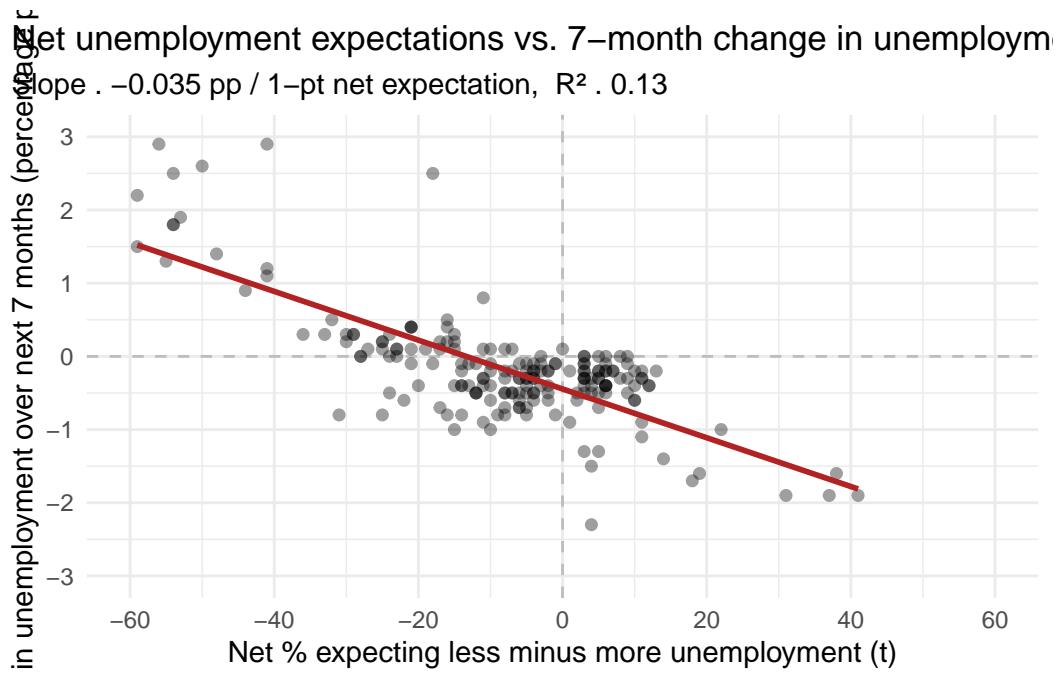
\$h_5m



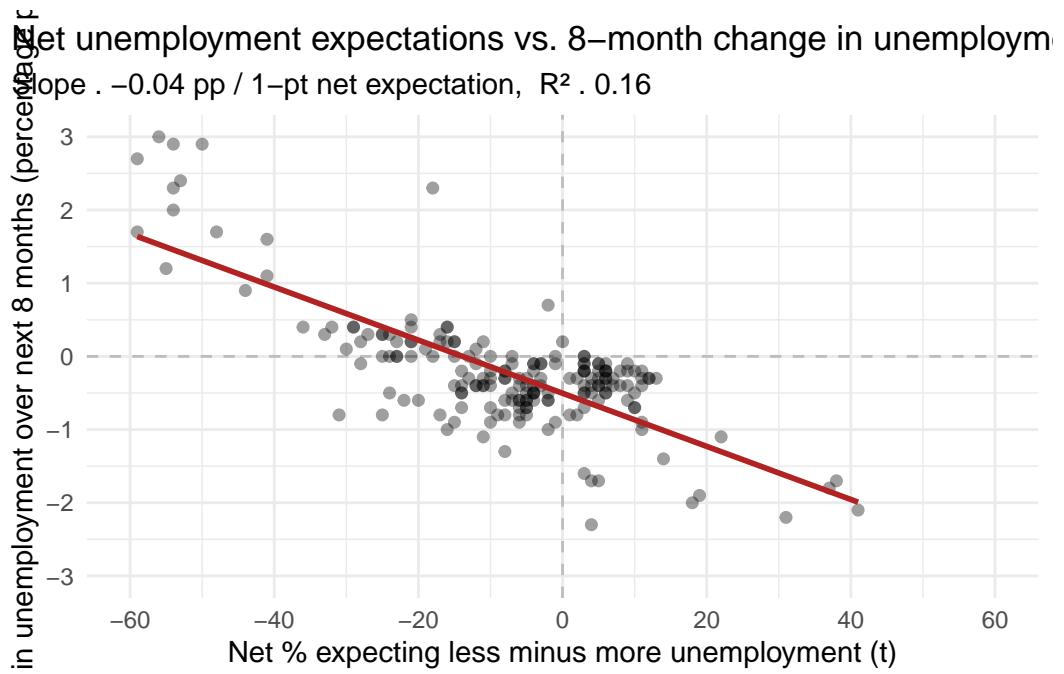
\$h_6m



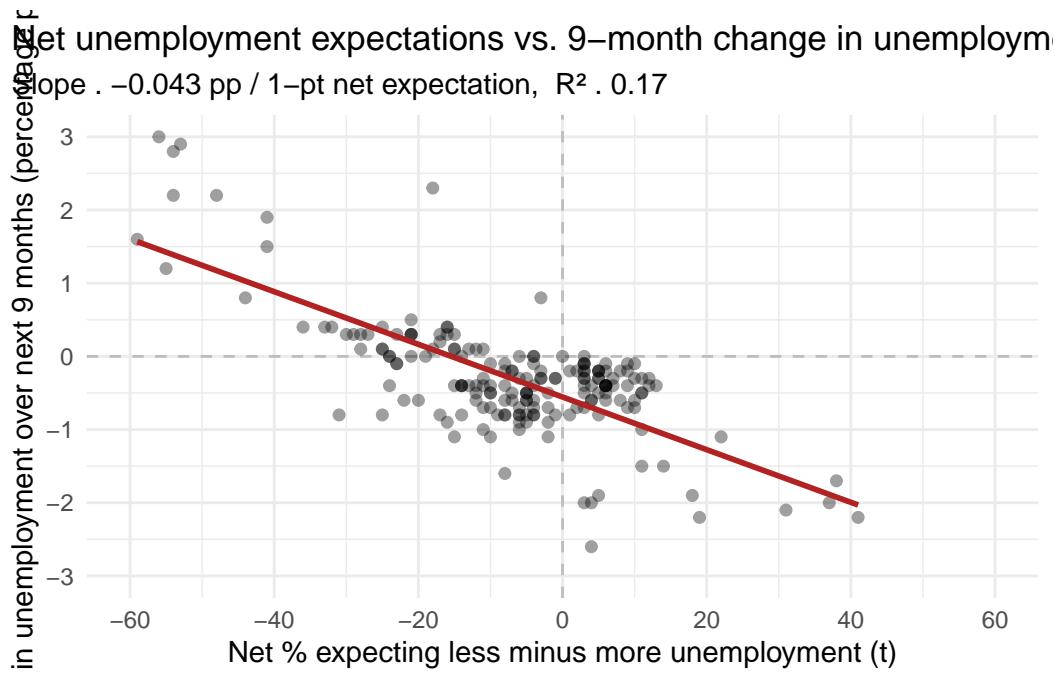
\$h_7m



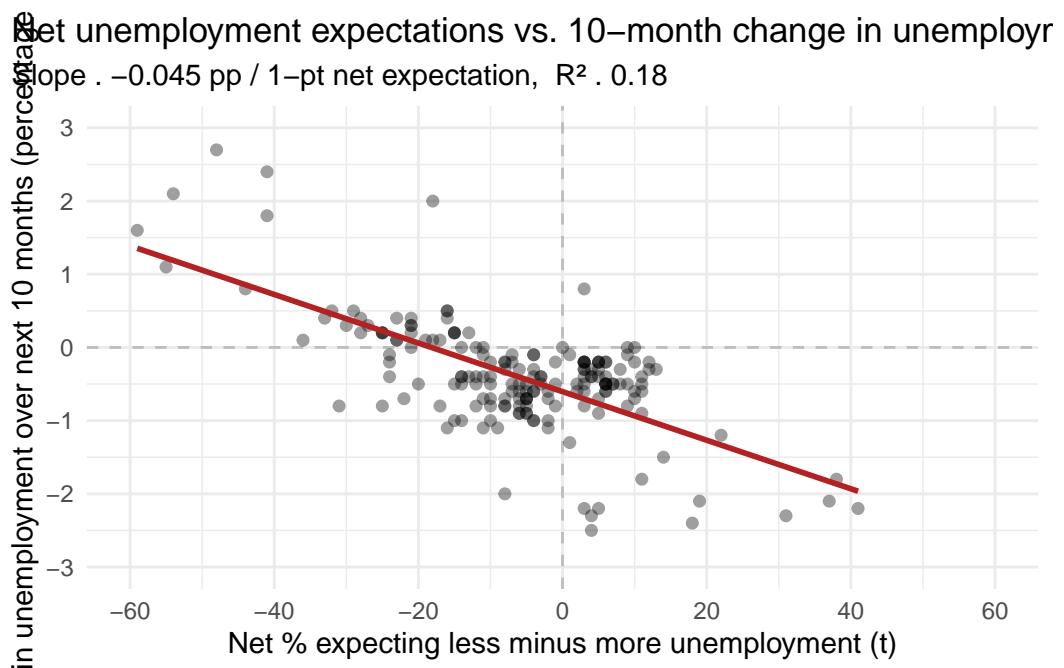
\$h_8m



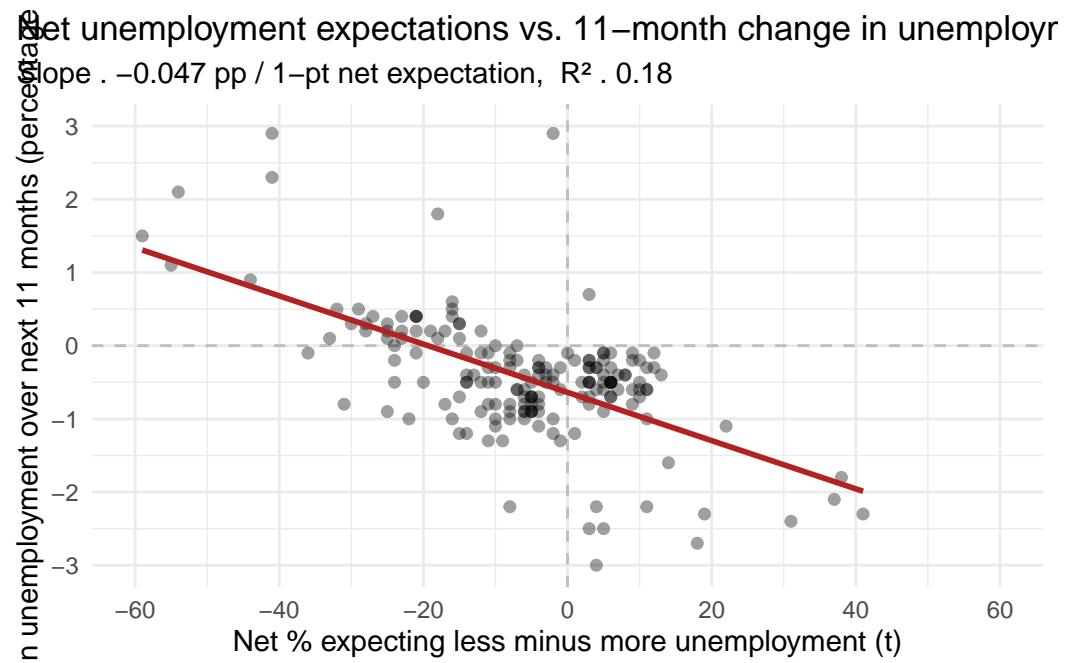
\$h_9m



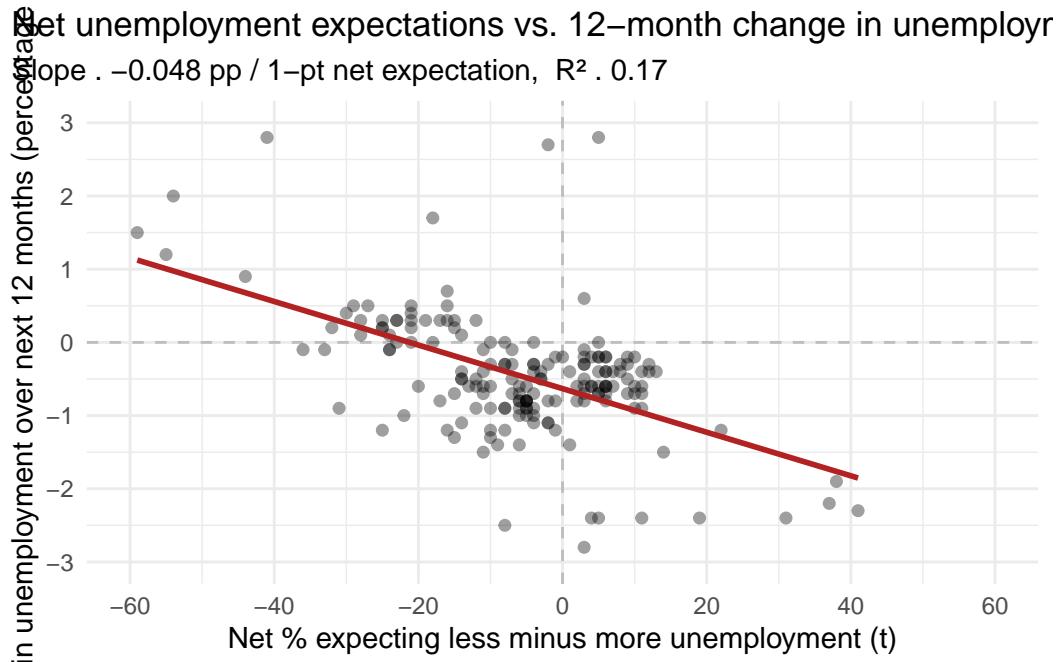
\$h_10m



\$h_11m



\$h_12m



Visualization 3. Time series: net expectations vs actual unemployment (dual axis)

```
expect_vs_unemp_dual <- function(data_macro2,
                                    cs_limits      = c(-60, 60), # for net expectations
                                    unemp_limits = c(2, 12)) {# for unemployment

  df <- data_macro2 %>%
    filter(!is.na(net_unemp_expect), !is.na(unrate)) %>%
    arrange(date)

  ex_min <- cs_limits[1]
  ex_max <- cs_limits[2]
```

```

ur_min <- unemp_limits[1]
ur_max <- unemp_limits[2]

ex_rng <- ex_max - ex_min
ur_rng <- ur_max - ur_min

df <- df %>%
  mutate(
    unrate_scaled = ex_min + (unrate - ur_min) * (ex_rng / ur_rng)
  )

ggplot(df, aes(x = date)) +
  # raw lines (lighter)
  geom_line(aes(y = net_unemp_expect,
                color = "Net expectations (Less-More)" ,
                alpha = 0.4) +
  geom_line(aes(y = unrate_scaled,
                color = "Unemployment" ),
                alpha = 0.4) +
  # smoothed lines (highlighted)
  geom_smooth(aes(y = net_unemp_expect,
                  color = "Net expectations (Less-More)" ,
                  se = FALSE, span = 0.2, linewidth = 0.9) +
  geom_smooth(aes(y = unrate_scaled,
                  color = "Unemployment" ),

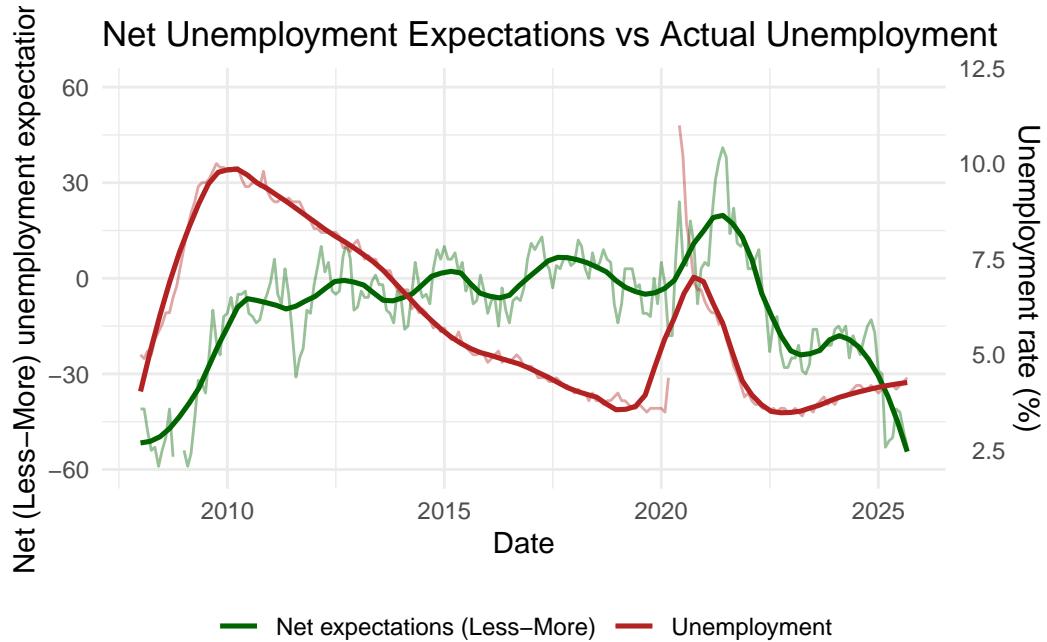
```

```

      se = FALSE, span = 0.2, linewidth = 0.9) +
      scale_y_continuous(
        name    = "Net (Less-More) unemployment expectations",
        limits = cs_limits,
        sec.axis = sec_axis(
          trans = ~ (.- ex_min) * (ur_rng / ex_rng) + ur_min,
          name  = "Unemployment rate (%)"
        )
      ) +
      scale_color_manual(
        values = setNames(
          c("darkgreen", "firebrick"),
          c("Net expectations (Less-More)", "Unemployment")
        )
      ) +
      labs(
        title = "Net Unemployment Expectations vs Actual Unemployment",
        x      = "Date",
        color = NULL
      ) +
      theme_minimal() +
      theme(legend.position = "bottom")
}

```

```
expect_vs_unemp_dual(macro2)
```



```
expect_vs_unemp_dual <- function(data_macro2,
                                    lag_months = 3,
                                    cs_limits = c(-60, 60), # for net expectations
                                    unemp_limits = c(2, 12)) { # for unemployment

  df <- data_macro2 %>%
    arrange(date) %>%
    mutate(unrate_lead = lead(unrate, lag_months)) %>%
    filter(!is.na(net_unemp_expect), !is.na(unrate_lead))

  ex_min <- cs_limits[1]
  ex_max <- cs_limits[2]
  ur_min <- unemp_limits[1]
```

```

ur_max <- unemp_limits[2]

ex_rng <- ex_max - ex_min
ur_rng <- ur_max - ur_min

df <- df %>%
  mutate(
    unrate_scaled = ex_min + (unrate_lead - ur_min) * (ex_rng / ur_rng)
  )

unemp_label <- paste0("Unemployment (t + ", lag_months, "m)")

ggplot(df, aes(x = date)) +
  # raw lines (lighter)
  geom_line(aes(y = net_unemp_expect,
                color = "Net expectations (Less-More)" ,
                alpha = 0.4) +
  geom_line(aes(y = unrate_scaled,
                color = unemp_label),
                alpha = 0.4) +
  # smoothed lines (highlighted)
  geom_smooth(aes(y = net_unemp_expect,
                  color = "Net expectations (Less-More)" ,
                  se = FALSE, span = 0.2, linewidth = 0.9) +
  geom_smooth(aes(y = unrate_scaled,

```

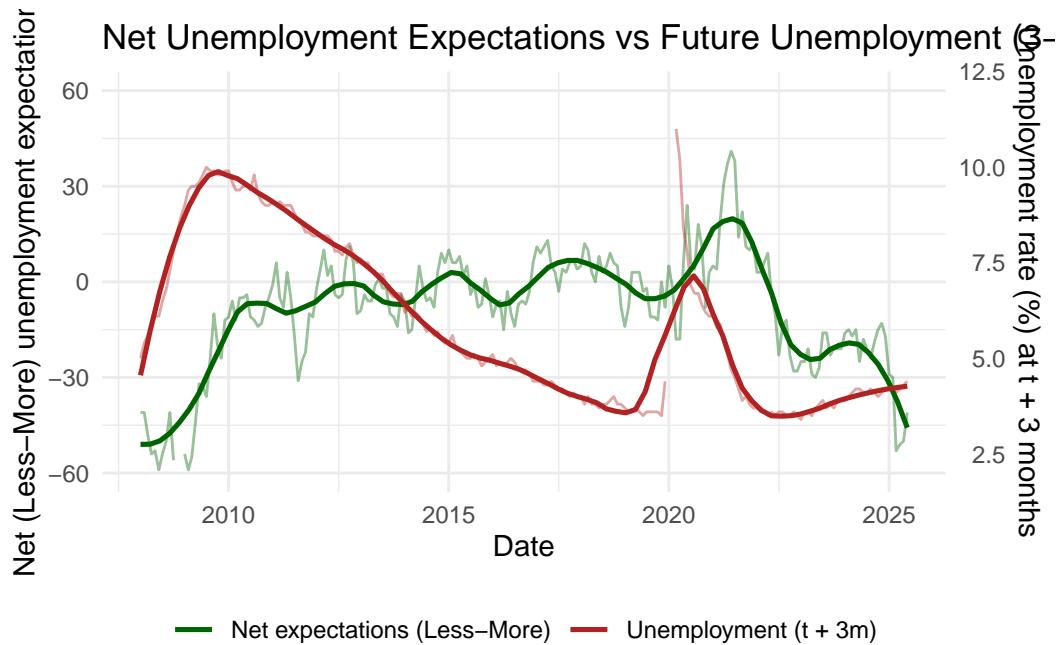
```

          color = unemp_label),
          se = FALSE, span = 0.2, linewidth = 0.9) +
scale_y_continuous(
  name    = "Net (Less-More) unemployment expectations",
  limits = cs_limits,
  sec.axis = sec_axis(
    trans = ~ (.- ex_min) * (ur_rng / ex_rng) + ur_min,
    name  = paste0("Unemployment rate (%) at t + ",
                  lag_months, " months")
  )
) +
scale_color_manual(
  values = setNames(
    c("darkgreen", "firebrick"),
    c("Net expectations (Less-More)", unemp_label)
  )
) +
labs(
  title = paste0("Net Unemployment Expectations vs Future Unemployment (",
                 lag_months, "-month lead)"),
  x      = "Date",
  color = NULL
) +
theme_minimal() +
theme(legend.position = "bottom")

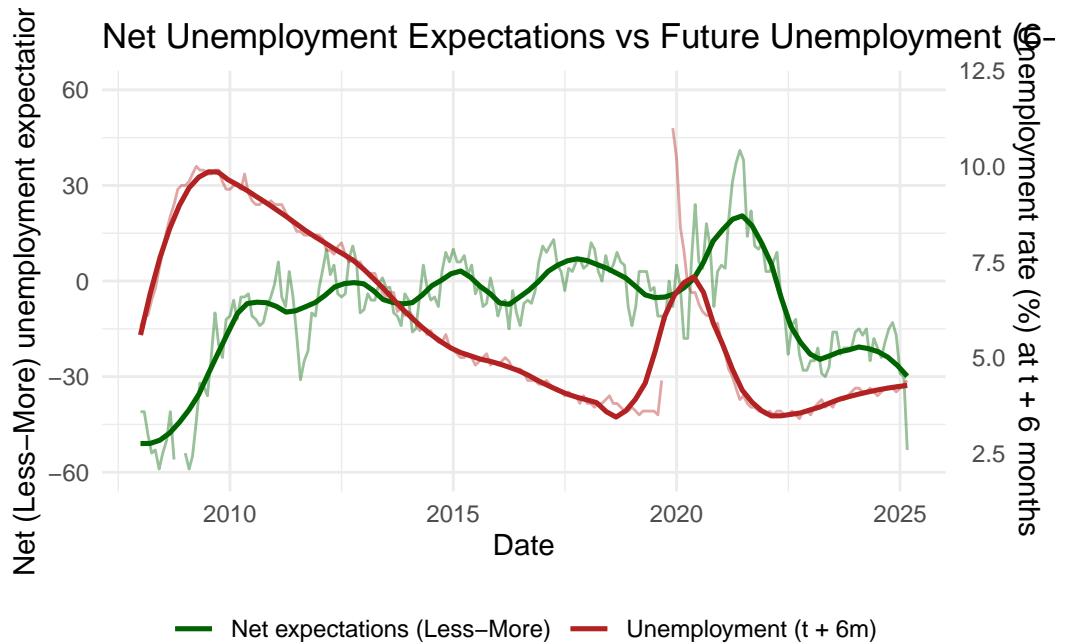
```

```
}
```

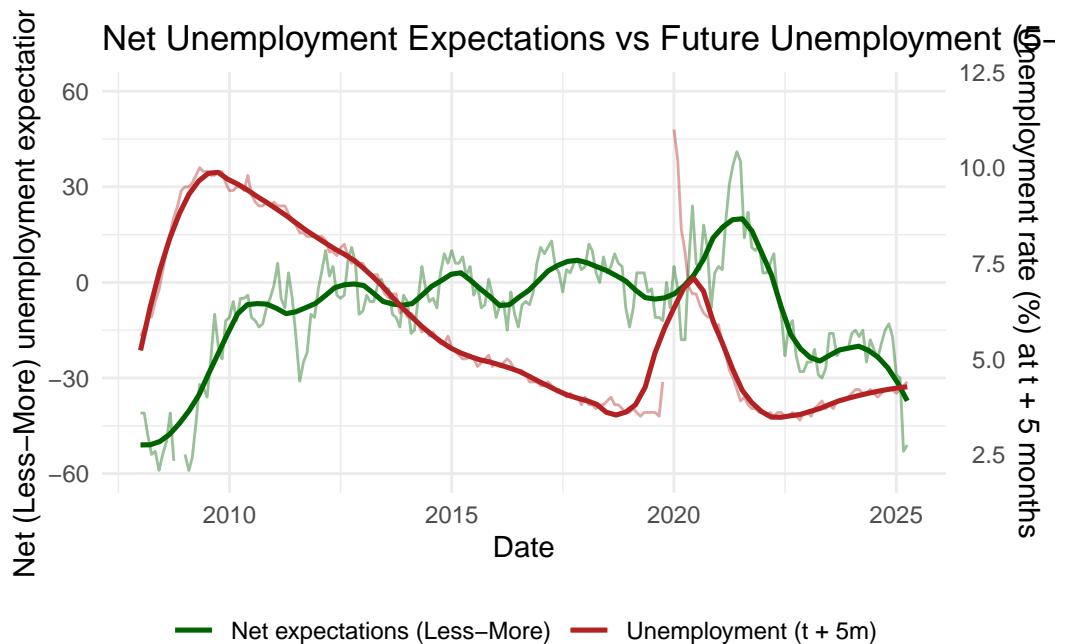
```
expect_vs_unemp_dual(macro2, lag_months = 3)
```



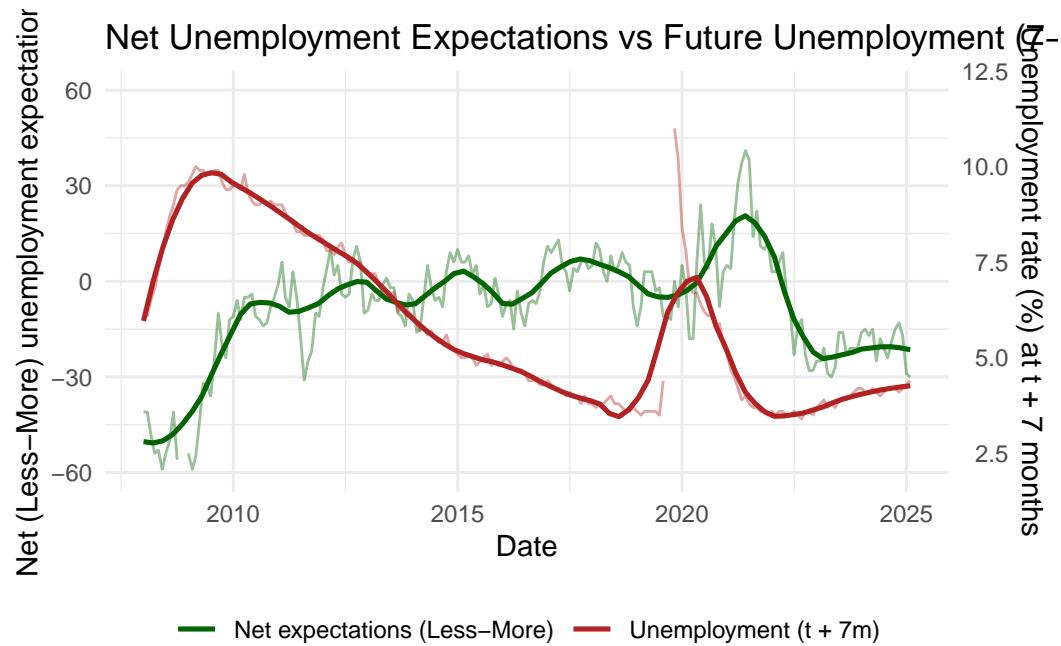
```
expect_vs_unemp_dual(macro2, lag_months = 6)
```



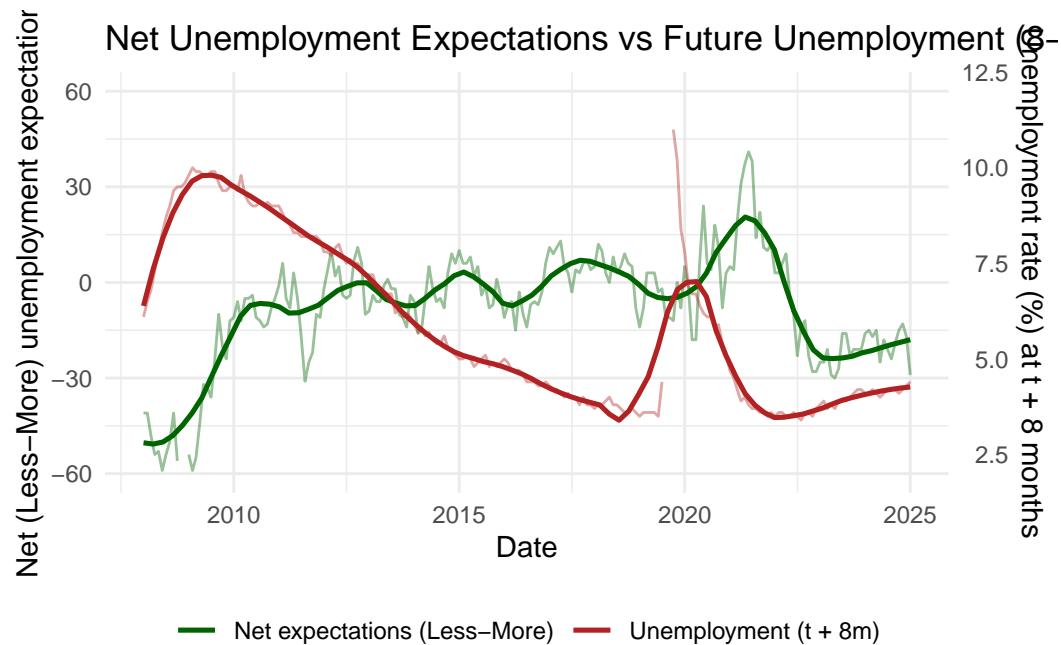
```
expect_vs_unemp_dual(macro2, lag_months = 5)
```



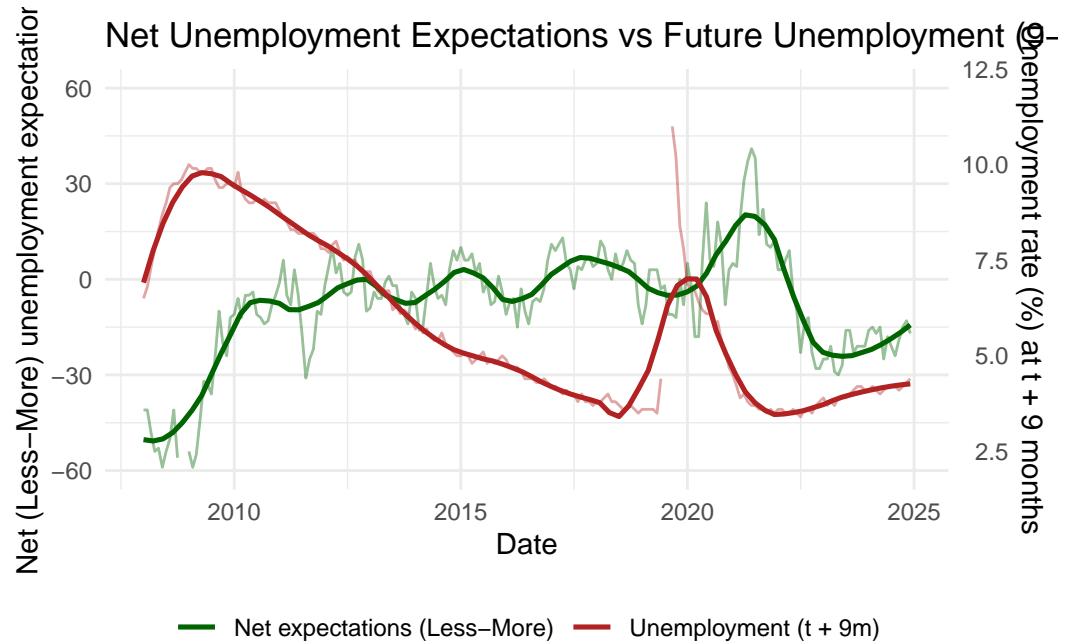
```
expect_vs_unemp_dual(macro2, lag_months = 7)
```



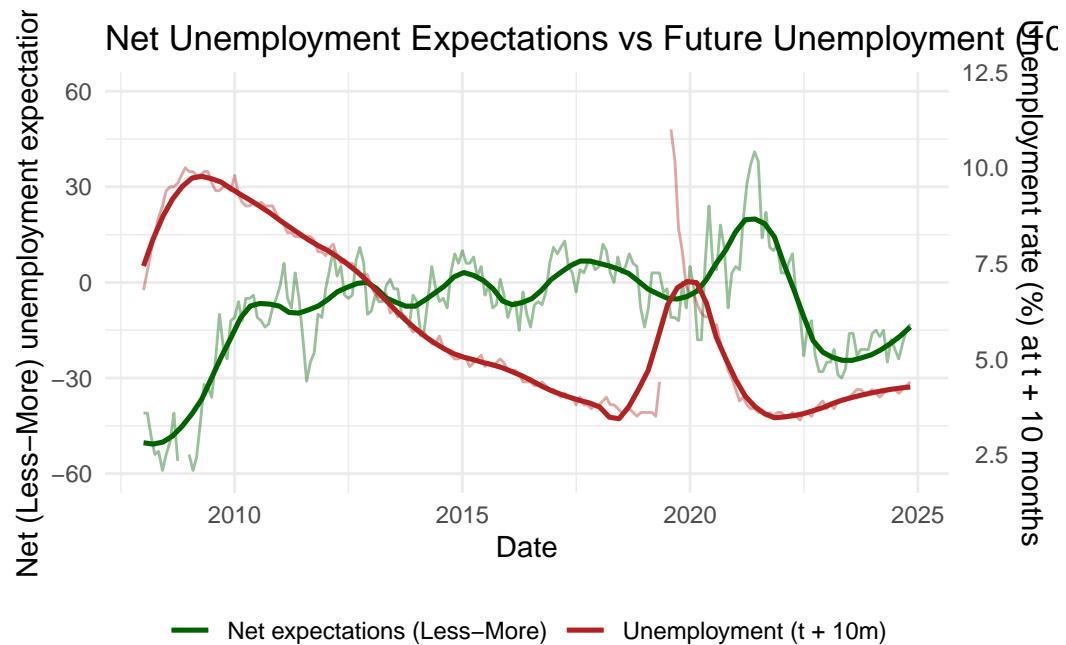
```
expect_vs_unemp_dual(macro2, lag_months = 8)
```



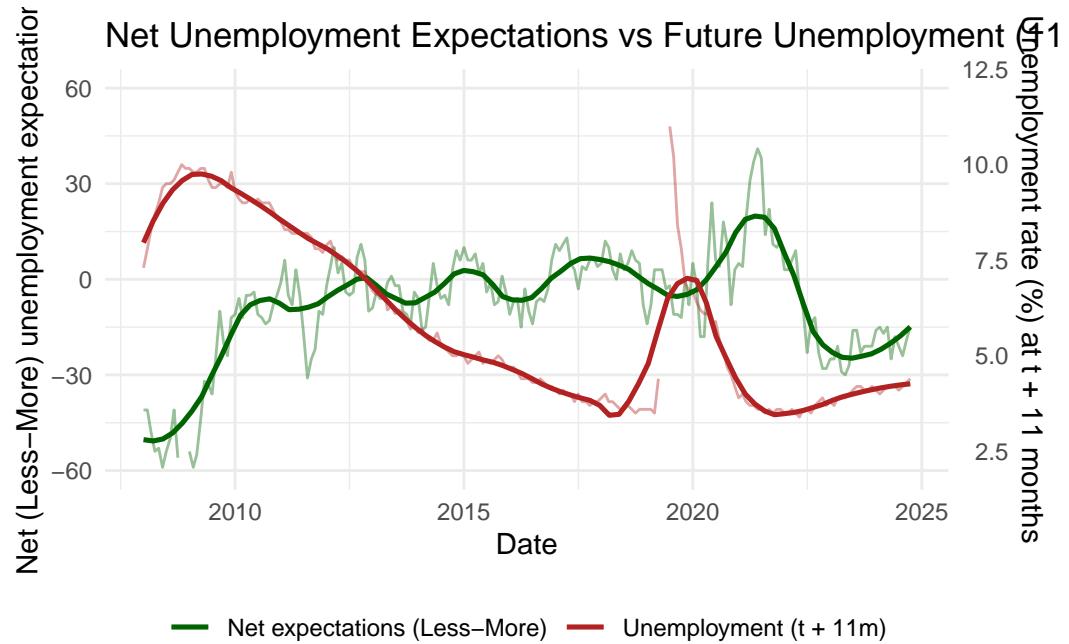
```
expect_vs_unemp_dual(macro2, lag_months = 9)
```



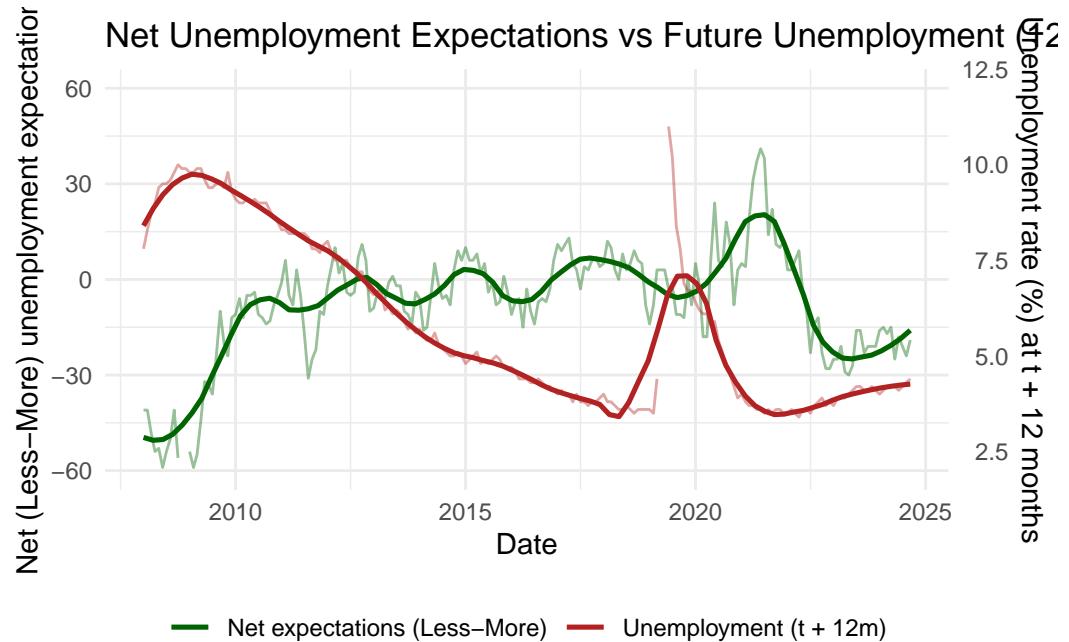
```
expect_vs_unemp_dual(macro2, lag_months = 10)
```



```
expect_vs_unemp_dual(macro2, lag_months = 11)
```



```
expect_vs_unemp_dual(macro2, lag_months = 12)
```



Indications

SOME REAL WORLD INDICATIONS.

Conclusion & Outlook

Limitation

References

<https://data.sca.isr.umich.edu/data-archive/mine.php>

<https://www.bls.gov/cps>

<https://www.bls.gov/ces>