

# 2023Spring\_UWE

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## Load in data

```
income = read_csv("/Users/linglei/housing_madison/median_house_income.csv")
price = read_csv("/Users/linglei/housing_madison/median_listing_price.csv")
```

## EDA Process

```
head(income)
```

```
## # A tibble: 6 x 2
##   DATE      MHIWI55025A052NCEN
##   <date>    <chr>
## 1 1989-01-01 31986
## 2 1990-01-01 .
## 3 1991-01-01 .
## 4 1992-01-01 .
## 5 1993-01-01 38821
## 6 1994-01-01 .
```

```
head(price)
```

```
## # A tibble: 6 x 2
##   DATE      MEDLISPRI31540
##   <date>    <dbl>
## 1 2016-07-01      299546
## 2 2016-08-01      299900
## 3 2016-09-01      299900
## 4 2016-10-01      297250
## 5 2016-11-01      299900
## 6 2016-12-01      299000
```

First rename the columns.

```

income = income %>%
  rename(date = DATE,
          income = MHIWI55025A052NCEN) %>%
  mutate(date = date(date),
          year = year(date));

price = price %>%
  rename(date = DATE,
          house_price = MEDLISPRI31540) %>%
  mutate(date = date(date),
          year = year(date));

```

Double check the datasets.

```
head(income)
```

```

## # A tibble: 6 x 3
##   date      income year
##   <date>    <chr> <dbl>
## 1 1989-01-01 31986  1989
## 2 1990-01-01 .      1990
## 3 1991-01-01 .      1991
## 4 1992-01-01 .      1992
## 5 1993-01-01 38821  1993
## 6 1994-01-01 .      1994

```

```
head(price)
```

```

## # A tibble: 6 x 3
##   date      house_price year
##   <date>          <dbl> <dbl>
## 1 2016-07-01     299546  2016
## 2 2016-08-01     299900  2016
## 3 2016-09-01     299900  2016
## 4 2016-10-01     297250  2016
## 5 2016-11-01     299900  2016
## 6 2016-12-01     299000  2016

```

Filtering all datasets from 2000 to 2022

```

income_2000 = income %>%
  filter(year >= 2016);

price_2000 = price %>%
  filter(year >= 2016);

```

## Merge two tables

```
fulldf = full_join(income_2000, price_2000, by = "date") %>%
  select(-year.x) %>%
  mutate(year = year.y) %>%
  select(-year.y)
```

## Implement NA values

```
price_16 = 70815
price_17 = 72385
price_18 = 71789
price_19 = 77828
price_20 = 74829
price_21 = 77653

fulldf = fulldf %>%
  mutate(income_new = case_when(
    year == 2016 ~ price_16,
    year == 2017 ~ price_17,
    year == 2018 ~ price_18,
    year == 2019 ~ price_19,
    year == 2020 ~ price_20,
    year == 2021 ~ price_21,
  )) %>%
  select(-income) %>%
  filter(!is.na(income_new)) %>%
  select(-year) %>%
  rename(income = income_new)
```

## Calculate the price to income

```
fulldf = fulldf %>%
  mutate(price_to_income = house_price / income)
```

## Data from Department of Numbers Madison Wisconsin

```
date = c("June 01 2012", "September 01 2012", "December 01 2012", "March 01 2013", "June 01 2013", "September 01 2013")
price_to_income = c(3.58, 3.58, 3.58, 3.32, 3.78, 3.89, 3.71, 3.57)
realtor_data = data.frame(date = mdy(date), price_to_income)
```

## Full join the tables

```
df = full_join(realtor_data, fulldf, by = "date")
```

```
df = df %>%
  mutate(
    year = year(date),
    price_ratio = case_when(
      year <= 2014 ~ price_to_income.x,
      year >= 2016 ~ price_to_income.y
    ) %>%
    select(-price_to_income.x, -price_to_income.y) %>%
    rename(price_to_income = price_ratio)
```

```
seq_date = seq(from = dmy("01 06 2012"), to = dmy("01 12 2021"), by = "month")
c = c(1:115)
data = data.frame(date = seq_date, c)
df = full_join(data, df, by = "date")
```

### Graph of the Price\_to\_income index

```
df %>%
  ggplot(aes(x = date, y = price_to_income)) +
  geom_line(alpha = 0.5, color = "green") +
  geom_point(size = 0.3, alpha = 0.5) +
  geom_text(aes(label = round(price_to_income, 1)),
            vjust = -1, hjust = "inward",
            show.legend = FALSE, size = 1.4, color = "blue") +
  xlab("Date") +
  ylab("Price to Income Ratio") +
  ggtitle("Price to Income Ratio Over Time")
```

```
## Warning: Removed 41 rows containing missing values ('geom_point()').
```

```
## Warning: Removed 41 rows containing missing values ('geom_text()').
```



```
## Warning: Removed 1 row containing missing values ('geom_line()').
```

```
## Warning: Removed 1 rows containing missing values ('geom_point()').
```

```
## Warning: Removed 1 rows containing missing values ('geom_text()').
```

