Constructing a bilateral real exchange rate

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```
library(tidyverse)
library(tidyquant)
library(timetk)
```

Introduction

This document expands the information that is pointed out in (Neely 2020)

Bilateral real exchange rate

$$BRER_{ij} = \frac{NER_{ij} * P_j}{P_i}$$

- Territory i
- Territory j
- $BRER_{ij}$: Bilateral real exchange rate between territory i and territory j from the perspective of territory i
- NER_{ij}: Nominal exchange rate between territory i and territory j from the perspective of territory i
  - $NER_{ij} = \frac{Currency_i}{Currency_j}$

For example if $i = US$ and $j = EUA$ then the idea is to calculate the bilateral real exchange rate between the United States of America and the Euro Area

Data

Case study: Bilateral real exchange rate between the US and the EUA

- Source: https://fred.stlouisfed.org/
- Variables:
  - $NER_{US,EUA}$: U.S. / Euro Foreign Exchange Rate
    - Code: DEXUSEU
  - P_{US}: Consumer Price Index for All Urban Consumers: All Items in U.S. City Average
    - Code: CPIAUCSL
  - P_{EUA}: Harmonized Index of Consumer Prices: All Items for Euro area (19 countries)
    - Code: CP0000EZ19M086NEST

Import and tidy

```
# Import
nex_us_eua <- tq_get(c("DEXUSEU"),
       get = "economic.data",
       complete_cases = TRUE,
       from = "1999-01-01")

pi_us_eua <- tq_get(c("CPIAUCSL", "CP0000EZ19M086NEST"),
                    get = "economic.data",
                    complete_cases = TRUE,
                    from = "1999-01-01")

# Tidy
nex_us_eua <- nex_us_eua %>%
  summarize_by_time(.date_var = date,
                    .by = "month",
                    DEXUSEU = mean(price, na.rm = TRUE))

pi_us_eua <- pi_us_eua %>%
  pivot_wider(id_cols = date,
              names_from = symbol,
              values_from = price)

data_clean <- nex_us_eua %>%
  inner_join(y = pi_us_eua, by = "date") %>%
  set_names(nm = c("date", "nex_us_eua", "p_us", "p_eua"))
```

Transform

Bilateral real exchange rate

```
data_transform <- data_clean %>%
  mutate(brer_us_eua = nex_us_eua * (p_eua / p_us))
```

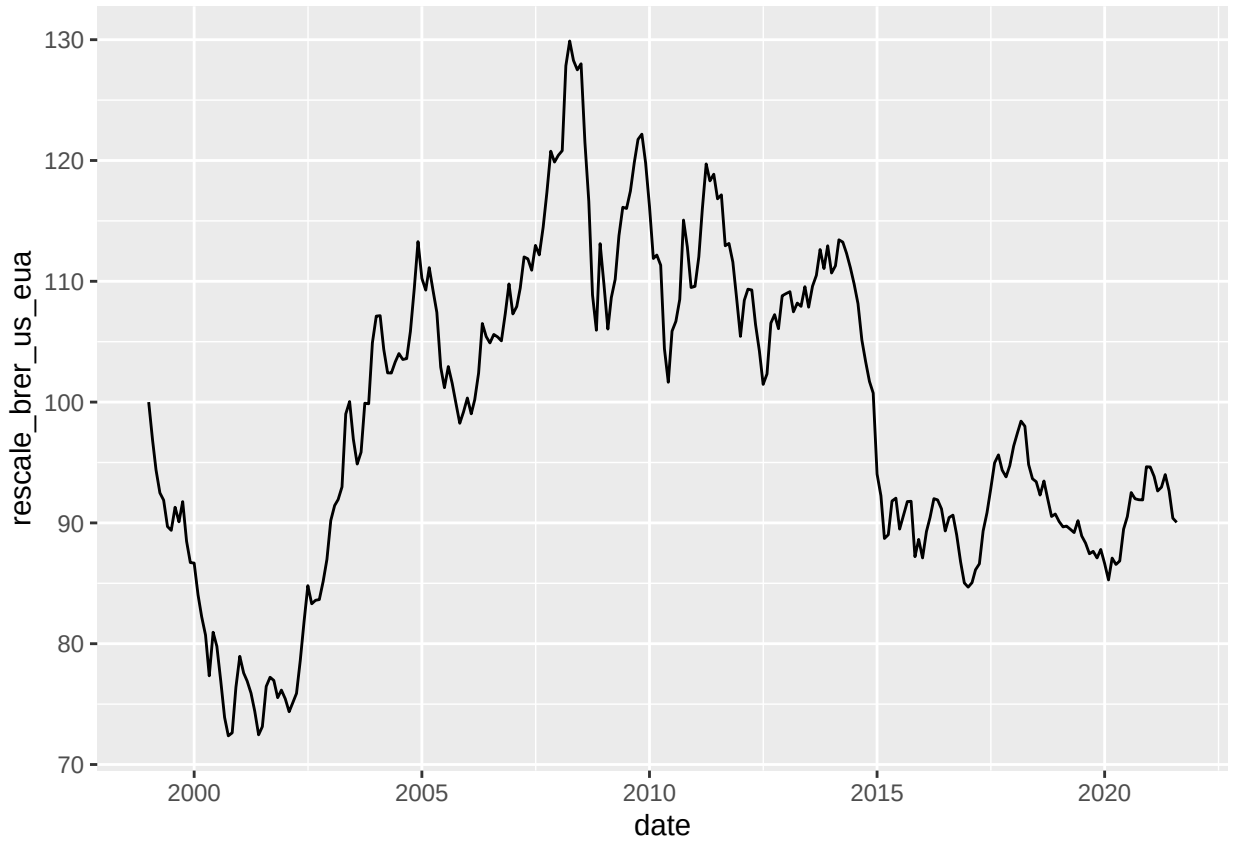
Rescale bilateral real exchange rate

```
brer_us_eua_100 <- data_transform$brer_us_eua[1]

data_transform <- data_transform %>%
  mutate(rescale_brer_us_eua = (100 * brer_us_eua) / brer_us_eua_100)
```

Visualize

```
data_transform %>%
  ggplot(aes(x = date, y = rescale_brer_us_eua)) +
  geom_line()
```



References

Neely, Chris. 2020. "Constructing a Bilateral Real Exchange Rate | FRED Blog." https://fredblog.stlouisfed.org/2020/07/constructing-a-bilateral-real-exchange-rate/.