

# Time Series Research Assignment

Jacques Rossouw - 21159793<sup>a</sup>

<sup>a</sup>*Stellenbosch, Western Cape, South Africa*

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## Abstract

Abstract to be written here.

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## 1. Introduction

- What did I do? This paper is a replication and critical evaluation of the research paper by  
1.
- why did I do this?

## 2. Literature Review

### *2.1. What did the Authors do?*

### *2.2. Motivation*

- Importance
- Methods
- Novel Contribution(s)

### *2.3. Critical Evaluation*

- Robustness checks/extensions

## 3. Replication

## 4. Importing and Cleaning the Data

### *4.1. Importing the full dataset:*

```
full_df <- fetch_full()
full_df
```

```
## # A tibble: 129 x 20
##   obs    LREERS    RIRR LRGDPPCR OPENY  FBYA NFAOFPY LPR2COMM5 LPRCOMM5
##   <chr>   <dbl>   <dbl>   <dbl> <dbl> <dbl>   <dbl>   <dbl>   <dbl>
## 1 1970Q1  4.59 -0.541    0.670 44.8 -5.62    7.41   -0.734   -0.851
## 2 1970Q2  4.58 -0.0509    0.663 46.1 -1.94    6.92   -0.729   -0.849
## 3 1970Q3  4.59 -0.707    0.632 47.9 -1.55    6.29   -0.747   -0.875
## 4 1970Q4  4.59  0.906    0.637 46.8 -3.49    5.12   -0.703   -0.846
## 5 1971Q1  4.59  1.54     0.675 47.5 -6.51    4.40   -0.690   -0.825
## 6 1971Q2  4.60  0.628    0.651 47.3 -4.91    3.86   -0.659   -0.792
## 7 1971Q3  4.59  1.09     0.643 46.9 -5.09    3.11   -0.675   -0.795
## 8 1971Q4  4.56  0.301    0.624 47.4 -7.57    2.87   -0.653   -0.749
## 9 1972Q1  4.49  0.117    0.625 45.7 -4.69    3.33   -0.591   -0.665
## 10 1972Q2  4.50 -0.0238    0.617 47.4 -8.77    4.63   -0.407   -0.481
## # ... with 119 more rows, and 11 more variables: LPR2COMM3 <dbl>,
## #   LPRCOMM3 <dbl>, LPR2GOLD <dbl>, LPRGOLD <dbl>, SDUMC1 <dbl>, SDUMC2 <dbl>,
## #   SDUMC3 <dbl>, DUMRER1 <dbl>, DUMRER2 <dbl>, DUMFBYA <dbl>, DUMNFAOFPY <dbl>
```

#### 4.2. Wrangling the dataset

```
full_df <- full_clean(full_df)
full_df
```

```
## # A tibble: 129 x 20
##   date      LREERS    RIRR LRGDPPCR OPENY  FBYA NFAOFPY LPR2COMM5 LPRCOMM5
##   <date>    <dbl>   <dbl>   <dbl> <dbl> <dbl>   <dbl>   <dbl>   <dbl>
## 1 1970-03-31  4.59 -0.541    0.670 44.8 -5.62    7.41   -0.734   -0.851
## 2 1970-06-30  4.58 -0.0509    0.663 46.1 -1.94    6.92   -0.729   -0.849
## 3 1970-09-30  4.59 -0.707    0.632 47.9 -1.55    6.29   -0.747   -0.875
## 4 1970-12-31  4.59  0.906    0.637 46.8 -3.49    5.12   -0.703   -0.846
## 5 1971-03-31  4.59  1.54     0.675 47.5 -6.51    4.40   -0.690   -0.825
## 6 1971-06-30  4.60  0.628    0.651 47.3 -4.91    3.86   -0.659   -0.792
## 7 1971-09-30  4.59  1.09     0.643 46.9 -5.09    3.11   -0.675   -0.795
## 8 1971-12-31  4.56  0.301    0.624 47.4 -7.57    2.87   -0.653   -0.749
## 9 1972-03-31  4.49  0.117    0.625 45.7 -4.69    3.33   -0.591   -0.665
## 10 1972-06-30  4.50 -0.0238    0.617 47.4 -8.77    4.63   -0.407   -0.481
## # ... with 119 more rows, and 11 more variables: LPR2COMM3 <dbl>,
## #   LPRCOMM3 <dbl>, LPR2GOLD <dbl>, LPRGOLD <dbl>, SDUMC1 <dbl>, SDUMC2 <dbl>,
```

---

```
## # SDUMC3 <dbl>, DUMRER1 <dbl>, DUMRER2 <dbl>, DUMFBYA <dbl>, DUMNFAOFPY <dbl>
```

#### *4.3. Variable Names (SECTION TO BE DELETED)*

```
as_tibble(names(full_df))
```

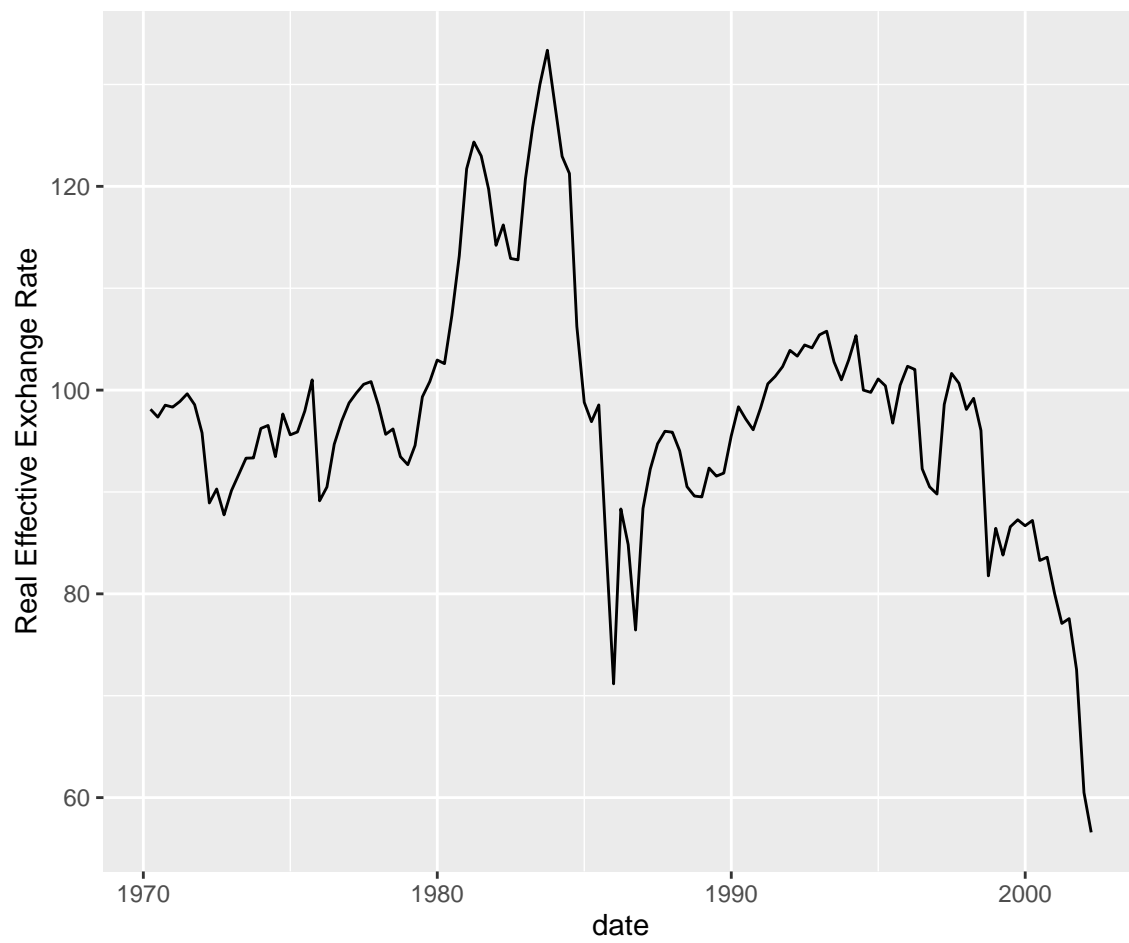
```
## # A tibble: 20 x 1
##   value
##   <chr>
## 1 date
## 2 LREERS
## 3 RIRR
## 4 LRGDPPCR
## 5 OPENY
## 6 FBYA
## 7 NFAOFPY
## 8 LPR2COMM5
## 9 LPRCOMM5
## 10 LPR2COMM3
## 11 LPRCOMM3
## 12 LPR2GOLD
## 13 LPRGOLD
## 14 SDUMC1
## 15 SDUMC2
## 16 SDUMC3
## 17 DUMRER1
## 18 DUMRER2
## 19 DUMFBYA
## 20 DUMNFAOFPY
```

#### *4.4. Plotting the Variables of Interest*

##### *4.4.1. Plotting REERS:*

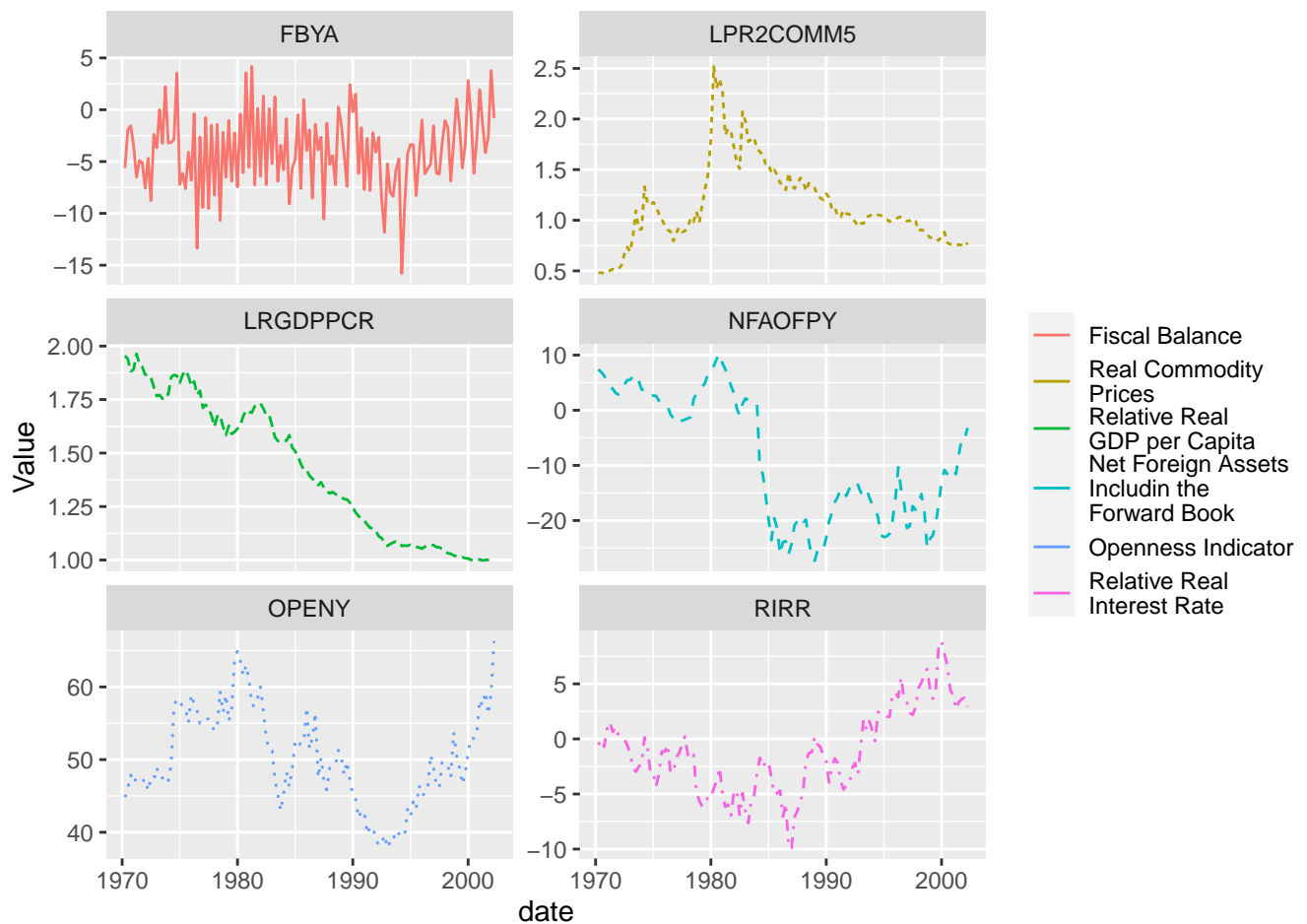
```
plot_endog1(full_df)
```

---



4.4.2. Plotting the determinants of the Real Effective Exchange Rate:

```
plot_endog2(df = full_df)
```



#### 4.5. VECM Model Estimation:

*Multiple ways to estimate VEC models:*

*First approach: ordinary least squares (yields accurate result) but does not allow to estimate the cointegrating relations among the variables. The estimated generalised least squares (EGLS) approach would be an alternative.*

*Most popular estimator: MLE of Johansen (1995) [In R: ca.jo function of the urca package of Pfaff (2008a)] Alternatively, VECM of tsDyn package of Di Narzo et al. (2020)*

*Before VECM: 1. Determine lag order  $p \rightarrow$  Det. rank of CI matrix  $r$  2. deterministic terms have to be specified. 3. Choose lag order: est. the VAR in levels 4. Choose lag specification that minimises an Information criterion*

---

#### 4.5.1. Determine the Lag Order

```
# var_aic <-  
  
#  
# endog_df <- split_data_endog(full_df)  
# exog_df <- split_data_exog(full_df)  
#  
#  
# mod <- VECM(data = endog_df[,2:8], lag = 4, r = 1,  
#             include = "const", estim = "ML", exogen = exog_df[,2:4])  
#  
# mod_summ <- summary(mod)  
  
# mod <- dynlm(full_df$LREERS ~ full_df$RIRR + full_df$LRGDPPCR + full_df$OPENY  
#             + full_df$FBYA + full_df$NFAOFPY + full_df$LPR2COMM5  
#             + full_df$DUMNFAOFPY + full_df$DUMRER1  
#             + full_df$DUMRER2 + full_df$DUMFBYA + full_df$SDUMC1  
#             + full_df$SDUMC2 + full_df$SDUMC3,  
#             lag = 4,  
#             include = "const", estim = "ML", exog  
#             exogen = exog_df[,2:8])  
  
# stargazer(mod_summ$model, header = FALSE)
```

## 5. Directly from ([MacDonald & Ricci, 2004](#))

### 5.1. Section 3 Data and Methodology

- Plotting the  $\exp(\text{LREER})$  and the rest of the variables
- Showcase the vector of interest
- Investigate LR CI Rel's amongst var's in vector
  - Method: MLE of Johansen ([1995](#))



- Why? Corrects for Autocorr and ednog parametrically using VECM specif.
- Key Advantage: the estimated coefficient - the  $\beta$  vector - can be used to provide a measure of the equilibrium real exchange rate and therefore a quantification of the gap between the prevailing real exchange rate and its equilibrium level. The methodology also derives estimates of the speed at which the real exchange rates converges to the equilibrium level.

## 6. Old Stuff

10 Johansen, S. 1995. *Likelihood-based inference in cointegrated vector autoregressive models*. OUP Oxford.

MacDonald, R. & Ricci, L.A. 2004. Estimation of the equilibrium real exchange rate for south africa  
1. *South African Journal of Economics*. 72(2):282–304.