

finc584_ps7

William Lee

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1 A

```
vol <- readxl::read_xlsx(file.path(proj, "volatility.xlsx")) %>%
  mutate(log_vol = log(variance), log_vol_demean = log_vol - mean(log_vol))

sample_mean <- mean(vol$log_vol)

sample_covariance_k <- function(k) (nrow(vol) - k)/(nrow(vol) - k - 1)*
  cov(x = vol$log_vol_demean[(k + 1):nrow(vol)],
      y = vol$log_vol_demean[1:(nrow(vol) - k)])

phi <- lapply(1:132, sample_covariance_k) %>% unlist()

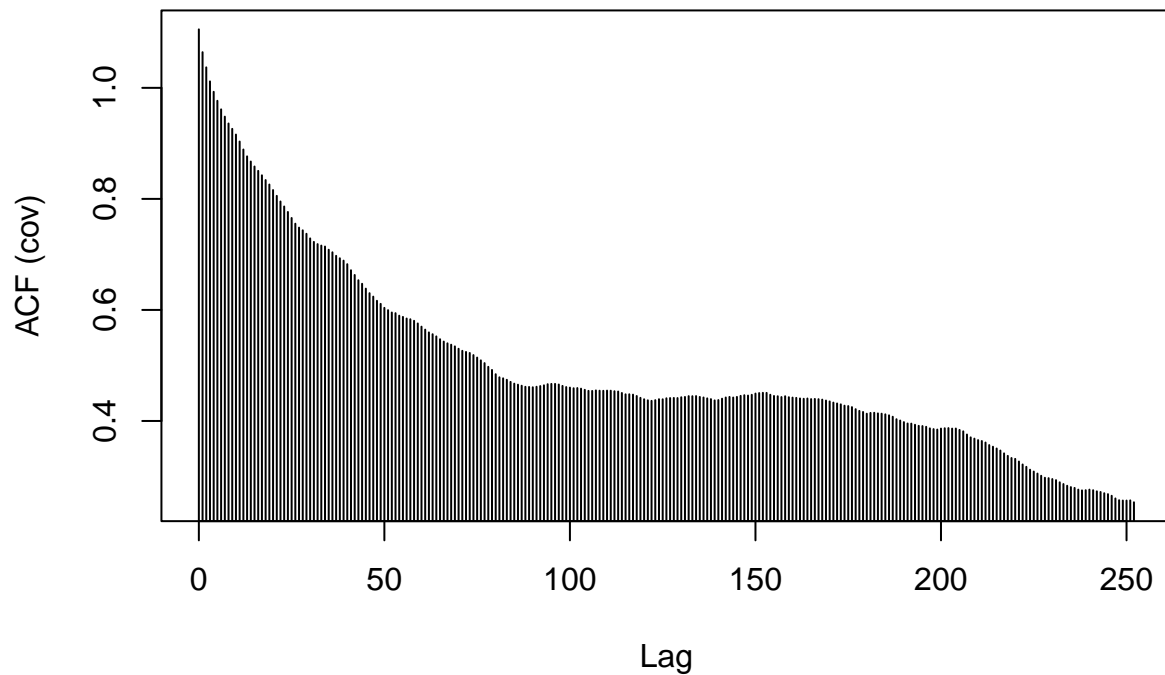
w <- (1 - (1:132)/133)

long_var_nw <- (1/nrow(vol))*(sample_covariance_k(0) + 2*sum(w*phi))
```

1 B

```
acf_vol <- stats::acf(vol$log_vol_demean,
  type = 'covariance', lag.max = 252)
```

Series vol\$log_vol_demean



1 C

```
epsilon <- rep(NA, nrow(vol))
epsilon[1:2] <- 0
kappa <- 0.9751
mu <- sample_mean
theta <- -0.1767

logvt_22 <- mu + (kappa^22)*vol$log_vol_demean[1:(nrow(vol)-22)]

data.frame(vol$log_vol[23:nrow(vol)], logvt_22, x = 1:(nrow(vol) -22)) %>%
  pivot_longer(cols = -x) %>%
  ggplot(aes(x = x, y = value, group = name, color = name)) +
  geom_line() +
  theme(legend.position = 'bottom')
```

