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# IBM.csv contains daily historical prices of IBM
# downloaded from Yahoo! Finance
Y <- read.csv("IBM.csv",header=T,na.strings="null")
# in the downloaded file, missing values are represented
# by the string "null" rather than by the symbol NA
Y <- na.omit(Y) # rows with missing values are omitted
N <- nrow(Y) # number of rows
d <- as.Date(Y[,1]) # dates in column 1
y <- log(Y[,6]) # adjusted close prices in column 6
r <- y[2:N]-y[1:(N-1)] # log returns

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par(mfrow=c(2,2),mar=c(2,2,1,1))
plot(d,y,type="l"); mtext("(a)",side=3,cex=0.7)
plot(d[2:N],r,type="l"); mtext("(b)",side=3,cex=0.7)
plot(d[2:N],r^2,type="l");
mtext("(c)",side=3,cex=0.7)
plot(d[2:N],r^4,type="l");
mtext("(d)",side=3,cex=0.7)

```

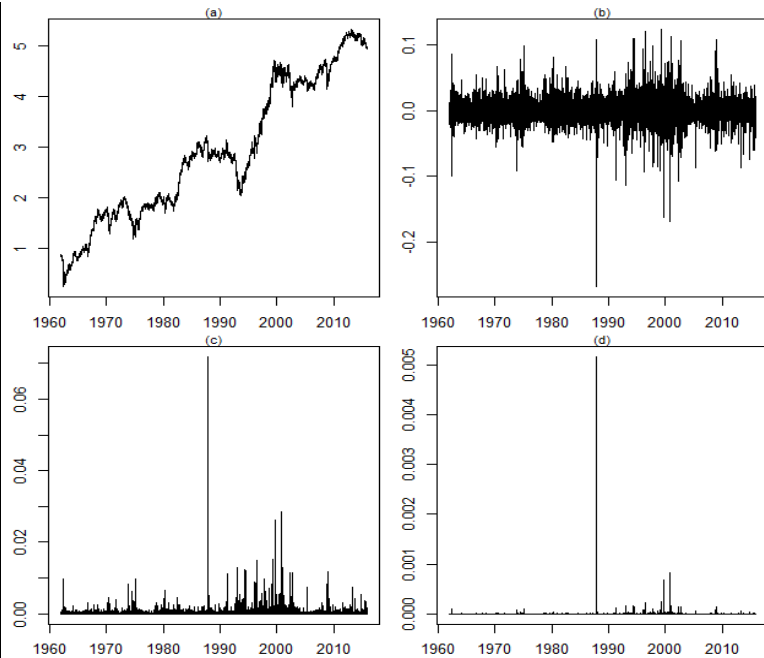


Figure 1.1: Historical daily quotes of IBM

(a) Log adjusted closing prices

(b) Log returns

(c) Squared log returns

(d) Fourth powers of log returns

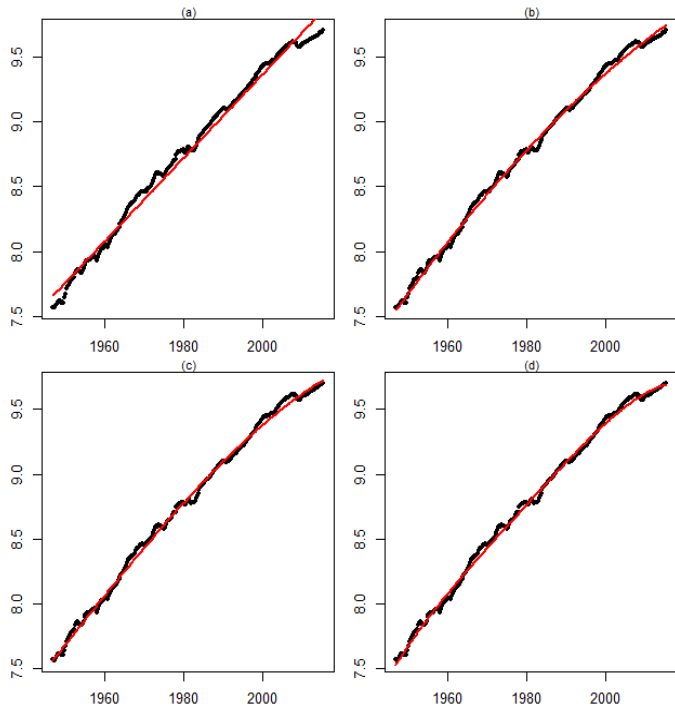


Figure 1.2: Polynomial trends of degree 1 (a), 2 (b), 3 (c), 4 (d) fitted to the quarterly (seasonally adjusted real) log U.S. GDP

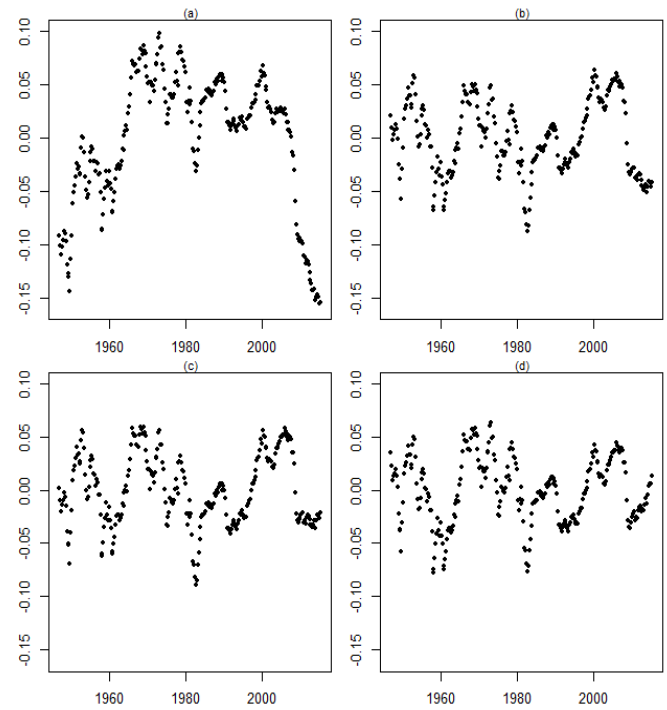


Figure 1.3: Deviations of quarterly log U.S. GDP from polynomial trends of degree 1 (a), 2 (b), 3 (c), 4 (d)

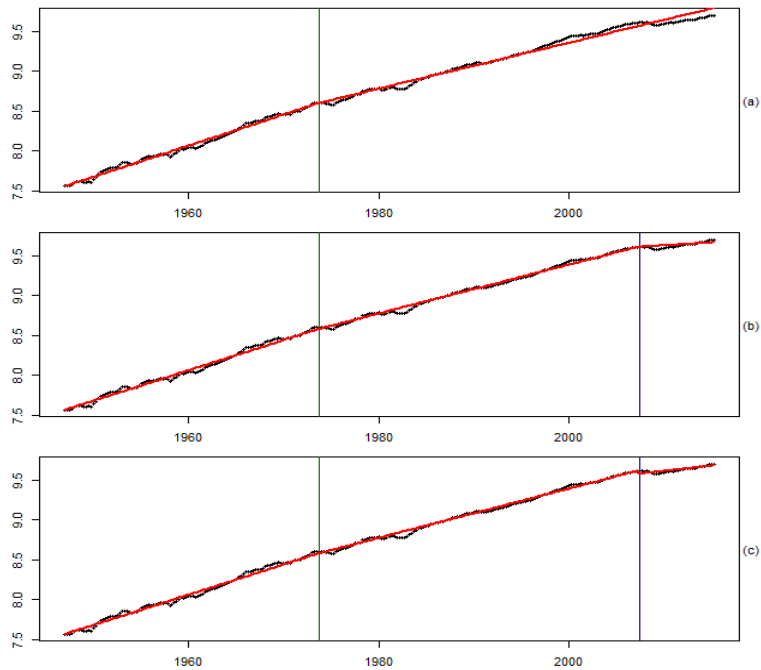


Figure 1.4: Broken linear trends fitted to the quarterly log U.S. GDP (a) break in slope after 1973.3, (b) break in slope after 1973.3, 2007.2 (c) break in slope after 1973.3, 2007.2, break in intercept after 2007.2

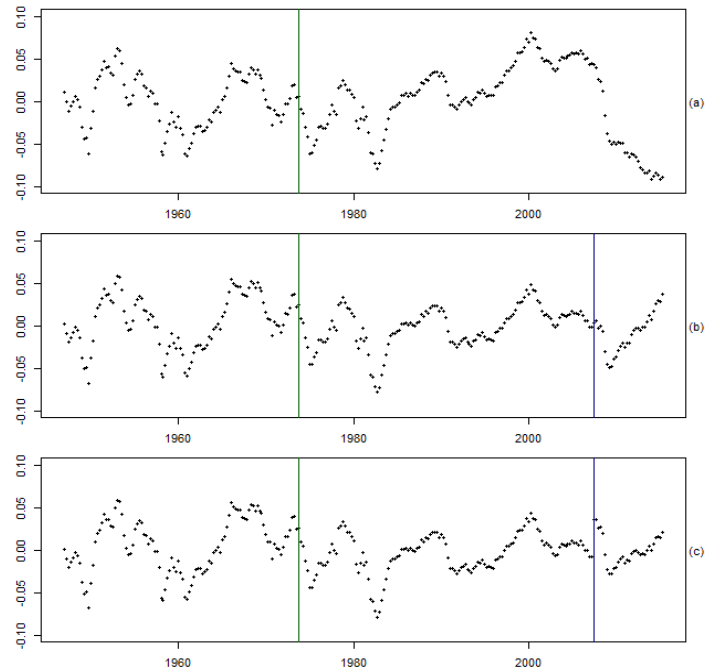


Figure 1.5: Deviations of quarterly log U.S. GDP from broken trends (a) break in slope after 1973.3, (b) break in slope after 1973.3, 2007.2 (c) break in slope after 1973.3, 2007.2, break in intercept after 2007.2

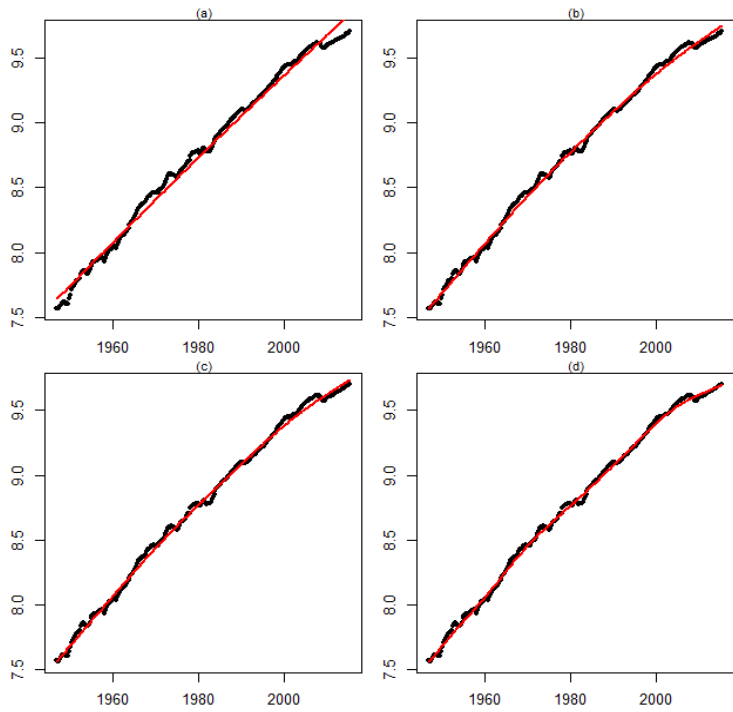


Figure 1.6: Hodrick-Prescott filter applied to the quarterly log U.S. GDP  
 (a)  $\lambda=50\,000\,000$  (b)  $\lambda=1\,000\,000$  (c)  $\lambda=500\,000$  (d)  $\lambda=50\,000$

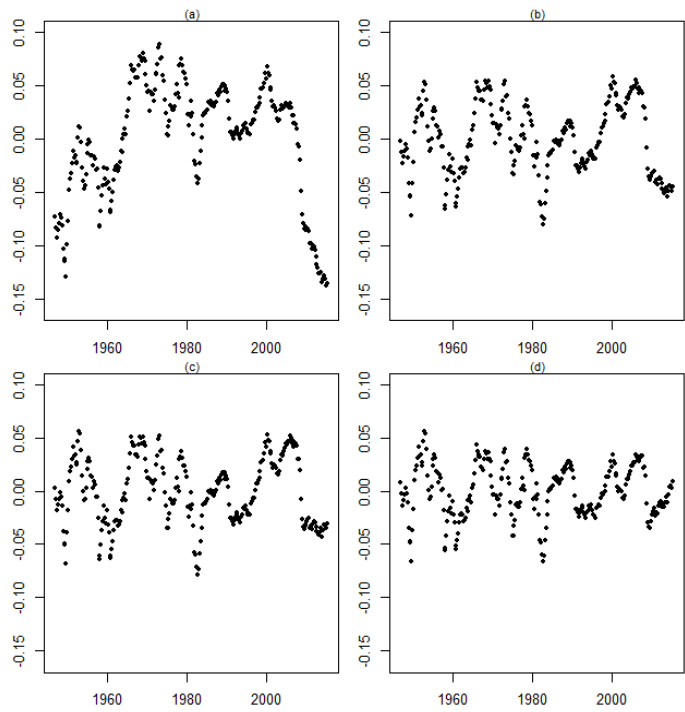


Figure 1.7: Deviations of quarterly log U.S. GDP from HP trends  
 (a)  $\lambda=50\,000\,000$  (b)  $\lambda=1\,000\,000$  (c)  $\lambda=500\,000$  (d)  $\lambda=50\,000$

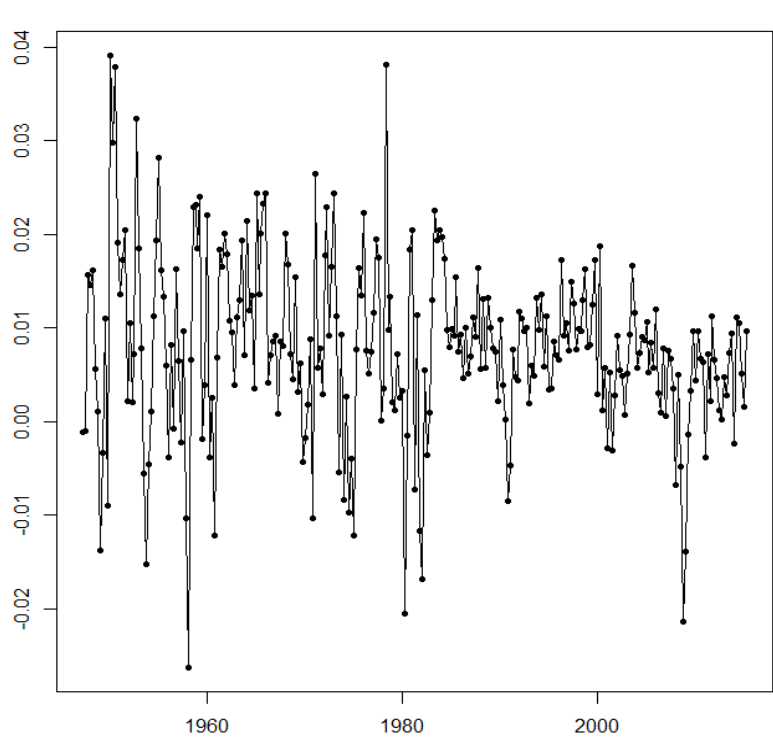


Figure 1.8: First differences of quarterly log U.S. GDP