h)

```
# h)
DW <- sum(diff(residuals(gdplmsqu))^2)/sum(residuals(gdplmsqu)^2)
DW
```

```
> # h)
> DW <- sum(diff(residuals(gdplmsqu))^2)/sum(residuals(gdplmsqu)^2)
> DW
[1] 1.210211
```

$H_0: \rho_1 = 0 \qquad H_a: \rho_1 > 0$

$$DW = \frac{\sum_{t=2}^{n} (e_t - e_{t-1})^2}{\sum_{t=1}^{n} e_t^2} = 1.210211$$ by R-code

since $n = 40, k = 3, \alpha = 0.05$, by Durbin-Watson table, we get $DW_L = 1.338, DW_U = 1.659$.

We therefore reject $H_0: \rho_1 = 0$, and conclude $\rho_1 > 0$. Thus, there exists positive lag 1 correlation.

i) From the R-code output, we get that DW = 1.2102, which is close to the result of the answer from part h). Furthermore, p-value is 0.00336, which is smaller than 0.05. Thus, we should reject null hypothesis and conclude that there exists positive lag 1 correlation, which is $\rho_1 > 0$, since the alternative hypothesis is true autocorrelation is greater than 0.

```
# i)
install.packages("lmtest")
library(lmtest)
dwtest (gdplmsqu)
```

```
        Durbin-Watson test

data:  gdplmsqu
DW = 1.2102, p-value = 0.00336
alternative hypothesis: true autocorrelation is greater than 0
```