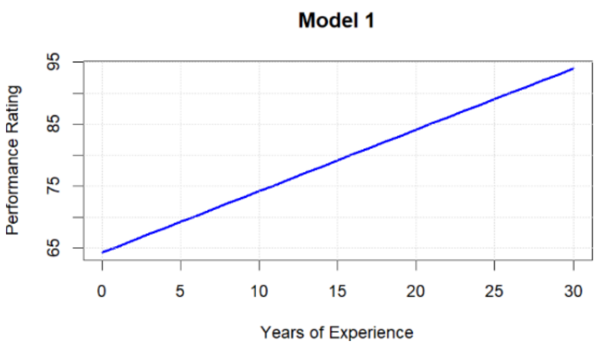
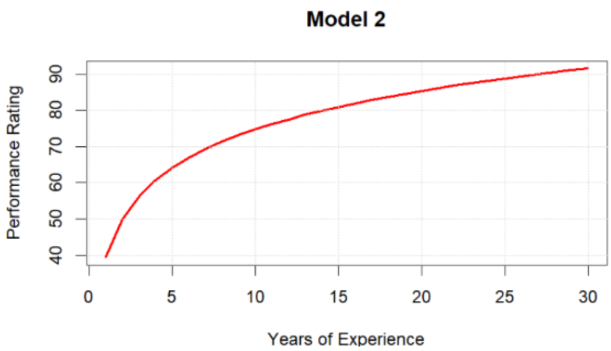
# 計量作業 0317

4.4a




b.




因為 ln 0 值不存在，所以 four artists 的資料就被剔除了。

c.

在 Model 1 中，β2 的斜率為 0.99，表達其他條件不變下，每增加一年經驗，

平均而言增加 0.99 的 Rating。

d.

```
> cat("marginal effect Model 2(EXPER=10): ",
+     marginal_effect_model2(10), "\n")
marginal effect Model 2(EXPER=10):  1.5312
> cat("marginal effect Model 2(EXPER=10): ",
+     marginal_effect_model2(20), "\n")
marginal effect Model 2(EXPER=10):  0.7656
```

e.

Model 1 的$R^2$是 0.3793

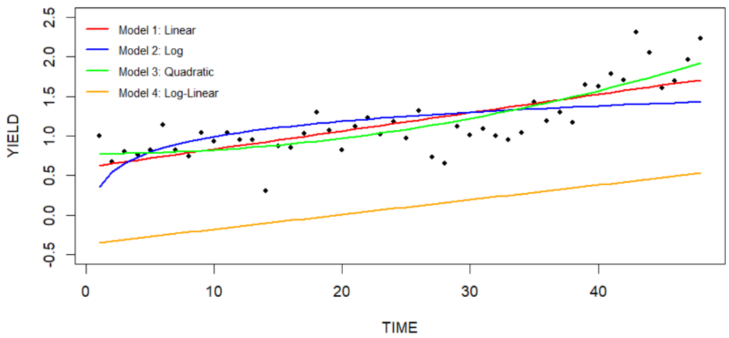
Model 2 的$R^2$是 0.6414

故 Model 2 的擬合度比 Model 1 好

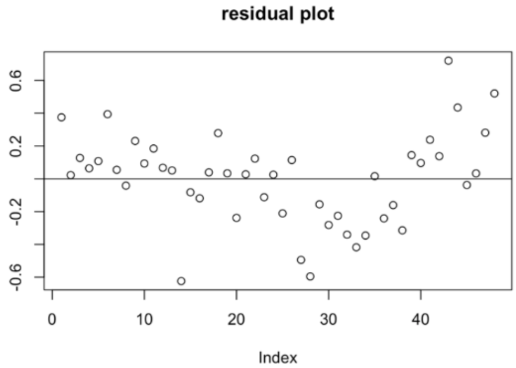
f.

在經濟意涵上 Model 2 比較合理一點，因為隨著經驗增長，對於 rating 的效果應該要呈現邊際效應遞減，此時解釋變數取 ln 較為符合。

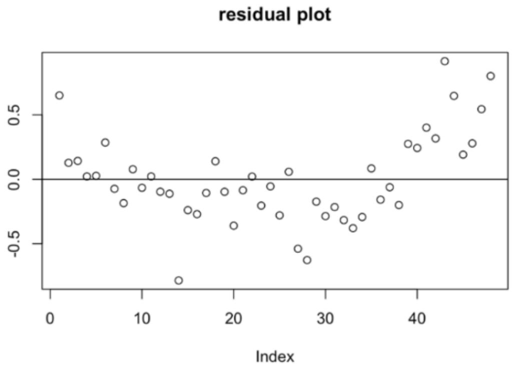
4.28a



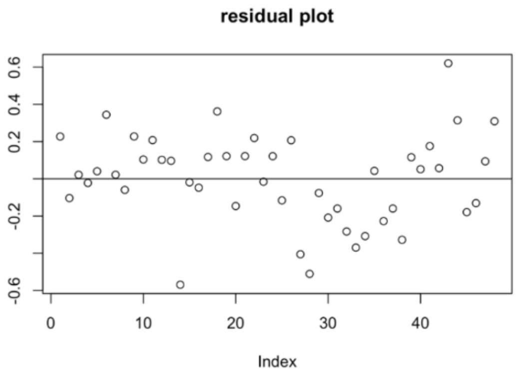

Linear



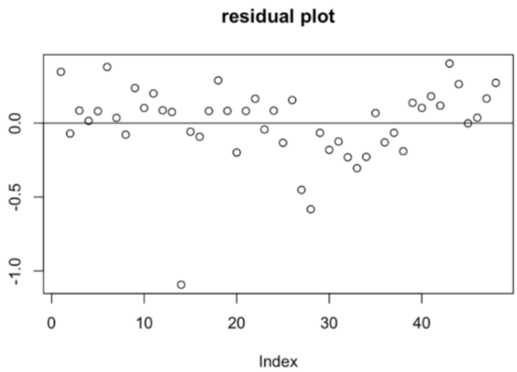

Linear-log




Quadratic




Log-linear



Error normality tests

| Model | W | p-value | R-square |
|---|---|---|---|
| linear | 0.98236 | 0.6792 | 0.5778 |
| log | 0.96657 | 0.1856 | 0.3385 |
| quadratic | 0.98589 | 0.8266 | 0.6890 |
| log-linear | 0.86894 | 0.00007205 | 0.5073 |

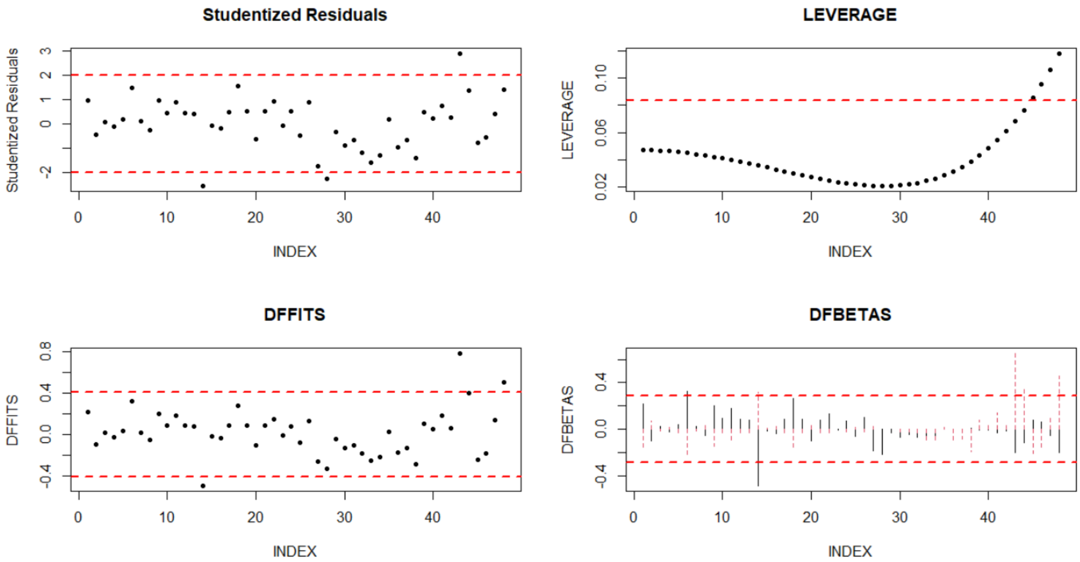
Quadratic 擁有最高的 p 值，表示其殘差最接近常態分布，較符合常態性假設。在 Shapiro-Wilk 檢定中，p 值越高，代表資料越有可能服從常態分布。

b.

```
Residuals:
     Min       1Q   Median       3Q      Max
-0.56899 -0.14970  0.03119  0.12176  0.62049

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 7.737e-01  5.222e-02   14.82  < 2e-16 ***
time2       4.986e-04  4.939e-05   10.10 3.01e-13 ***
```

時間變數的係數 $\gamma_1$ 代表時間對小麥產量的二次效應。當 $\gamma_1 > 0$ 時，表示產量的增長速度隨著時間呈現加速趨勢。

c.




d.

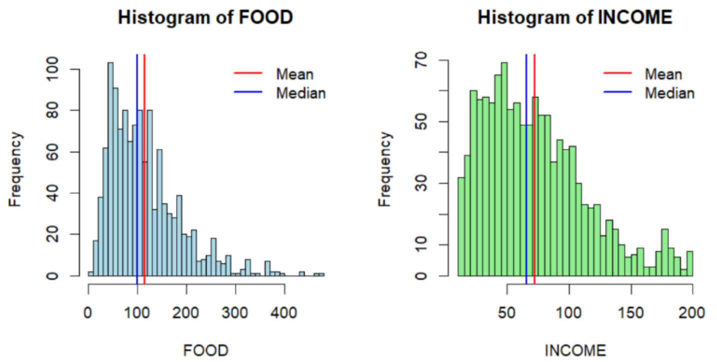
confidence interval = [1.4126, 2.4324]

YIELD = 2.2318 ∈ [1.4126, 2.4324]

the interval contains the true value.

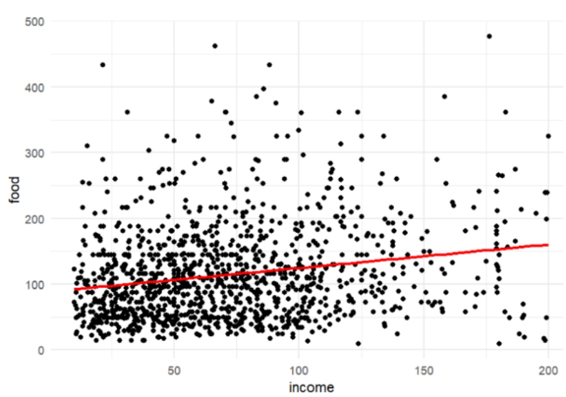
4.29 a.

| Statistic | Food | Income |
|---|---|---|
| Mean | 114.4431 | 72.14264 |
| Median | 99.8000 | 65.29000 |
| Min | 9.6300 | 10.00000 |
| Max | 476.6700 | 200.00000 |
| SD | 72.6575 | 41.65228 |




```
> jarque.bera.test(cex5_small$food)

        Jarque Bera Test

data:  cex5_small$food
X-squared = 648.65, df = 2, p-value < 2.2e-16

> jarque.bera.test(cex5_small$income)

        Jarque Bera Test

data:  cex5_small$income
X-squared = 148.21, df = 2, p-value < 2.2e-16
```

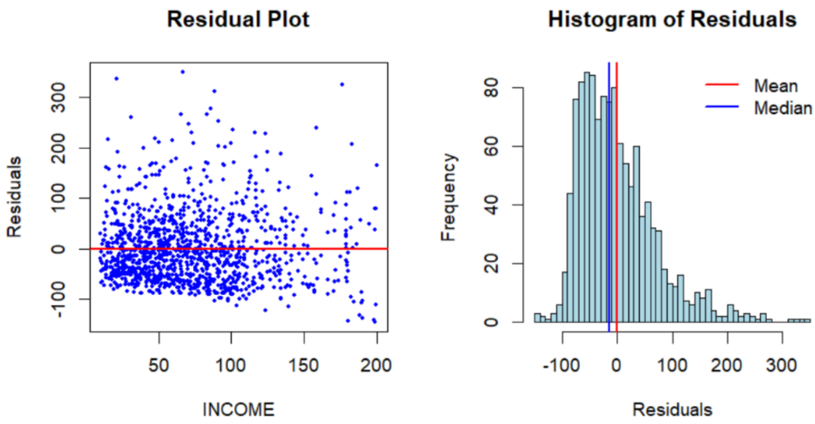
b.



```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 88.56650    4.10819  21.559  < 2e-16 ***
income       0.35869    0.04932   7.272 6.36e-13 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 71.13 on 1198 degrees of freedom
Multiple R-squared:  0.04228,	Adjusted R-squared:  0.04148 
F-statistic: 52.89 on 1 and 1198 DF,  p-value: 6.357e-13
```

```
                 2.5 %    97.5 %
(Intercept) 80.5064570 96.626543
income       0.2619215  0.455452
```

c.




```
> jarque.bera.test(residuals)

	Jarque Bera Test

data:  residuals
X-squared = 624.19, df = 2, p-value < 2.2e-16
```

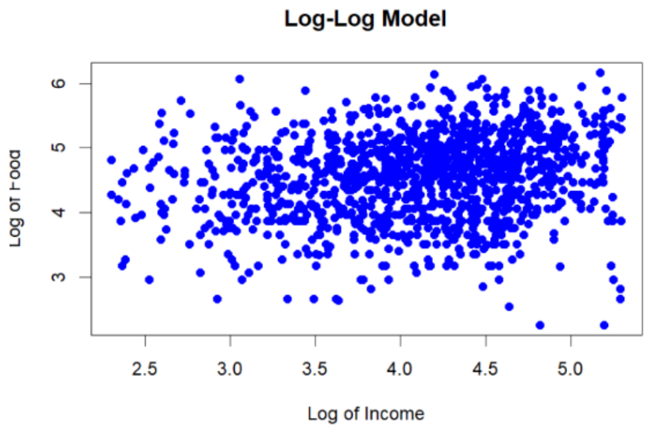
d.

| Income | Food_hat | ϵ | se_ϵ | ϵ_lower_bound | ϵ_upper_bound |
|---|---|---|---|---|---|
| 19 | 95.38155 | 0.07145038 | 0.00982475 | 0.05219423 | 0.09070654 |
| 65 | 111.88114 | 0.20838756 | 0.02865423 | 0.15222630 | 0.26454882 |
| 160 | 145.95638 | 0.39319883 | 0.05406661 | 0.28723022 | 0.49916745 |

隨著收入增加，食物支出的所得彈性也隨之上升，說明不同收入階層之間在食物消費上的彈性存在明顯差異。所得彈性的信賴區間彼此沒有重疊，顯示不同收入群體的食物消費行為在統計上有顯著差異。 一般認為食物是基本需求，因

此食物支出的所得彈性通常會隨著收入增加而降低或趨於穩定。然而，結果顯示彈性反而隨收入上升，這與傳統經濟理論的預測並不完全一致。

e.



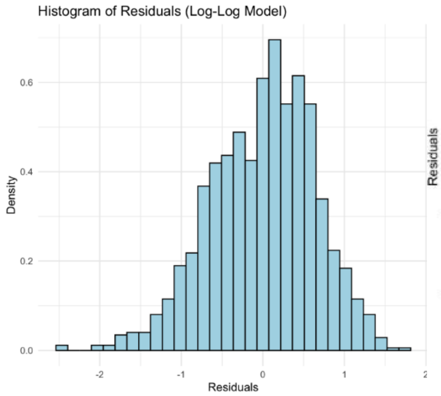

```
> print(r2_linear)
[1] 0.0422812
> print(r2_generalized)
[1] 0.0332564
```

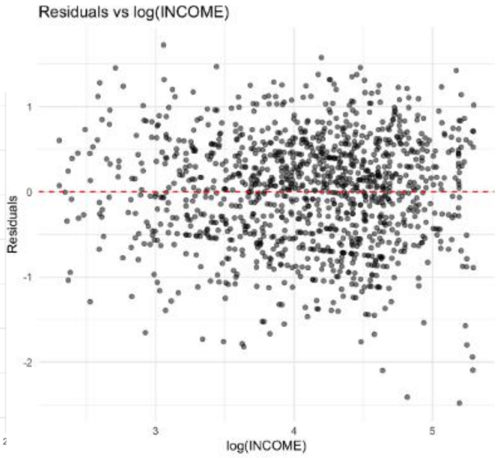
f.

```
Income: 19
Z-value: 3.743498
P-value: 0.0001814758
The two elasticities are significantly different (reject H0).

Income: 65
Z-value: -0.5407951
P-value: 0.5886488
No significant difference between the two elasticities (fail to reject H0).

Income: 160
Z-value: -3.367963
P-value: 0.0007572575
The two elasticities are significantly different (reject H0).
```

```
> print(ci_lower)
[1] 0.1293432
> print(ci_upper)
[1] 0.2432675
```

g.



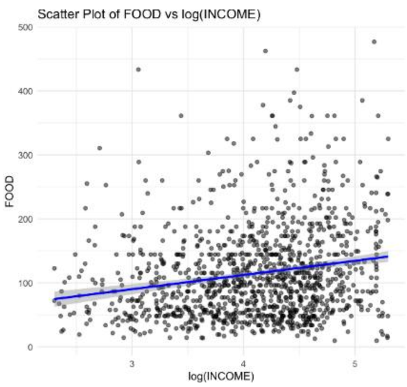

```
        Jarque Bera Test

data:  residuals_log
X-squared = 25.85, df = 2, p-value = 2.436e-06
```

1. 散點圖顯示，數據點隨機分佈於零附近，未顯示明顯的結構性偏誤。

2. 殘差分佈整體趨近常態，但左尾稍長，呈現一定程度的左偏分佈特性。

3. 由於 p 值低於顯著水準 0.05，故拒絕殘差常態性假設，意味殘差分佈不服從 常態。

h.



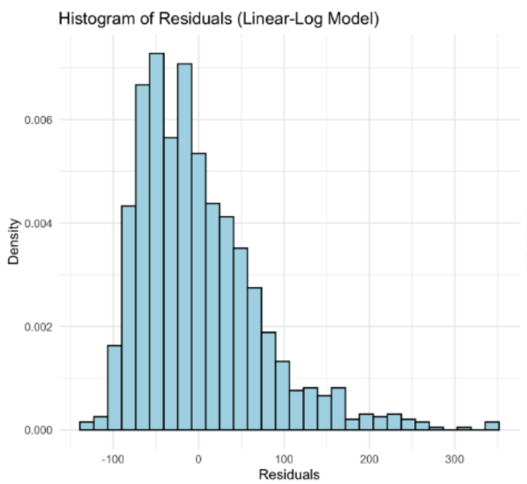

Linear model 更符合

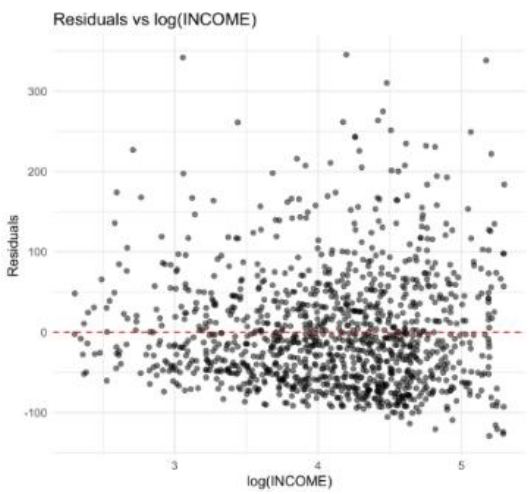
i.

log-log model 與 linear-log model：在各收入水準下，log-log model 與 linear-log model 所估計之彈性值於統計上並無顯著差異，結果顯示二者具一致性。

linear-log model 與 linear model：當收入分別為 19 與 160 時，兩模型之信賴區間並未重疊，顯示 linear-log model 與 linear-linear model 所估計之彈性值在統計上存在顯著差異。

j.




Jarque Bera Test

```
data:  residuals_lin_log
X-squared = 628.07, df = 2, p-value < 2.2e-16
```

k.

我選擇 log-log 模型，因為相比其他模型，它的殘差更符合常態分佈。