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LAMPIRAN

Lampiran 1. Penurunan Fungsi Log *Likelihood* $\left(\kappa, \boldsymbol{\beta}(u_i, v_i)\right)$

Turunan pertama fungsi log *likelihood* pada Persamaan (62) terhadap (κ) dinyatakan sebagai berikut:

$$\frac{\partial Q_1^*}{\partial(\kappa)} = \frac{\partial}{\partial(\kappa)}\left[\sum_{i=1}^{n}(1 - z_i^{(m)})\left[\sum_{b=0}^{y_i-1}\ln\left(b + \frac{1}{\kappa}\right) + y_i \ln(\kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i)) - \left(y_i + \frac{1}{\kappa}\right)\ln(1 + \kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i))\right] \boldsymbol{w}_{ij}(u_i, v_i)\right]$$

$$= \sum_{i=1}^{n}(1 - z_i^{(m)})\boldsymbol{w}_{ij}(u_i, v_i)\frac{\partial}{\partial(\kappa)}\left[\sum_{b=0}^{y_i-1}\ln\left(b + \frac{1}{\kappa}\right) + y_i \ln(\kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i)) - \left(y_i + \frac{1}{\kappa}\right)\ln(1 + \kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i))\right]$$

$$= \sum_{i=1}^{n}(1 - z_i^{(m)})\boldsymbol{w}_{ij}(u_i, v_i)\frac{\partial}{\partial(\kappa)}\left[\sum_{b=0}^{y_i-1}\ln\left(b + \frac{1}{\kappa}\right) + y_i(\ln(\kappa) + \ln \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i)) - \left(y_i + \frac{1}{\kappa}\right)\ln(1 + \kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i))\right]$$

Penjabaran turunan pada persamaan di atas untuk setiap bagian

$$\frac{\partial}{\partial(\kappa)}\left[\sum_{b=0}^{y_i-1}\ln\left(b + \frac{1}{\kappa}\right)\right] + \frac{\partial}{\partial(\kappa)}[y_i(\ln(\kappa) + \ln \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i))] + \frac{\partial}{\partial(\kappa)}\left[-\left(y_i + \frac{1}{\kappa}\right)\ln(1 + \kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i))\right]$$

Dapat dituliskan

Bagian I + Bagian II + Bagian III

Bagian I

$$\frac{\partial}{\partial(\kappa)}\left[\sum_{b=0}^{y_i-1}\ln\left(b + \frac{1}{\kappa}\right)\right] = \sum_{b=0}^{y_i-1}\frac{d}{d(\kappa)}\ln\left(b + \frac{1}{k}\right) = \sum_{b=0}^{y_i-1}\frac{1}{b+\frac{1}{\kappa}}\cdot\left(-\frac{1}{\kappa^2}\right) = -\sum_{b=0}^{y_i-1}\frac{1}{\kappa^2\left(b+\frac{1}{\kappa}\right)}$$

Bagian II

$$\frac{\partial}{\partial(\kappa)}[y_i(\ln(\kappa) + \ln \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i))] = \frac{y_i}{\kappa} + 0 = \frac{y_i}{\kappa}$$

Bagian III

$$\frac{\partial}{\partial(\kappa)}\left[-\left(y_i + \frac{1}{\kappa}\right)\ln(1 + \kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i))\right]$$

$$= -\left(-\frac{1}{\kappa^2}\cdot\ln(1 + \kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i)) + \left(y_i + \frac{1}{\kappa}\right)\frac{\exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i)}{(1 + \kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i))}\right)$$

$$= \frac{1}{\kappa^2}\ln(1 + \kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i)) - \left(y_i + \frac{1}{\kappa}\right)\cdot\frac{\exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i)}{(1 + \kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i))}$$

Sehingga diperoleh bentuk persamaan secara keseluruhan

$$\frac{\partial Q_1^*}{\partial(\kappa)} = \sum_{i=1}^{n}(1 - z_i^{(m)})\boldsymbol{w}_{ij}(u_i, v_i)\left[-\sum_{b=0}^{y_i-1}\frac{1}{\kappa^2\left(b+\frac{1}{\kappa}\right)} + \frac{y_i}{\kappa} + \frac{1}{\kappa^2}\ln(1 + \kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i)) - \left(y_i + \frac{1}{\kappa}\right)\cdot\frac{\exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i)}{(1 + \kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i))}\right]$$

Selanjutnya turunan kedua fungsi log *likelihood* pada Persamaan (64) terhadap (κ) dinyatakan sebagai berikut:

$$\frac{\partial^2 Q_1^*}{\partial^2(\kappa)} = \frac{\partial}{\partial(\kappa)}\sum_{i=1}^{n}(1 - z_i^{(m)})\boldsymbol{w}_{ij}(u_i, v_i)\left[-\sum_{b=0}^{y_i-1}\frac{1}{\kappa^2\left(b+\frac{1}{\kappa}\right)} + \frac{y_i}{\kappa} + \frac{1}{\kappa^2}\ln(1 + \kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i)) - \left(y_i + \frac{1}{\kappa}\right)\cdot\frac{\exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i)}{(1 + \kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i))}\right]$$

Lampiran 1. Penurunan Fungsi log *Likelihood* $(\kappa, \boldsymbol{\beta}(u_i, v_i))$ (Lanjutan)

$$= \sum_{i=1}^{n}(1 - z_i^{(m)})\boldsymbol{w}_{ij}(u_i, v_i)\frac{\partial}{\partial(\kappa)}\left[-\sum_{b=0}^{y_i-1}\frac{1}{\kappa^2\left(b+\frac{1}{\kappa}\right)} + \frac{y_i}{\kappa} + \frac{1}{\kappa^2}\ln(1 + \kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i, v_i)) - \left(y_i + \frac{1}{\kappa}\right)\cdot\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))}\right]$$

Penjabaran turunan pada persamaan di atas untuk setiap bagian

$$\frac{\partial}{\partial(\kappa)}\left[-\sum_{b=0}^{y_i-1}\frac{1}{\kappa^2\left(b+\frac{1}{\kappa}\right)}\right] + \frac{\partial}{\partial(\kappa)}\left[\frac{y_i}{\kappa}\right] + \frac{\partial}{\partial(\kappa)}\left[\frac{1}{\kappa^2}\ln(1 + \kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i, v_i))\right] + \frac{\partial}{\partial(\kappa)}\left[-\left(y_i + \frac{1}{\kappa}\right)\cdot\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))}\right]$$

Dapat dituliskan

Bagian I + Bagian II + Bagian III + Bagian IV

Bagian I

$$\frac{\partial}{\partial(\kappa)}\left[-\sum_{b=0}^{y_i-1}\frac{1}{\kappa^2\left(b+\frac{1}{\kappa}\right)}\right] = -\sum_{b=0}^{y_i-1}\frac{d}{d(\kappa)}\left(\frac{1}{\kappa^2 b+\kappa}\right) = -\sum_{b=0}^{y_i-1}\frac{u'v-uv'}{v^2}$$

$$= -\sum_{b=0}^{y_i-1}\frac{0\cdot(\kappa^2 b+\kappa)-1\cdot(2\kappa b+1)}{(\kappa^2 b+\kappa)^2} = -\sum_{b=0}^{y_i-1}\frac{-(2\kappa b+1)}{(\kappa^2 b+\kappa)^2} = \sum_{b=0}^{y_i-1}\frac{(2\kappa b+1)}{(\kappa^2 b+\kappa)^2}$$

Bagian II

$$\frac{\partial}{\partial(\kappa)}\left[\frac{y_i}{\kappa}\right] = -\frac{y_i}{\kappa^2}$$

Bagian III

$$\frac{\partial}{\partial(\kappa)}\left[\frac{1}{k^2}\ln(1 + \kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i, v_i))\right] = -\frac{2}{\kappa^3}\ln(1 + \kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i, v_i)) + \frac{1}{\kappa^2}\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))}$$

Bagian IV

$$\frac{\partial}{\partial(\kappa)}\left[-\left(y_i + \frac{1}{\kappa}\right)\cdot\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))}\right]$$

$$= -\left(-\frac{1}{\kappa^2}\cdot\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))} - \left(y_i + \frac{1}{\kappa}\right)\cdot\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)\cdot(\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))}{(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))^2}\right)$$

$$= \frac{1}{\kappa^2}\cdot\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))} + \left(y_i + \frac{1}{\kappa}\right)\cdot\frac{(\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))^2}{(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))^2}$$

Sehingga diperoleh bentuk persamaan secara keseluruhan

$$\frac{\partial^2 Q_1^*}{\partial^2(\kappa)} = \sum_{i=1}^{n}(1 - z_i^{(m)})\boldsymbol{w}_{ij}(u_i, v_i)\left[\sum_{b=0}^{y_i-1}\frac{(2\kappa b+1)}{(\kappa^2 b+\kappa)^2} - \frac{y_i}{\kappa^2} - \frac{2}{\kappa^3}\cdot\ln(1 + \kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i, v_i)) + \frac{1}{\kappa^2}\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))} + \frac{1}{\kappa^2}\cdot\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))} - \left(y_i + \frac{1}{\kappa}\right)\cdot\frac{(\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))^2}{(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))^2}\right]$$

Turunan pertama fungsi log *likelihood* pada Persamaan (62) terhadap $(\boldsymbol{\beta}(u_i, v_i))$ dinyatakan sebagai berikut:

$$\frac{\partial Q_1^*}{\partial(\boldsymbol{\beta}(u_i,v_i))} = \frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))}\sum_{i=1}^{n}(1 - z_i^{(m)})\left[\sum_{b=0}^{y_i-1}\ln\left(b + \frac{1}{k}\right) + y_i\ln(\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i, v_i)) - \left(y_i + \frac{1}{k}\right)\ln(1 + \kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i, v_i))\right]\boldsymbol{w}_{ij}(u_i, v_i)$$

Lampiran 1. Penurunan Fungsi log *Likelihood* $\left(\kappa,\boldsymbol{\beta}(u_i,v_i)\right)$ (Lanjutan)

$$= \sum_{i=1}^{n}(1-z_i^{(m)})\boldsymbol{w}_{ij}(u_i,v_i)\frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))}\left[\sum_{b=0}^{y_i-1}\ln\left(b+\frac{1}{k}\right)+ y_i\ln(\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))-\left(y_i+\frac{1}{k}\right)\ln(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))\right]$$

Turunan terhadap vektor $\boldsymbol{\beta}(u_i,v_i)$ pada persamaan di atas dapat dituliskan

$$\frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))}\left[\sum_{b=0}^{y_i-1}\ln\left(b+\frac{1}{k}\right)+y_i\ln(\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))-\left(y_i+\frac{1}{k}\right)\ln(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))\right]$$

$$= \frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))}\left[\sum_{b=0}^{y_i-1}\ln\left(b+\frac{1}{k}\right)+y_i\ln\left(\kappa\exp[1\quad x_{i1}\quad x_{i2}\quad x_{i3}]\begin{bmatrix}\beta_0(u_i,v_i)\\\beta_1(u_i,v_i)\\\beta_2(u_i,v_i)\\\beta_3(u_i,v_i)\end{bmatrix}\right)-\left(y_i+\frac{1}{k}\right)\ln\left(1+\kappa\exp[1\quad x_{i1}\quad x_{i2}\quad x_{i3}]\begin{bmatrix}\beta_0(u_i,v_i)\\\beta_1(u_i,v_i)\\\beta_2(u_i,v_i)\\\beta_3(u_i,v_i)\end{bmatrix}\right)\right]$$

$$= \frac{\partial}{\partial\boldsymbol{\beta}(u_i,v_i)}\left[\sum_{b=0}^{y_i-1}\ln\left(b+\frac{1}{k}\right)+y_i\ln\left(\kappa\exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p}\beta_j(u_i,v_i)x_{ij}\right)\right)-\left(y_i+\frac{1}{k}\right)\ln\left(1+\kappa\exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p}\beta_j(u_i,v_i)x_{ij}\right)\right)\right]$$

Penjabaran turunan pada persamaan di atas untuk setiap bagian

$$= \frac{\partial}{\partial\boldsymbol{\beta}(u_i,v_i)}\left[\sum_{b=0}^{y_i-1}\ln\left(b+\frac{1}{k}\right)\right]+\frac{\partial}{\partial\boldsymbol{\beta}(u_i,v_i)}\left[y_i\ln\left(\kappa\exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p}\beta_j(u_i,v_i)x_{ij}\right)\right)\right]+ \frac{\partial}{\partial\boldsymbol{\beta}(u_i,v_i)}\left[-\left(y_i+\frac{1}{k}\right)\ln\left(1+\kappa\exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p}\beta_j(u_i,v_i)x_{ij}\right)\right)\right]$$

$$= 0+\frac{\partial}{\partial\boldsymbol{\beta}(u_i,v_i)}\left[y_i\ln\left(\kappa\exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p}\beta_j(u_i,v_i)x_{ij}\right)\right)\right]- \frac{\partial}{\partial\boldsymbol{\beta}(u_i,v_i)}\left[\left(y_i+\frac{1}{k}\right)\ln\left(1+\kappa\exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p}\beta_j(u_i,v_i)x_{ij}\right)\right)\right]$$

Dapat dituliskan

0 + Bagian I + Bagian II

Diketahui

$\beta_0(u_i,v_i)+\sum_{j=1}^{p}\beta_j(u_i,v_i)x_{ij} = \boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)$

$x_{ip} = [1\quad x_{i1}\quad x_{i2}\quad \dots\quad x_{ip}] = \boldsymbol{x}_i^T$

$x_{i0} = 1$

1. Bagian I

   Terhadap $\beta_0(u_i,v_i)$

   $$\frac{\partial}{\partial(\beta_0(u_i,v_i))}\left[y_i\ln\left(\kappa\exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p}\beta_j(u_i,v_i)x_{ij}\right)\right)\right]$$

   $$= \frac{\partial}{\partial(\beta_0(u_i,v_i))}\left[y_i\ln(\kappa)+y_i\ln\left(\exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p}\beta_j(u_i,v_i)x_{ij}\right)\right)\right]$$

   $$= \frac{\partial}{\partial(\beta_0(u_i,v_i))}\left[y_i\ln(\kappa)+y_i\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p}\beta_j(u_i,v_i)x_{ij}\right)\right]$$

   $$= [0+y_ix_{i0}+0+0+0] = y_ix_{i0}$$

   Terhadap $\beta_1(u_i,v_i)$

   $$\frac{\partial}{\partial(\beta_1(u_i,v_i))}\left[y_i\ln\left(\kappa\exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p}\beta_j(u_i,v_i)x_{ij}\right)\right)\right]$$

Lampiran 1. Penurunan Fungsi log *Likelihood* $\left(\kappa, \boldsymbol{\beta}(u_i, v_i)\right)$ (Lanjutan)

$= \frac{\partial}{\partial(\beta_1(u_i,v_i))}\left[y_i \ln(\kappa) + y_i\left(\beta_0(u_i, v_i) + \sum_{j=1}^{p} \beta_j(u_i, v_i)x_{ij}\right)\right]$

$= [0 + 0 + y_i x_{i1} + 0 + 0] = y_i x_{i1}$

Terhadap $\beta_1(u_i, v_i)$

$= y_i x_{i1}$

Terhadap $\beta_p(u_i, v_i)$

$= y_i x_{ip}$

Maka bentuk umumnya

$$\frac{\partial}{\partial\left(\boldsymbol{\beta}(u_i, v_i)\right)} = y_i \boldsymbol{x}_i^T$$

2. Bagian II

Terhadap $\beta_0(u_i, v_i)$

$\frac{\partial}{\partial(\beta_0(u_i,v_i))}\left[-\left(y_i + \frac{1}{k}\right)\ln\left(1 + \kappa \exp\left(\beta_0(u_i, v_i) + \sum_{j=1}^{p} \beta_j(u_i, v_i)x_{ij}\right)\right)\right]$

$= -\frac{\partial}{\partial(\beta_0(u_i,v_i))}\left[\left(y_i + \frac{1}{k}\right)\ln\left(1 + \kappa \exp\left(\beta_0(u_i, v_i) + \sum_{j=1}^{p} \beta_j(u_i, v_i)x_{ij}\right)\right)\right]$

$= -\left(y_i + \frac{1}{k}\right)\frac{1}{\left(1+\kappa \exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p} \beta_j(u_i,v_i)x_{ij}\right)\right)}\left(\kappa \exp\left(\beta_0(u_i, v_i) + \sum_{j=1}^{p} \beta_j(u_i, v_i)x_{ij}\right)\right)x_{i0}$

$= -\left(y_i + \frac{1}{k}\right)\frac{\kappa \exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p} \beta_j(u_i,v_i)x_{ij}\right)}{1+\kappa \exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p} \beta_j(u_i,v_i)x_{ij}\right)}x_{i0}$

Terhadap $\beta_1(u_i, v_i)$

$\frac{\partial}{\partial(\beta_1(u_i,v_i))}\left[-\left(y_i + \frac{1}{k}\right)\ln\left(1 + \kappa \exp\left(\beta_0(u_i, v_i) + \sum_{j=1}^{p} \beta_j(u_i, v_i)x_{ij}\right)\right)\right]$

$= -\left(y_i + \frac{1}{k}\right)\frac{\kappa \exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p} \beta_j(u_i,v_i)x_{ij}\right)}{1+\kappa \exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p} \beta_j(u_i,v_i)x_{ij}\right)}x_{i1}$

Terhadap $\beta_p(u_i, v_i)$

$= -\left(y_i + \frac{1}{k}\right)\frac{\kappa \exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p} \beta_j(u_i,v_i)x_{ij}\right)}{1+\kappa \exp\left(\beta_0(u_i,v_i)+\sum_{j=1}^{p} \beta_j(u_i,v_i)x_{ij}\right)}x_{ip}$

Maka bentuk umumnya

$$\frac{\partial}{\partial\left(\boldsymbol{\beta}(u_i, v_i)\right)} = -\left(y_i + \frac{1}{k}\right)\frac{\kappa \exp\left(\boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i)\right)}{1 + \kappa \exp\left(\boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i)\right)}\boldsymbol{x}_i^T$$

Sehingga diperoleh bentuk umum persamaan secara keseluruhan

$$\frac{\partial Q_1^*}{\partial(\boldsymbol{\beta}(u_i,v_i))} = \sum_{i=1}^{n}(1 - z_i^{(m)})\boldsymbol{w}_{ij}(u_i, v_i)\left[y_i \boldsymbol{x}_i^T - \left(y_i + \frac{1}{\kappa}\right)\frac{\kappa \exp\left(\boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)}{1+\kappa \exp\left(\boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)}\boldsymbol{x}_i^T\right]$$

$$= \sum_{i=1}^{n}(1 - z_i^{(m)})\boldsymbol{w}_{ij}(u_i, v_i)\left[y_i - \left(y_i + \frac{1}{\kappa}\right)\frac{\kappa \exp\left(\boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)}{1+\kappa \exp\left(\boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)}\right]\boldsymbol{x}_i^T$$

Selanjutnya turunan kedua fungsi log *likelihood* pada Persamaan (66) terhadap $(\boldsymbol{\beta}(u_i, v_i))$ dinyatakan sebagai berikut:

Lampiran 1. Penurunan Fungsi log *Likelihood* $(\kappa, \boldsymbol{\beta}(u_i, v_i))$ (Lanjutan)

$$\frac{\partial^2 Q_1^*}{\partial^2(\boldsymbol{\beta}(u_i,v_i))} = \frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))} \sum_{i=1}^{n} (1 - z_i^{(m)}) \boldsymbol{w}_{ij}(u_i, v_i) \left[y_i - \left(y_i + \frac{1}{\kappa} \right) \frac{\kappa \exp\left(\boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)}{1+\kappa \exp\left(\boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)} \right] \boldsymbol{x}_i^T$$

$$= \sum_{i=1}^{n} (1 - z_i^{(m)}) \boldsymbol{w}_{ij}(u_i, v_i) \boldsymbol{x}_i^T \frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))} \left[y_i - \left(y_i + \frac{1}{\kappa} \right) \frac{\kappa \exp\left(\boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)}{1+\kappa \exp\left(\boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)} \right]$$

Penjabaran turunan pada persamaan di atas untuk setiap bagian

$$\frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))} [y_i] + \frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))} \left[-\left(y_i + \frac{1}{k} \right) \frac{\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}}{1+\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}} \right]$$

$$= 0 + \frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))} \left[-\left(y_i + \frac{1}{k} \right) \frac{\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}}{1+\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}} \right]$$

Dapat ditulis

0 + Bagian I

Bagian I

Terhadap $\beta_0(u_i, v_i)$

$$\frac{\partial}{\partial(\beta_0(u_i,v_i))} \left[-\left(y_i + \frac{1}{k} \right) \frac{\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}}{1+\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}} \right]$$

$$= -\frac{\partial}{\partial(\beta_0(u_i,v_i))} \left[\frac{\left(y_i+\frac{1}{k}\right)\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}}{1+\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}} \right]$$

$$= -\frac{u'v - uv\prime}{v^2}\ \kappa e^{\boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)} x_{i0}$$

$$= -\frac{\left(y_i+\frac{1}{k}\right)\left(1+\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}\right) - \left(y_i+\frac{1}{k}\right)\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}(1)}{\left(1+\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}\right)^2} \kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)} x_{i0}$$

$$= -\frac{\left(y_i+\frac{1}{k}\right)}{\left(1+\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}\right)^2} \kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)} x_{i0}$$

$$= -\frac{\left(y_i+\frac{1}{k}\right)\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}}{\left(1+\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}\right)^2} x_{i0}$$

Terhadap $\beta_1(u_i, v_i)$

$$\frac{\partial}{\partial(\beta_0(u_i,v_i))} \left[-\left(y_i + \frac{1}{k} \right) \frac{\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}}{1+\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}} \right]$$

$$= -\frac{\left(y_i+\frac{1}{k}\right)\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}}{\left(1+\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}\right)^2} x_{i1}$$

Terhadap $\beta_p(u_i, v_i)$

$$= -\frac{\left(y_i+\frac{1}{k}\right)\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}}{\left(1+\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}\right)^2} x_{ip}$$

Maka bentuk umumnya

$$\frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))} = -\frac{\left(y_i + \frac{1}{k}\right)\kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}}{\left(1 + \kappa e^{x_i^T \boldsymbol{\beta}(u_i,v_i)}\right)^2} \boldsymbol{x}_i^T$$

Lampiran 1. Penurunan Fungsi log *Likelihood* $\left(\kappa, \boldsymbol{\beta}(u_i, v_i)\right)$ (Lanjutan)

Sehingga diperoleh bentuk umum persamaan secara keseluruhan

$$\frac{\partial^2 Q_1^*}{\partial^2(\boldsymbol{\beta}(u_i,v_i))} =$$

$$-\sum_{i=1}^{n}(1-z_i^{(m)})\boldsymbol{w}_{ij}(u_i,v_i)\boldsymbol{x}_i^T\left[\left(\left(y_i+\frac{1}{k}\right)\left(\frac{\kappa\exp\left(\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)\right)}{\left(1+\kappa\exp\left(\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)\right)\right)^2}\right)\right)\boldsymbol{x}_i^T\right]$$

Untuk turunan parsial kedua fungsi log *likelihood* pada Persamaan (62) terhadap parameter dispersi κ dan parameter regresi $\boldsymbol{\beta}(u_i, v_i)$ dinyatakan sebagai berikut:

$$\frac{\partial^2 Q_1^*}{\partial(\kappa)\partial(\boldsymbol{\beta}(u_i,v_i))} = \frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))}\sum_{i=1}^{n}(1-z_i^{(m)})\boldsymbol{w}_{ij}(u_i,v_i)\left[-\sum_{b=0}^{y_i-1}\frac{1}{\kappa^2\left(b+\frac{1}{\kappa}\right)}+\frac{y_i}{\kappa}+\frac{1}{\kappa^2}\ln(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))-\left(y_i+\frac{1}{\kappa}\right)\cdot\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))}\right]$$

$$=\sum_{i=1}^{n}(1-z_i^{(m)})\boldsymbol{w}_{ij}(u_i,v_i)\frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))}\left[-\sum_{b=0}^{y_i-1}\frac{1}{\kappa^2\left(b+\frac{1}{\kappa}\right)}+\frac{y_i}{\kappa}+\frac{1}{\kappa^2}\ln(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))-\left(y_i+\frac{1}{\kappa}\right)\cdot\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))}\right]$$

Penjabaran turunan pada persamaan di atas untuk setiap bagian

$$\frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))}\left[-\sum_{b=0}^{y_i-1}\frac{1}{\kappa^2\left(b+\frac{1}{\kappa}\right)}\right]+\frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))}\left[\frac{y_i}{\kappa}\right]+\frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))}\left[\frac{1}{\kappa^2}\ln(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))\right]+\frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))}\left[-\left(y_i+\frac{1}{\kappa}\right)\cdot\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))}\right]$$

$$=0+0+\frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))}\left[\frac{1}{\kappa^2}\ln(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))\right]+\frac{\partial}{\partial(\boldsymbol{\beta}(u_i,v_i))}\left[-\left(y_i+\frac{1}{\kappa}\right)\cdot\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))}\right]$$

Dapat dituliskan

0 + 0 + Bagian I +Bagian II

1 Bagian I

Terhadap $\beta_0(u_i, v_i)$

$$\frac{\partial}{\partial(\beta_0(u_i,v_i))}\left[\frac{1}{k^2}\ln(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))\right]$$

$$=\frac{1}{k^2}\cdot\frac{1}{1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)\,x_{i0}=\frac{1}{k^2}\cdot\frac{\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}x_{i0}$$

$$=\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{\kappa(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))}x_{i0}$$

Terhadap $\beta_1(u_i, v_i)$

$$=\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{\kappa(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))}x_{i1}$$

Terhadap $\beta_p(u_i, v_i)$

$$=\frac{\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i)}{\kappa(1+\kappa\exp\boldsymbol{x}_i^T\boldsymbol{\beta}(u_i,v_i))}x_{ip}$$

Lampiran 1. Penurunan Fungsi log *Likelihood* $\left(\kappa, \boldsymbol{\beta}(u_i, v_i)\right)$ (Lanjutan)

Bentuk Umum bagian I

$$\frac{\partial}{\partial\left(\boldsymbol{\beta}(u_i, v_i)\right)} = \frac{\exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i)}{\kappa(1 + \kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i))} \boldsymbol{x}_i^T$$

2 Bagian II

Terhadap $\beta_0(u_i, v_i)$

$$\frac{\partial}{\partial\left(\beta_{\boldsymbol{0}}(u_i,v_i)\right)}\left[-\left(y_i + \frac{1}{\kappa}\right) \cdot \frac{\exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)}{\left(1+\kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)}\right] =$$

$$-\frac{\partial}{\partial(\beta_{\boldsymbol{0}}(u_i,v_i))}\left[\left(y_i + \frac{1}{\kappa}\right) \cdot \frac{\exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)}{\left(1+\kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)}\right]$$

$$= -\left(0 + \left(y_i + \frac{1}{\kappa}\right) \cdot \frac{u'v - uv'}{v^2}\right)$$

$$= -\left(y_i + \frac{1}{\kappa}\right) \cdot \frac{\exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i) x_{i0} \left(1+\kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right) - \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\left(\kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right) x_{i0}}{\left(1+\kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)^2}$$

$$= -\frac{\left(y_i+\frac{1}{\kappa}\right) \cdot \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)}{\left(1+\kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)^2} x_{i0}$$

Terhadap $\beta_1(u_i, v_i)$

$$\frac{\partial}{\partial(\beta_{\boldsymbol{1}}(u_i,v_i))}\left[-\left(y_i + \frac{1}{\kappa}\right) \cdot \frac{\exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)}{\left(1+\kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)}\right]$$

$$= -\frac{\left(y_i+\frac{1}{\kappa}\right) \cdot \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)}{\left(1+\kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)^2} x_{i1}$$

Terhadap $\beta_p(u_i, v_i)$

$$= -\frac{\left(y_i+\frac{1}{\kappa}\right) \cdot \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)}{\left(1+\kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)^2} x_{ip}$$

Bentuk Umum Bagian II

$$\frac{\partial}{\partial\left(\boldsymbol{\beta}(u_i, v_i)\right)} = -\frac{\left(y_i + \frac{1}{\kappa}\right) \cdot \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i)}{(1 + \kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i, v_i))^2} \boldsymbol{x}_i^T$$

Sehingga diperoleh bentuk umum persamaan secara keseluruhan

$$\frac{\partial^2 Q_1^*}{\partial(\kappa)\partial\left(\boldsymbol{\beta}(u_i,v_i)\right)} =$$

$$\sum_{i=1}^n (1 - z_i^{(m)}) \boldsymbol{w}_{ij}(u_i, v_i) \left[\frac{\exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)}{\kappa\left(1+\kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)} \boldsymbol{x}_i^T - \frac{\left(y_i+\frac{1}{\kappa}\right) \cdot \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)}{\left(1+\kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)^2} \boldsymbol{x}_i^T\right]$$

$$= \sum_{i=1}^n (1 - z_i^{(m)}) \boldsymbol{w}_{ij}(u_i, v_i) \left[\frac{\exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)}{\kappa\left(1+\kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)} - \frac{\left(y_i+\frac{1}{\kappa}\right) \cdot \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)}{\left(1+\kappa \exp \boldsymbol{x}_i^T \boldsymbol{\beta}(u_i,v_i)\right)^2}\right] \boldsymbol{x}_i^T$$

Lampiran 2. Penurunan Fungsi log *Likelihood* $(\boldsymbol{\gamma}(u_i, v_i))$

Turunan pertama fungsi log *likelihood* pada Persamaan (69) terhadap $(\boldsymbol{\gamma}(u_i, v_i))$ dinyatakan sebagai berikut:

$$\frac{\partial Q_2^*}{\partial(\boldsymbol{\gamma}(u_i,v_i))} = \frac{\partial}{\partial\boldsymbol{\gamma}(u_i,v_i)}\sum_{i=1}^{n}\left(1 - z_i{}^{(m)}\right)\boldsymbol{w}_{ij}(u_i,v_i)\left[y_i\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right) - \ln\left(1 + \exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)\right]$$

$$= \sum_{i=1}^{n}\left(1 - z_i{}^{(m)}\right)\boldsymbol{w}_{ij}(u_i,v_i)\frac{\partial}{\partial\boldsymbol{\gamma}(u_i,v_i)}\left[y_i\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right) - \ln\left(1 + \exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)\right]$$

Penjabaran turunan pada persamaan di atas untuk setiap bagian

$$\frac{\partial}{\partial\boldsymbol{\gamma}(u_i,v_i)}\left[y_i\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right] + \frac{\partial}{\partial\boldsymbol{\gamma}(u_i,v_i)}\left[-\ln\left(1 + \exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)\right]$$

Dapat ditulis

Bagian I + Bagian II

1. Bagian I

   Terhadap γ_0

   $$\frac{\partial}{\partial\gamma_0(u_i,v_i)}\left[y_i\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right] = y_i x_{i0}$$

   Terhadap γ_1

   $$\frac{\partial}{\partial\gamma_1(u_i,v_i)}\left[y_i\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right]$$

   $$= y_i x_{i1}$$

   Terhadap γ_p

   $$= y_i x_{ip}$$

   Bentuk Umum Bagian I

   $$\frac{\partial}{\partial(\boldsymbol{\gamma}(u_i,v_i))} = y_i\boldsymbol{x}_i^T$$

2. Bagian II

   Terhadap γ_0

   $$\frac{\partial}{\partial\gamma_0(u_i,v_i)}\left[-\ln\left(1 + \exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)\right] = -\frac{\partial}{\partial\gamma_0(u_i,v_i)}\left[\ln\left(1 + \exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)\right]$$

   $$= -\frac{1}{1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)x_{i0}$$

   $$= \frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}x_{i0}$$

   Terhadap γ_1

   $$\frac{\partial}{\partial\gamma_0(u_i,v_i)}\left[-\ln\left(1 + \exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)\right]$$

   $$= \frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}x_{i1}$$

   Terhadap γ_p

   $$= \frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}x_{ip}$$

Lampiran 2. Penurunan Fungsi log *Likelihood* $(\boldsymbol{\gamma}(u_i, v_i))$ (Lanjutan)

Bentuk Umum Bagian II

$$\frac{\partial}{\partial(\boldsymbol{\gamma}(u_i,v_i))} = \frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}\boldsymbol{x}_i^T$$

Sehingga diperoleh bentuk umum persamaan secara keseluruhan

$$\frac{\partial Q_2^*}{\partial(\boldsymbol{\gamma}(u_i,v_i))} = \sum_{i=1}^n \left(1 - z_i{}^{(m)}\right)\boldsymbol{w}_{ij}(u_i, v_i)\left[y_i\boldsymbol{x}_i^T - \frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)}\boldsymbol{x}_i^T\right]$$

$$= \sum_{i=1}^n \left(1 - z_i{}^{(m)}\right)\boldsymbol{w}_{ij}(u_i, v_i)\left[\left(y_i - \frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)}\right)\boldsymbol{x}_i^T\right]$$

Selanjutnya turunan kedua fungsi log *likelihood* pada Persamaan (70) terhadap $(\boldsymbol{\gamma}(u_i, v_i))$ dinyatakan sebagai berikut:

$$\frac{\partial^2 Q_2^*}{\partial^2(\boldsymbol{\gamma}(u_i,v_i))} = \frac{\partial}{\partial\boldsymbol{\gamma}(u_i,v_i)}\sum_{i=1}^n \left(1 - z_i{}^{(m)}\right)\boldsymbol{w}_{ij}(u_i, v_i)\left[\left(y_i - \frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)}\right)\boldsymbol{x}_i^T\right]$$

$$= \sum_{i=1}^n \left(1 - z_i{}^{(m)}\right)\boldsymbol{w}_{ij}(u_i, v_i)\boldsymbol{x}_i^T\frac{\partial}{\partial\boldsymbol{\gamma}(u_i,v_i)}\left[y_i - \frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)}\right]$$

Penjabaran turunan pada persamaan di atas untuk setiap bagian

$$\frac{\partial}{\partial\boldsymbol{\gamma}(u_i,v_i)}[y_i] + \frac{\partial}{\partial\boldsymbol{\gamma}(u_i,v_i)}\left[-\frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)}\right]$$

$$= 0 + \frac{\partial}{\partial\boldsymbol{\gamma}(u_i,v_i)}\left[-\frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)}\right]$$

Dapat ditulis

0 + Bagian I

Bagian I

Terhadap γ_0

$$\frac{\partial}{\partial\gamma_0(u_i,v_i)}\left[-\frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)}\right]$$

$$= -\frac{\partial}{\partial\gamma_0(u_i,v_i)}\left[\frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)}\right]$$

$$= -\frac{u'v - uv'}{v^2}$$

$$= -\left(\frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right) - \exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)^2}\right)x_{i0}$$

$$= -\left(\frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)^2}\right)x_{i0}$$

Terhadap γ_1

$$\frac{\partial}{\partial\gamma_1(u_i,v_i)}\left[-\frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)}\right]$$

$$= -\left(\frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)^2}\right)x_{i1}$$

Lampiran 2. Penurunan Fungsi log *Likelihood* $\left(\boldsymbol{\gamma}(u_i, v_i)\right)$ (Lanjutan)

Terhadap γ_p

$$= -\left(\frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)^2}\right)x_{ip}$$

Bentuk Umum Bagian I

$$\frac{\partial}{\partial(\boldsymbol{\gamma}(u_i,v_i))} = -\left(\frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)^2}\right)\boldsymbol{x}_i^T$$

Sehingga diperoleh bentuk umum persamaan secara keseluruhan

$$\frac{\partial^2 Q_2^*}{\partial^2(\boldsymbol{\gamma}(u_i,v_i))} = -\sum_{i=1}^{n}\left(1 - z_i{}^{(m)}\right)\boldsymbol{w}_{ij}(u_i, v_i)\,\boldsymbol{x}_i^T\left[\left(\frac{\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)}{\left(1+\exp\left(\boldsymbol{x}_i^T\boldsymbol{\gamma}(u_i,v_i)\right)\right)^2}\right)\boldsymbol{x}_i^T\right]$$

Lampiran 3. Data dan Koordinat Kabupaten/Kota di Sulawesi Selatan

Kabupaten/Kota	Lintang	Bujur	Y	X1	X2	X3
Kepulauan Selayar	-6,12026	120,46631	2	4,84	80,26	25
Bulukumba	-5,55833	120,19315	0	13,12	77,92	33,09
Bantaeng	-5,55371	119,96704	0	3,73	68,36	92,54
Jeneponto	-5,67679	119,7493	2	3,43	76,55	83,19
Takalar	-5,42607	119,44103	0	1,22	39,92	78
Gowa	-5,20042	119,45299	0	2,34	79,45	90,42
Sinjai	-5,12008	120,23544	3	4,53	85,34	51,25
Maros	-5,01637	119,57441	0	3,98	64,89	67,96
Pangkajene Kepulauan	-4,84514	119,55968	3	4,61	75,56	81,55
Barru	-4,41439	119,6182	0	4,89	58,52	34,55
Bone	-4,53802	120,30988	0	3,05	75,21	58,06
Soppeng	-4,36448	119,89772	3	7,25	81,03	97,17
Wajo	-4,11238	120,02753	0	5,83	71,33	31,58
Sidenreng Rappang	-3,93321	119,76933	0	5,39	66,28	92,45
Pinrang	-3,8091	119,6499	0	4,46	72,25	96,3
Enrekang	-3,58824	119,77022	0	5,09	65,7	89,15
Luwu	-3,39253	120,36608	5	10,8	73,83	99,56
Tana Toraja	-3,08662	119,85716	0	1,86	58,8	95,6
Luwu Utara	-2,54978	120,34628	0	4,16	86,27	87,86
Luwu Timur	-2,61482	121,12405	1	5,68	67,01	88,98
Toraja Utara	-2,91385	119,90021	0	3,74	60,1	94,7
Kota Makassar	-5,13322	119,40801	0	2,87	76,68	43,79
Kota Parepare	-4,02771	119,63315	0	5,4	57,07	86,36
Kota Palopo	-3,00846	120,20149	0	3,98	31	87,5

Lampiran 4. Output RStudio Nilai VIF

```
# Memanggil Data
library(readxl)
data.project <- read_excel("D:/B Kuliah/Kuliah 8/Excel/Data Skripsi.xlsx")

#Persamaan Regresi Linear
reg.ln = data.project$Y~data.project$X1+data.project$X2+data.project$X3

#Persamaan Ordinary Least Square
reg.OLS=lm(reg.ln,data=data.project)

#Uji Multikol dengan VIF
library(car)
vif_values <- vif(reg.OLS)
print(vif_values)
data.project$X1 data.project$X2 data.project$X3
       1.101797        1.121253        1.062502
```

Lampiran 5. Output RStudio Pengecekan Overdispersi pada regresi Poisson

```
#Menghitung Overdispersi pada regresi poisson
# Membangun model regresi Poisson
model_poisson <- glm(reg.ln,data=data.project, family = "poisson")
summary(model_poisson)

Call:
glm(formula = reg.ln, family = "poisson", data = data.project)

Coefficients:
                 Estimate Std. Error z value Pr(>|z|)
(Intercept)     -10.80408    3.13422  -3.447 0.000567 ***
data.project$X1   0.17899    0.07063   2.534 0.011276 *
data.project$X2   0.11028    0.03597   3.066 0.002169 **
data.project$X3   0.01759    0.00971   1.811 0.070089 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for poisson family taken to be 1)

    Null deviance: 50.292  on 23  degrees of freedom
Residual deviance: 29.112  on 20  degrees of freedom
AIC: 56.796

Number of Fisher Scoring iterations: 6

# Menghitung deviance
deviance_value <- deviance(model_poisson)
df <- df.residual(model_poisson)# Menghitung derajat kebebasan

# Menampilkan hasil
cat("Deviance:", deviance_value, "\n")
Deviance: 29.11196
cat("Derajat Kebebasan:", df, "\n")
Derajat Kebebasan: 20
#Melihat rasio overdispersi
overdispersion_ratio <- deviance_value / df
cat("Rasio Overdispersi:", overdispersion_ratio, "\n")
Rasio Overdispersi: 1.455598
```

Lampiran 6. *Output* SPSS Uji Kecocokan Distribusi Poisson pada Variabel Respon

One-Sample Kolmogorov-Smirnov Test		
		Y
N		24
Poisson Parameter[a,b]	Mean	.79
Most Extreme Differences	Absolute	.255
	Positive	.255
	Negative	-.120
Kolmogorov-Smirnov Z		1.250
Asymp. Sig. (2-tailed)		.088

a. Test distribution is Poisson.

b. Calculated from data.

Lampiran 7. *Output* RStudio Nilai Hasil Estimasi Parameter ZINB

```
model <- zeroinfl(y ~  x1 + x2 + x3, dist = "negbin")
model_summary <- summary(model)
model_summary

Call:
zeroinfl(formula = y ~ x1 + x2 + x3, dist = "negbin")

Pearson residuals:
       Min         1Q     Median         3Q        Max
-1.172e+00 -5.859e-01 -1.789e-03 -2.407e-09  2.399e+00

Count model coefficients (negbin with log link):
             Estimate Std. Error z value Pr(>|z|)
(Intercept)  -6.20545    4.40269  -1.409  0.15870
x1            0.35763    0.10158   3.521  0.00043 ***
x2            0.06896    0.05106   1.351  0.17680
x3           -0.01041    0.01127  -0.923  0.35590
Log(theta)   12.67423  299.71380   0.042  0.96627

Zero-inflation model coefficients (binomial with logit link):
            Estimate Std. Error z value Pr(>|z|)
(Intercept) 198.4764   369.8275   0.537    0.591
x1            1.1055     3.3735   0.328    0.743
x2           -2.4814     4.4488  -0.558    0.577
x3           -0.4502     0.9308  -0.484    0.629
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Theta = 319408.6487
Number of iterations in BFGS optimization: 666
Log-likelihood: -17.62 on 9 Df
```

Lampiran 8. Jarak antar Lokasi (Kilometer) berdasarkan *Google Maps*

Kabupaten/kota	1	2	3	4	5	6	7	8	9	10	11	12
1	0	98,7	127,4	160,3	212,3	238,3	132,8	267,3	261,3	291,3	210,3	245,3
2	98,7	0	28,7	62,1	115	133	70,7	174	198	229	148	185
3	127,4	28,7	0	33,4	86,1	115	99,8	146	169	219	176	214
4	160,3	62,1	33,4	0	53,1	81,2	131	113	136	182	209	240
5	212,3	115	86,1	53,1	0	29,2	150	56,9	78,6	130	196	187
6	238,3	133	115	81,2	29,2	0	130	30	53	102	173	163
7	132,8	70,7	99,8	131	150	130	0	139	132	162	81,2	117
8	267,3	174	146	113	56,9	30	139	0	23,3	73,1	143	134
9	261,3	198	169	136	78,6	53	132	23,3	0	51,6	163	116
10	291,3	229	219	182	130	102	162	73,1	51,6	0	120	53,9
11	210,3	148	176	209	196	173	81,2	143	163	120	0	69
12	245,3	185	214	240	187	163	117	134	116	53,9	69	0
13	280,3	218	249	279	221	197	150	167	137	220	72,4	41,9
14	308,3	246	275	266	212	183	180	154	133	80,6	131	64,4
15	337,3	276	299	266	210	183	208	154	133	80,5	154	92,5
16	353,3	292	319	302	250	222	224	193	171	120	172	109
17	365,3	304	334	364	337	314	236	277	253	200	157	159
18	433,3	372	406	386	333	303	304	273	253	130	251	189
19	486,3	425	452	485	458	433	357	405	353	302	278	280
20	592,3	531	455	592	564	540	464	512	460	408	384	386
21	453,3	392	426	405	353	322	324	293	272	200	268	208

Lampiran 8. Jarak antar Lokasi (Kilometer) berdasarkan *Google Maps* (lanjutan)

22	253,3	154	126	93,3	39,4	11	139	25,8	48,8	98,4	168	159
23	330,3	271	272	239	183	156	202	126	104	53,6	154	86,4
24	418,3	357	384	417	390	368	289	337	305	253	210	212

Kabupaten/kota	13	14	15	16	17	18	19	20	21	22	23	24
1	280,3	308,3	337,3	353,3	365,3	433,3	486,3	592,3	453,3	253,3	330,3	418,3
2	218	246	276	292	304	372	425	531	392	154	271	357
3	249	275	299	319	334	406	452	455	426	126	272	384
4	279	266	266	302	364	386	485	592	405	93,3	239	417
5	221	212	210	250	337	333	458	564	353	39,4	183	390
6	197	183	183	222	314	303	433	540	322	11	156	368
7	150	180	208	224	236	304	357	464	324	139	202	289
8	167	154	154	193	277	273	405	512	293	25,8	126	337
9	137	133	133	171	253	253	353	460	272	48,8	104	305
10	220	80,6	80,5	120	200	130	302	408	200	98,4	53,6	253
11	72,4	131	154	172	157	251	278	384	268	168	154	210
12	41,9	64,4	92,5	109	159	189	280	386	208	159	86,4	212
13	0	59,4	84,1	101	118	180	239	345	200	195	82,8	171
14	59,4	0	34,6	54,6	144	134	264	371	154	179	27,8	179
15	84,1	34,6	0	40,6	168	120	222	329	140	179	27,7	165
16	101	54,6	40,6	0	184	80,1	182	288	99,7	218	67,1	124
17	118	144	168	184	0	116	122	228	112	310	166	54,2
18	180	134	120	80,1	116	0	102	208	19,9	299	147	63,8

Lampiran 8. Jarak antar Lokasi (Kilometer) berdasarkan *Google Maps* (lanjutan)

19	239	264	222	182	122	102	0	107	82	422	249	68,2
20	345	371	329	288	228	208	107	0	189	528	356	175
21	200	154	140	99,7	112	19,9	82	189	0	318	167	58
22	195	179	179	218	310	299	422	528	318	0	152	364
23	82,8	27,8	27,7	67,1	166	147	249	356	167	152	0	191
24	171	179	165	124	54,2	63,8	68,2	175	58	364	191	0

Lampiran 9. Jarak antar Lokasi dalam Satuan *Decimal Degree*

Kabupaten/kota	1	2	3	4	5	6	7	8	9	10	11	12
1	0	0,887	1,144	1,440	1,907	2,141	1,193	2,401	2,347	2,617	1,889	2,204
2	0,887	0	0,258	0,558	1,033	1,195	0,635	1,563	1,779	2,057	1,330	1,662
3	1,144	0,258	0	0,300	0,773	1,033	0,897	1,312	1,518	1,967	1,581	1,922
4	1,440	0,558	0,300	0	0,477	0,729	1,177	1,015	1,222	1,635	1,877	2,156
5	1,907	1,033	0,773	0,477	0	0,262	1,347	0,511	0,706	1,168	1,761	1,680
6	2,141	1,195	1,033	0,729	0,262	0	1,168	0,269	0,476	0,916	1,554	1,464
7	1,193	0,635	0,897	1,177	1,347	1,168	0	1,249	1,186	1,455	0,729	1,051
8	2,401	1,563	1,312	1,015	0,511	0,269	1,249	0	0,209	0,657	1,285	1,204
9	2,347	1,779	1,518	1,222	0,706	0,476	1,186	0,209	0	0,464	1,464	1,042
10	2,617	2,057	1,967	1,635	1,168	0,916	1,455	0,657	0,464	0	1,078	0,484
11	1,889	1,330	1,581	1,877	1,761	1,554	0,729	1,285	1,464	1,078	0	0,620
12	2,204	1,662	1,922	2,156	1,680	1,464	1,051	1,204	1,042	0,484	0,620	0
13	2,518	1,958	2,237	2,506	1,985	1,770	1,347	1,500	1,231	1,976	0,650	0,376
14	2,770	2,210	2,470	2,390	1,904	1,644	1,617	1,383	1,195	0,724	1,177	0,579
15	3,030	2,479	2,686	2,390	1,886	1,644	1,869	1,383	1,195	0,723	1,383	0,831
16	3,174	2,623	2,866	2,713	2,246	1,994	2,012	1,734	1,536	1,078	1,545	0,979
17	3,282	2,731	3,000	3,270	3,027	2,821	2,120	2,488	2,273	1,797	1,410	1,428
18	3,892	3,342	3,647	3,468	2,991	2,722	2,731	2,452	2,273	1,168	2,255	1,698
19	4,369	3,818	4,060	4,357	4,114	3,890	3,207	3,638	3,171	2,713	2,497	2,515
20	5,321	4,770	4,087	5,318	5,067	4,851	4,168	4,599	4,132	3,665	3,450	3,468
21	4,072	3,521	3,827	3,638	3,171	2,893	2,911	2,632	2,443	1,797	2,407	1,869

Lampiran 9. Jarak antar Lokasi dalam Satuan *Decimal Degree* (lanjutan)

22	2,275	1,383	1,132	0,838	0,354	0,099	1,249	0,232	0,438	0,884	1,509	1,428
23	2,967	2,434	2,443	2,147	1,644	1,401	1,815	1,132	0,934	0,481	1,383	0,776
24	3,758	3,207	3,450	3,746	3,503	3,306	2,596	3,027	2,740	2,273	1,886	1,904
Kabupaten/kota	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
1	2,518	2,770	3,030	3,174	3,282	3,892	4,369	5,321	4,072	2,275	2,967	3,758
2	1,958	2,210	2,479	2,623	2,731	3,342	3,818	4,770	3,521	1,383	2,434	3,207
3	2,237	2,470	2,686	2,866	3,000	3,647	4,060	4,087	3,827	1,132	2,443	3,450
4	2,506	2,390	2,390	2,713	3,270	3,468	4,357	5,318	3,638	0,838	2,147	3,746
5	1,985	1,904	1,886	2,246	3,027	2,991	4,114	5,067	3,171	0,354	1,644	3,503
6	1,770	1,644	1,644	1,994	2,821	2,722	3,890	4,851	2,893	0,099	1,401	3,306
7	1,347	1,617	1,869	2,012	2,120	2,731	3,207	4,168	2,911	1,249	1,815	2,596
8	1,500	1,383	1,383	1,734	2,488	2,452	3,638	4,599	2,632	0,232	1,132	3,027
9	1,231	1,195	1,195	1,536	2,273	2,273	3,171	4,132	2,443	0,438	0,934	2,740
10	1,976	0,724	0,723	1,078	1,797	1,168	2,713	3,665	1,797	0,884	0,481	2,273
11	0,650	1,177	1,383	1,545	1,410	2,255	2,497	3,450	2,407	1,509	1,383	1,886
12	0,376	0,579	0,831	0,979	1,428	1,698	2,515	3,468	1,869	1,428	0,776	1,904
13	0	0,534	0,755	0,907	1,060	1,617	2,147	3,099	1,797	1,752	0,744	1,536
14	0,534	0	0,311	0,490	1,294	1,204	2,372	3,333	1,383	1,608	0,250	1,608
15	0,755	0,311	0	0,365	1,509	1,078	1,994	2,955	1,258	1,608	0,249	1,482
16	0,907	0,490	0,365	0	1,653	0,720	1,635	2,587	0,896	1,958	0,603	1,114
17	1,060	1,294	1,509	1,653	0	1,042	1,096	2,048	1,006	2,785	1,491	0,487
18	1,617	1,204	1,078	0,720	1,042	0	0,916	1,869	0,179	2,686	1,321	0,573

Lampiran 9. Jarak antar Lokasi dalam Satuan *Decimal Degree* (lanjutan)

19	2,147	2,372	1,994	1,635	1,096	0,916	0	0,961	0,737	3,791	2,237	0,613
20	3,099	3,333	2,955	2,587	2,048	1,869	0,961	0	1,698	4,743	3,198	1,572
21	1,797	1,383	1,258	0,896	1,006	0,179	0,737	1,698	0	2,857	1,500	0,521
22	1,752	1,608	1,608	1,958	2,785	2,686	3,791	4,743	2,857	0	1,365	3,270
23	0,744	0,250	0,249	0,603	1,491	1,321	2,237	3,198	1,500	1,365	0	1,716
24	1,536	1,608	1,482	1,114	0,487	0,573	0,613	1,572	0,521	3,270	1,716	0

Lampiran 10. *Output* Pembobot dengan *Adaptive Bisquere Kernel*

Kabupaten/kota	1	2	3	4	5	6	7	8	9	10	11	12
1	1	0,8453	0,7495	0,6200	0,3933	0,2811	0,7295	0,1672	0,1893	0,0888	0,4021	0,2522
2	0,7728	1	0,9797	0,9066	0,6987	0,6091	0,8798	0,3897	0,2636	0,1219	0,5302	0,3309
3	0,6392	0,9798	1	0,9726	0,8253	0,7000	0,7691	0,5427	0,4189	0,1661	0,3812	0,1887
4	0,5139	0,9168	0,9756	1	0,9388	0,8600	0,6576	0,7384	0,6340	0,4033	0,2691	0,1335
5	0,1881	0,6953	0,8224	0,9304	1	0,9787	0,5145	0,9203	0,8508	0,6204	0,2677	0,3143
6	0,0213	0,5387	0,6417	0,8115	0,9745	1	0,5562	0,9731	0,9173	0,7115	0,3023	0,3604
7	0,4636	0,8273	0,6721	0,4754	0,3515	0,4820	1	0,4231	0,4689	0,2758	0,7756	0,5660
8	0	0,2006	0,3736	0,5885	0,8854	0,9674	0,4194	1	0,9803	0,8146	0,3932	0,4523
9	0	0,0270	0,1530	0,3669	0,7539	0,8838	0,3951	0,9770	1	0,8897	0,1880	0,5086
10	0	0	0	0	0,1723	0,4095	0,0084	0,6643	0,8242	1	0,2516	0,8090
11	0	0,0905	0,0001	0	0	0,0020	0,6234	0,1206	0,0231	0,2920	1	0,7191
12	0	0	0	0	0	0	0,2257	0,0970	0,2343	0,7896	0,6682	1
13	0	0	0	0	0	0	0,0789	0,0118	0,1601	0	0,6930	0,8909
14	0	0	0	0	0	0,0018	0,0053	0,1034	0,2440	0,6628	0,2591	0,7768
15	0	0	0	0	0	0,0378	0	0,1845	0,3301	0,7126	0,1845	0,6307
16	0	0	0	0	0	0	0	0,0527	0,1562	0,4931	0,1507	0,5689
17	0	0	0	0	0	0	0,0048	0	0	0,1100	0,3459	0,3336
18	0	0	0	0	0	0	0	0,0002	0,0234	0,6028	0,0277	0,2781
19	0	0	0	0	0	0	0	0	0	0,0363	0,0987	0,0925
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0,0207	0,2885	0,0285	0,2493

Lampiran 10. *Output* Pembobot dengan *Adaptive Bisquere Kernel* (lanjutan)

22	0	0,3943	0,5639	0,7455	0,9519	0,9962	0,4857	0,9792	0,9267	0,7193	0,3105	0,3641
23	0	0	0	0	0	0,0733	0	0,2748	0,4568	0,8352	0,0837	0,6026
24	0	0	0	0	0	0	0	0	0	0,0423	0,2049	0,1955
Kabupaten/kota	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
1	0,1225	0,0456	0,0034	0	0	0	0	0	0	0,2201	0,0095	0
2	0,1682	0,0620	0,0030	0	0	0	0	0	0	0,4980	0,0078	0
3	0,0548	0,0043	0	0	0	0	0	0	0	0,6463	0,0074	0
4	0,0203	0,0486	0,0486	0	0	0	0	0	0	0,8174	0,1374	0
5	0,1493	0,1895	0,1989	0,0461	0	0	0	0	0	0,9614	0,3355	0
6	0,1733	0,2463	0,2463	0,0669	0	0	0	0	0	0,9964	0,4019	0
7	0,3515	0,1712	0,0472	0,0085	0	0	0	0	0	0,4231	0,0685	0
8	0,2415	0,3220	0,3220	0,1028	0	0	0	0	0	0,9759	0,5048	0
9	0,3598	0,3880	0,3880	0,1418	0	0	0	0	0	0,9010	0,5920	0
10	0	0,6008	0,6017	0,2516	0	0,1723	0	0	0	0,4420	0,8110	0
11	0,6933	0,2045	0,0590	0,0031	0,0454	0	0	0	0	0,0098	0,0590	0
12	0,8699	0,7072	0,4515	0,2964	0,0009	0	0	0	0	0,0009	0,5095	0
13	1	0,7872	0,5990	0,4542	0,3080	0	0	0	0	0	0,6098	0,0043
14	0,8083	1	0,9327	0,8367	0,1655	0,2365	0	0	0,1034	0,0069	0,9563	0,0069
15	0,6887	0,9432	1	0,9223	0,1031	0,4272	0	0	0,2794	0,0526	0,9634	0,1191
16	0,6226	0,8805	0,9330	1	0,0899	0,7522	0,0992	0	0,6311	0,0003	0,8224	0,4651
17	0,5888	0,4271	0,2793	0,1887	1	0,6009	0,5645	0,0173	0,6248	0	0,2912	0,9042
18	0,3264	0,5813	0,6552	0,8374	0,6756	1	0,7436	0,1828	0,9895	0	0,5099	0,8952

Lampiran 10. *Output* Pembobot dengan *Adaptive Bisquere Kernel* (lanjutan)

19	0,2431	0,1455	0,3165	0,4985	0,7533	0,8239	1	0,8071	0,8842	0	0,2023	0,9191
20	0,0014	0	0,0155	0,1083	0,3358	0,4225	0,8233	1	0,5056	0	0	0,5659
21	0,2885	0,5264	0,5978	0,7832	0,7307	0,9909	0,8504	0,3441	1	0	0,4587	0,9237
22	0,1628	0,2474	0,2474	0,0648	0	0	0	0	0	1	0,4065	0
23	0,6313	0,9542	0,9545	0,7484	0,0304	0,1242	0	0	0,0270	0,0946	1	0
24	0,4059	0,3628	0,4384	0,6547	0,9284	0,9015	0,8879	0,3843	0,9182	0	0,2995	1

Lampiran 11. *Output* RStudio Pengujian Dependensi Spasial dengan Uji *Moran's I*

```
> #Data Kematian Bayi Akibat Demam
> # Memanggil Data
> library(readxl)
> data.project <- read_excel("D:/B Kuliah/Kuliah 8/Excel/Data Skripsi.xlsx")
> #Persamaan Regresi Linear
> reg.ln=data.project$Y~data.project$X1+data.project$X2+data.project$X3
> #Persamaan Ordinary Least Square
> reg.OLS=lm(reg.ln,data=data.project)
> residual_klasik <- residuals(reg.OLS)
> #PEMBOBOT IDW terstandariasai untuk Dependensi Spasialnya
> IDW <- read_excel("D:/B Kuliah/Kuliah 8/Excel/Matriks Bobot IDW.xlsx", sheet =
2)
> library(spdep)
> #Uji Dependensi Spasial
> Wj=as.matrix(IDW)
> invers.Wj <- mat2listw(Wj, style = "W")
> invers.Wj
Characteristics of weights list object:
Neighbour list object:
Number of regions: 24
Number of nonzero links: 552
Percentage nonzero weights: 95.83333
Average number of links: 23

Weights style: W
Weights constants summary:
  n  nn S0       S1       S2
W 24 576 24 3.815281 97.12505
> moran.test(data.project$Y, invers.Wj)
            Moran I test under randomisation

data:  data.project$Y
weights: invers.Wj

Moran I statistic standard deviate = -0.28106, p-value = 0.6107
alternative hypothesis: greater
sample estimates:
Moran I statistic       Expectation          Variance
    -0.057997084      -0.043478261       0.002668546
> moran.test(data.project$X1, invers.Wj)

            Moran I test under randomisation
```

Lampiran 11. *Output* RStudio Pengujian Dependensi Spasial dengan Uji *Moran's I* (lanjutan)

```
data:  data.project$X1
weights: invers.Wj
Moran I statistic standard deviate = 0.67919, p-value = 0.2485
alternative hypothesis: greater
sample estimates:
Moran I statistic       Expectation          Variance
     -0.010246666      -0.043478261       0.002393969

> moran.test(data.project$X2, invers.Wj)
              Moran I test under randomisation

data:  data.project$X2
weights: invers.Wj

Moran I statistic standard deviate = 0.090956, p-value = 0.4638
alternative hypothesis: greater
sample estimates:
Moran I statistic       Expectation          Variance
     -0.038773017      -0.043478261       0.002676083

> moran.test(data.project$X3, invers.Wj)
              Moran I test under randomisation

data:  data.project$X3
weights: invers.Wj

Moran I statistic standard deviate = 0.83429, p-value = 0.2021
alternative hypothesis: greater
sample estimates:
Moran I statistic       Expectation          Variance
      0.002230804      -0.043478261       0.003001731

> moran.test(residual_klasik, invers.Wj)
              Moran I test under randomisation
data:  residual_klasik
weights: invers.Wj

Moran I statistic standard deviate = 0.013284, p-value = 0.4947
alternative hypothesis: greater
sample estimates:
Moran I statistic       Expectation          Variance
     -0.042755336      -0.043478261       0.002961771
```

Lampiran 12. *Output* RStudio Pengujian Heterogenitas Spasial dengan *Breusch-Pagan Test*

```
#Uji Heterogenitas spasial
library(lmtest)
#BP Test
bp_test_result <- bptest(reg.OLS)
print(bp_test_result)

        studentized Breusch-Pagan test

data:  reg.OLS
BP = 12.4, df = 3, p-value = 0.006131
```

Lampiran 13. *Output* RStudio Uji Serentak Parameter Model GWZINBR

```
#pengujian serentak punyaku
library(MASS)
library(readxl)
data.project <- read_excel("D:/B Kuliah/Kuliah 8/Excel/Data Skripsi.xlsx")
w <- read_excel("D:/B Kuliah/Kuliah 8/Excel/Adaptive Besquare Kernel/Bobot
Adaptive Besquare.xlsx")
w1 <- as.matrix(w)
k1=12.67422659

s0_beta<-as.vector(c(-6.20544674,0.357627,0.06896491,-0.01040523))
s0_gamma <- as.vector(c(198.4763604,1.1054903,-2.4814029,-0.4501948))
X1=data.project$X1
X2=data.project$X2
X3=data.project$X3
X=cbind(1,X1,X2,X3)
Y=data.project$Y

#nilai N
sum_result <- function(Y, kappa)
{
  sum_value <- 0
  for (b in 0:(Y - 1)) {
    sum_value <- sum_value +  log(b + 1/kappa)
  }
   return(sum_value)
}
N <-  sum_result(Y=24, kappa = k1)

par_beta <- read_excel("D:/B Kuliah/Kuliah 8/Excel/Adaptive Besquare
Kernel/ParBeta_Adaptive Besquare.xlsx")
par_beta <- as.matrix(par_beta)

par_gamma <- read_excel("D:/B Kuliah/Kuliah 8/Excel/Adaptive Besquare
Kernel/ParGamma_Adaptive Besquare.xlsx")
par_gamma <- as.matrix(par_gamma)

Ezm<-matrix(c(0),nrow=24,ncol=1)
for(i in 1:24)
{
  beta_hat<-as.vector(par_beta[1:5,i])
  beta_hat
  gamma_hat<-as.vector(par_gamma[1:4,i])
```

Lampiran 13. Output RStudio Uji Serentak Parameter Model GWZINBR (Lanjutan)

```
  gamma_hat
  Ezm[i]= 1/((1+exp(-  X[i,]%*%s0_gamma))*((1/(1+k1*exp(X[i,]%*%s0_beta)))^(1/k1)))
  Ezm[i]<-ifelse(Y[i]>0,0,Ezm[i])
  ww<-diag(w1[i,])
  ww
  beta_nol<-beta_hat[1]
  gamma_nol<-gamma_hat[1]
  l=m=n=o=0

  l=l+(Ezm[i]*gamma_nol-log(1+exp(gamma_nol)))
   m=m+(1-Ezm[i])*(N - log(factorial(Y[i])) + Y[i]*log(k1*exp(beta_nol)) -
   (Y[i]+1/k1)*log(1+k1*exp(beta_nol)) )

  n=n+(Ezm[i]*gamma_hat-log(1+exp(gamma_hat)))
  n[is.infinite(n) & n < 0] <- 10000

   o=o+ (1-Ezm[i])*(N - log(factorial(Y[i])) + Y[i]*log(k1*exp(beta_hat)) -
   (Y[i]+1/k1)*log(1+k1*exp(beta_hat)) )
  l
  m
  LLH0=sum(l)+sum(m)
  n
  o
  LLP=sum(n)+sum(o)
  LLP
  G=-2*(LLH0-LLP)
}
G
[1] 17624.91
```

Lampiran 14. Pengujian Parameter Model GWZINBR dengan Pembobot *Adaptive Bisquare Kernel*

Kabupaten/kota	Parameter	Nilai Estimasi	W	Keterangan
Selayar	$\hat{\kappa}$	12,6742	-1,1E+09	Signifikan
	$\hat{\beta}_0$	-6,2055	-6308140	Signifikan
	$\hat{\beta}_1$	0,3554	4,3962	Signifikan
	$\hat{\beta}_2$	0,0677	13,3218	Signifikan
	$\hat{\beta}_3$	-0,0064	-1,6006	Tidak Signifikan
	$\hat{\gamma}_0$	198,8942	18301774	Signifikan
	$\hat{\gamma}_1$	-365,6083	-81,4146	Signifikan
	$\hat{\gamma}_2$	69,5987	214,5213	Signifikan
	$\hat{\gamma}_3$	-24,5593	-240,4869	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Bulukumba	$\hat{\kappa}$	12,6741	-1,2E+09	Signifikan
	$\hat{\beta}_0$	-6,2054	-4040926	Signifikan
	$\hat{\beta}_1$	0,3649	4,3127	Signifikan
	$\hat{\beta}_2$	0,0655	12,4519	Signifikan
	$\hat{\beta}_3$	-0,0052	-1,3815	Tidak Signifikan
	$\hat{\gamma}_0$	199,0035	16295934	Signifikan
	$\hat{\gamma}_1$	-472,3667	-70,5154	Signifikan
	$\hat{\gamma}_2$	91,8220	231,7438	Signifikan
	$\hat{\gamma}_3$	-34,4639	-326,0233	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Bantaeng	$\hat{\kappa}$	12,6741	-1,5E+09	Signifikan
	$\hat{\beta}_0$	-6,2054	-2740467	Signifikan
	$\hat{\beta}_1$	0,3759	3,7508	Signifikan
	$\hat{\beta}_2$	0,0621	9,9702	Signifikan
	$\hat{\beta}_3$	-0,0016	-0,3698	Tidak Signifikan
	$\hat{\gamma}_0$	198,8396	13762615	Signifikan
	$\hat{\gamma}_1$	-540,0876	-66,1556	Signifikan
	$\hat{\gamma}_2$	71,1158	143,6879	Signifikan
	$\hat{\gamma}_3$	40,1525	93,9466	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Jeneponto	$\hat{\kappa}$	12,6741	-1,4E+09	Signifikan
	$\hat{\beta}_0$	-6,2053	-2045780	Signifikan
	$\hat{\beta}_1$	0,3894	3,2686	Signifikan
	$\hat{\beta}_2$	0,0585	7,9868	Signifikan
	$\hat{\beta}_3$	0,0015	0,3294	Tidak Signifikan
	$\hat{\gamma}_0$	199,0644	13266537	Signifikan
	$\hat{\gamma}_1$	-546,7114	-56,7103	Signifikan
	$\hat{\gamma}_2$	106,4341	201,0555	Signifikan
	$\hat{\gamma}_3$	-38,7098	-275,7397	Signifikan

Lampiran 14. Pengujian Parameter Model GWZINBR dengan Pembobot *Adaptive Bisquare Kernel* (Lanjutan)

Kabupaten/kota	Parameter	Nilai Estimasi	W	Keterangan
Takalar	$\hat{\kappa}$	12,6741	-6,1E+08	Signifikan
	$\hat{\beta}_0$	-6,2052	-1421944	Signifikan
	$\hat{\beta}_1$	0,4118	2,2947	Signifikan
	$\hat{\beta}_2$	0,0534	4,9936	Signifikan
	$\hat{\beta}_3$	0,0049	0,7882	Tidak Signifikan
	$\hat{\gamma}_0$	199,5137	5811138	Signifikan
	$\hat{\gamma}_1$	-849,7089	-42,5459	Signifikan
	$\hat{\gamma}_2$	171,9711	174,0559	Signifikan
	$\hat{\gamma}_3$	-74,0158	-376,5472	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Gowa	$\hat{\kappa}$	12,6741	-3,9E+08	Signifikan
	$\hat{\beta}_0$	-6,2050	-763515	Signifikan
	$\hat{\beta}_1$	0,4302	2,0046	Signifikan
	$\hat{\beta}_2$	0,0490	3,8565	Signifikan
	$\hat{\beta}_3$	0,0079	1,0982	Tidak Signifikan
	$\hat{\gamma}_0$	200,5978	2260009	Signifikan
	$\hat{\gamma}_1$	-1492,1126	-37,3693	Signifikan
	$\hat{\gamma}_2$	302,7535	164,1652	Signifikan
	$\hat{\gamma}_3$	-131,2667	-371,2878	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Sinjai	$\hat{\kappa}$	12,6741	-7,5E+08	Signifikan
	$\hat{\beta}_0$	-6,2054	-2585473	Signifikan
	$\hat{\beta}_1$	0,3693	3,8895	Signifikan
	$\hat{\beta}_2$	0,0648	11,3000	Signifikan
	$\hat{\beta}_3$	-0,0053	-1,3595	Tidak Signifikan
	$\hat{\gamma}_0$	199,2651	10305656	Signifikan
	$\hat{\gamma}_1$	-693,9948	-59,0571	Signifikan
	$\hat{\gamma}_2$	139,1986	220,7583	Signifikan
	$\hat{\gamma}_3$	-59,0747	-452,9633	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Maros	$\hat{\kappa}$	12,6741	-3E+08	Signifikan
	$\hat{\beta}_0$	-9,5473	-0,00346	Tidak Signifikan
	$\hat{\beta}_1$	0,4850	1,2390	Tidak Signifikan
	$\hat{\beta}_2$	0,0790	0,2217	Tidak Signifikan
	$\hat{\beta}_3$	0,0169	1,2530	Tidak Signifikan
	$\hat{\gamma}_0$	201,2671	1091393	Signifikan
	$\hat{\gamma}_1$	-1473,1768	-35,6479	Signifikan
	$\hat{\gamma}_2$	295,8495	140,4046	Signifikan
	$\hat{\gamma}_3$	-127,8561	-331,8501	Signifikan

Lampiran 14. Pengujian Parameter Model GWZINBR dengan Pembobot *Adaptive Bisquare Kernel* (Lanjutan)

Kabupaten/kota	Parameter	Nilai Estimasi	W	Keterangan
Pangkajene Kepulauan	$\hat{\kappa}$	12,6730	-1,8E+07	Signifikan
	$\hat{\beta}_0$	-3,5663	-0,0014	Tidak Signifikan
	$\hat{\beta}_1$	0,4248	0,9573	Tidak Signifikan
	$\hat{\beta}_2$	0,0183	0,0543	Tidak Signifikan
	$\hat{\beta}_3$	0,0044	0,3757	Tidak Signifikan
	$\hat{\gamma}_0$	201,7472	756444	Signifikan
	$\hat{\gamma}_1$	-1642,3458	266,0419	Signifikan
	$\hat{\gamma}_2$	296,7685	130,1348	Signifikan
	$\hat{\gamma}_3$	-118,9721	-461,8918	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Barru	$\hat{\kappa}$	12,6895	-5339,17	Signifikan
	$\hat{\beta}_0$	-52,8551	0,008586	Tidak Signifikan
	$\hat{\beta}_1$	-1,2700	0,1342	Tidak Signifikan
	$\hat{\beta}_2$	0,6725	-1,0335	Tidak Signifikan
	$\hat{\beta}_3$	0,0876	2,3701	Signifikan
	$\hat{\gamma}_0$	-4974,4492	-32	Signifikan
	$\hat{\gamma}_1$	41446,7960	4,1127	Signifikan
	$\hat{\gamma}_2$	364,8507	88,6798	Signifikan
	$\hat{\gamma}_3$	-2618,9871	-73,2494	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Bone	$\hat{\kappa}$	12,6741	-4,5E+08	Signifikan
	$\hat{\beta}_0$	-54,5165	-0,00772	Tidak Signifikan
	$\hat{\beta}_1$	0,8486	0,9942	Tidak Signifikan
	$\hat{\beta}_2$	0,5958	0,6864	Tidak Signifikan
	$\hat{\beta}_3$	0,0152	1,7418	Tidak Signifikan
	$\hat{\gamma}_0$	189,3614	1167176	Signifikan
	$\hat{\gamma}_1$	-15748,2261	-18,6602	Signifikan
	$\hat{\gamma}_2$	3215,2319	87,6945	Signifikan
	$\hat{\gamma}_3$	-1388,4156	-201,8742	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Soppeng	$\hat{\kappa}$	12,6884	-5615,35	Signifikan
	$\hat{\beta}_0$	-43,5261	0,012196	Tidak Signifikan
	$\hat{\beta}_1$	-0,8016	0,0684	Tidak Signifikan
	$\hat{\beta}_2$	0,5234	-1,1286	Tidak Signifikan
	$\hat{\beta}_3$	0,0741	-1,1103	Tidak Signifikan
	$\hat{\gamma}_0$	238,8332	30515	Signifikan
	$\hat{\gamma}_1$	-244,0541	-844,6461	Signifikan
	$\hat{\gamma}_2$	2230,7039	93,0817	Signifikan
	$\hat{\gamma}_3$	-1591,9042	-130,6970	Signifikan

Lampiran 14. Pengujian Parameter Model GWZINBR dengan Pembobot *Adaptive Bisquare Kernel* (Lanjutan)

Kabupaten/kota	Parameter	Nilai Estimasi	W	Keterangan
Wajo	$\hat{\kappa}$	12,6752	-55397,9	Signifikan
	$\hat{\beta}_0$	-22,1068	-0,00644	Tidak Signifikan
	$\hat{\beta}_1$	1,0323	0,5146	Tidak Signifikan
	$\hat{\beta}_2$	0,3184	0,7654	Tidak Signifikan
	$\hat{\beta}_3$	-0,1058	-1,1090	Tidak Signifikan
	$\hat{\gamma}_0$	220,6326	33205	Signifikan
	$\hat{\gamma}_1$	-132,9164	-546,3187	Signifikan
	$\hat{\gamma}_2$	1155,0459	63,6946	Signifikan
	$\hat{\gamma}_3$	-825,4791	-89,4763	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Sidenreng Rappang	$\hat{\kappa}$	12,6690	-32112	Signifikan
	$\hat{\beta}_0$	-186,8686	0,030693	Tidak Signifikan
	$\hat{\beta}_1$	-4,1954	0,4127	Tidak Signifikan
	$\hat{\beta}_2$	1,3782	3,4099	Signifikan
	$\hat{\beta}_3$	1,1687	-1,6724	Tidak Signifikan
	$\hat{\gamma}_0$	212,3779	38211	Signifikan
	$\hat{\gamma}_1$	-81,1198	-416,9004	Signifikan
	$\hat{\gamma}_2$	654,9219	52,6979	Signifikan
	$\hat{\gamma}_3$	-469,3225	-74,1267	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Pinrang	$\hat{\kappa}$	12,6662	-21203,4	Signifikan
	$\hat{\beta}_0$	-153,4983	0,053221	Tidak Signifikan
	$\hat{\beta}_1$	-2,3381	0,2930	Tidak Signifikan
	$\hat{\beta}_2$	1,6023	2,3225	Signifikan
	$\hat{\beta}_3$	0,4905	-1,4025	Tidak Signifikan
	$\hat{\gamma}_0$	-15621,9029	-60	Signifikan
	$\hat{\gamma}_1$	109183,0925	8,7833	Signifikan
	$\hat{\gamma}_2$	5443,8232	154,4592	Signifikan
	$\hat{\gamma}_3$	-10093,0819	-97,0424	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Enrekang	$\hat{\kappa}$	12,6603	-20200,8	Signifikan
	$\hat{\beta}_0$	-262,3542	-0,03622	Tidak Signifikan
	$\hat{\beta}_1$	-0,9238	0,1383	Tidak Signifikan
	$\hat{\beta}_2$	3,2699	1,0341	Tidak Signifikan
	$\hat{\beta}_3$	0,1560	-0,4645	Tidak Signifikan
	$\hat{\gamma}_0$	207,8607	35770	Signifikan
	$\hat{\gamma}_1$	-54,8705	-265,2000	Signifikan
	$\hat{\gamma}_2$	422,8309	35,4305	Signifikan
	$\hat{\gamma}_3$	-304,0469	-49,9154	Signifikan

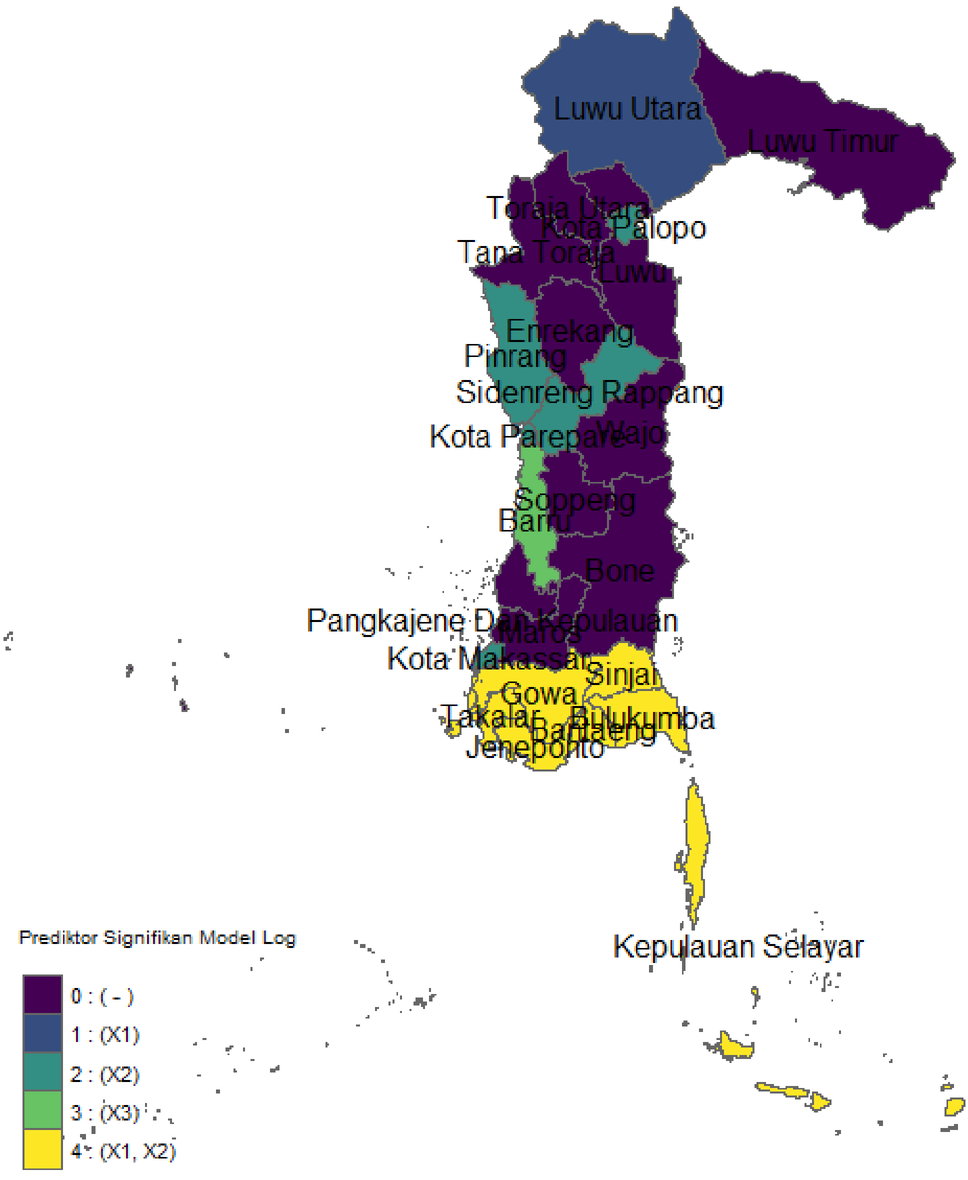
Lampiran 14. Pengujian Parameter Model GWZINBR dengan Pembobot *Adaptive Bisquare Kernel* (Lanjutan)

Kabupaten/kota	Parameter	Nilai Estimasi	W	Keterangan
Luwu	$\hat{\kappa}$	12,6743	-171099	Signifikan
	$\hat{\beta}_0$	51,0152	0,007412	Tidak Signifikan
	$\hat{\beta}_1$	0,3886	-0,4453	Tidak Signifikan
	$\hat{\beta}_2$	-0,6112	0,5831	Tidak Signifikan
	$\hat{\beta}_3$	-0,0777	-0,0864	Tidak Signifikan
	$\hat{\gamma}_0$	-1432,5210	-654	Signifikan
	$\hat{\gamma}_1$	48312,6712	25,4993	Signifikan
	$\hat{\gamma}_2$	-1860,0824	-68,9179	Signifikan
	$\hat{\gamma}_3$	-1464,4383	-119,7151	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Tana Toraja	$\hat{\kappa}$	12,6740	-119607	Signifikan
	$\hat{\beta}_0$	-11,7258	-0,00417	Tidak Signifikan
	$\hat{\beta}_1$	0,4046	1,7428	Tidak Signifikan
	$\hat{\beta}_2$	-0,2550	-0,2993	Tidak Signifikan
	$\hat{\beta}_3$	0,2855	-0,9036	Tidak Signifikan
	$\hat{\gamma}_0$	-27,2367	-46	Signifikan
	$\hat{\gamma}_1$	5559,6516	15,8868	Signifikan
	$\hat{\gamma}_2$	-564,5676	-59,2434	Signifikan
	$\hat{\gamma}_3$	83,2690	30,1799	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Luwu Utara	$\hat{\kappa}$	12,6717	-137414	Signifikan
	$\hat{\beta}_0$	40,1297	-0,00818	Tidak Signifikan
	$\hat{\beta}_1$	1,5427	-0,2792	Tidak Signifikan
	$\hat{\beta}_2$	-0,5911	-2,5712	Signifikan
	$\hat{\beta}_3$	-0,1009	0,0501	Tidak Signifikan
	$\hat{\gamma}_0$	-152,5233	-184	Signifikan
	$\hat{\gamma}_1$	8602,9139	17,2889	Signifikan
	$\hat{\gamma}_2$	-1573,7213	-69,5216	Signifikan
	$\hat{\gamma}_3$	640,6493	105,3432	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Luwu Timur	$\hat{\kappa}$	12,6675	-71844,6	Signifikan
	$\hat{\beta}_0$	81,7616	-0,00417	Tidak Signifikan
	$\hat{\beta}_1$	2,9877	-0,2021	Tidak Signifikan
	$\hat{\beta}_2$	-0,7027	-1,3754	Tidak Signifikan
	$\hat{\beta}_3$	-0,5795	0,1188	Tidak Signifikan
	$\hat{\gamma}_0$	197,6382	46215	Signifikan
	$\hat{\gamma}_1$	76,5610	2,2179	Signifikan
	$\hat{\gamma}_2$	118,7832	1,3342	Tidak Signifikan
	$\hat{\gamma}_3$	-96,3054	-1,7234	Tidak Signifikan

Lampiran 14. Pengujian Parameter Model GWZINBR dengan Pembobot *Adaptive Bisquare Kernel* (Lanjutan)

Kabupaten/kota	Parameter	Nilai Estimasi	W	Keterangan
Toraja Utara	$\hat{\kappa}$	12,6734	-128998	Signifikan
	$\hat{\beta}_0$	-4,0396	-0,01142	Tidak Signifikan
	$\hat{\beta}_1$	0,3209	-0,2963	Tidak Signifikan
	$\hat{\beta}_2$	-0,4105	-1,0651	Tidak Signifikan
	$\hat{\beta}_3$	0,3346	-0,5576	Tidak Signifikan
	$\hat{\gamma}_0$	-29,4697	-52	Signifikan
	$\hat{\gamma}_1$	5543,0727	16,7782	Signifikan
	$\hat{\gamma}_2$	-738,0574	-72,7807	Signifikan
	$\hat{\gamma}_3$	209,3737	82,5366	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Kota Makassar	$\hat{\kappa}$	12,6741	-2,2E+08	Signifikan
	$\hat{\beta}_0$	-6,2049	-763893	Signifikan
	$\hat{\beta}_1$	0,4493	1,8433	Tidak Signifikan
	$\hat{\beta}_2$	0,0445	3,0945	Signifikan
	$\hat{\beta}_3$	0,0110	1,3842	Tidak Signifikan
	$\hat{\gamma}_0$	200,7238	1926595	Signifikan
	$\hat{\gamma}_1$	-1552,4676	-34,8268	Signifikan
	$\hat{\gamma}_2$	314,3034	151,1280	Signifikan
	$\hat{\gamma}_3$	-136,0960	-345,3332	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Kota Parepare	$\hat{\kappa}$	12,6675	-8365,5	Signifikan
	$\hat{\beta}_0$	-92,4174	0,038348	Tidak Signifikan
	$\hat{\beta}_1$	-1,0238	0,1247	Tidak Signifikan
	$\hat{\beta}_2$	1,3073	4,5753	Signifikan
	$\hat{\beta}_3$	-0,0265	0,4079	Tidak Signifikan
	$\hat{\gamma}_0$	-6937,1717	-48	Signifikan
	$\hat{\gamma}_1$	54175,8352	6,4976	Signifikan
	$\hat{\gamma}_2$	2369,1397	125,4146	Signifikan
	$\hat{\gamma}_3$	-4778,1242	-79,5404	Signifikan
Kabupaten/kota	**Parameter**	**Nilai Estimasi**	**W**	**Keterangan**
Kota Palopo	$\hat{\kappa}$	12,6731	-160012	Signifikan
	$\hat{\beta}_0$	11,0527	-0,00213	Tidak Signifikan
	$\hat{\beta}_1$	0,6139	-0,0605	Tidak Signifikan
	$\hat{\beta}_2$	-0,5159	16,9513	Signifikan
	$\hat{\beta}_3$	0,2299	-0,0760	Tidak Signifikan
	$\hat{\gamma}_0$	-120,0076	-202	Signifikan
	$\hat{\gamma}_1$	8013,0660	21,4375	Signifikan
	$\hat{\gamma}_2$	-1163,2125	-93,6215	Signifikan
	$\hat{\gamma}_3$	373,6592	119,7372	Signifikan

Lampiran 15. Peta Hasil Pengelompokkan Kabupaten/Kota di Sulawesi Selatan Berdasarkan Variabel Prediktor Signifikan pada Model Log



Lampiran 16. Peta Hasil Pengelompokkan Kabupaten/Kota di Sulawesi Selatan Berdasarkan Variabel Prediktor Signifikan pada Model Logit