Sesgo de las estimadores de Hamilton.

$$\xi_H^{(2)}(r) = \frac{DD(r)\, RR(r)}{[DR(r)]^2}$$

Primero calculamos   con $n = \bar{n}(1+\delta)$

$$DD(r) = \int n_1 w_1\, dV_1 \int n_2 w_2\, dV_2 = \int n_1 n_2\, w_1 w_2\, dV_1\, dV_2 = \int \bar{n}_1 (1+\delta_1)\, \bar{n}_2 (1+\delta_2)\, w_1 w_2\, dV_1\, dV_2$$

$$= \bar{n}^2 \iint (1 + \delta_1 + \delta_2 + \delta_1 \delta_2)\, w_1 w_2\, dV_1\, dV_2$$

Como

$$\psi = \frac{\langle\langle \delta(r)\, W(r)\, W(r) \rangle\rangle}{\langle\langle W(r)\, W(r) \rangle\rangle} \therefore \psi \langle\langle W(r)\, W(r) \rangle\rangle = \langle\langle \delta(r)\, W(r)\, W(r) \rangle\rangle$$

$$\xi^2(r) = \frac{\langle\langle W(r)\, W(r)\, \delta(r)\, \delta(r) \rangle\rangle}{\langle\langle W(r)\, W(r) \rangle\rangle} \therefore \xi^2(r) \cdot \langle\langle W(r)\, W(r) \rangle\rangle = \langle\langle \delta(r)\, \delta(r)\, W(r)\, W(r) \rangle\rangle$$

Entonces $DD(r)$:

$$DD(r) = \bar{n}^2 \left[\langle\langle w_1 w_2 \rangle\rangle + \psi_1 \langle\langle w_1 w_2 \rangle\rangle + \psi_2 \langle\langle w_1 w_2 \rangle\rangle + \xi^{(2)} \langle\langle w_1 w_2 \rangle\rangle \right] = \bar{n}^2 \langle\langle w_1 w_2 \rangle\rangle (1 + \psi_1 + \psi_2 + \xi^{(2)})$$

Ahora calculamos

$$RR(r) = \int \bar{n}_1 w_1\, dV_1 \int \bar{n}_2 W_2\, dV_2 = \bar{n}^2 \iint w_1 w_2\, dV_1\, dV_2 = \bar{n}^2 \langle\langle w_1 w_2 \rangle\rangle$$

Finalmente

$$DR = \int n_1 w_1\, dV_1 \int \bar{n}_2 w_2\, dV_2 = \iint \bar{n}_1 \bar{n}_2 (1+\delta_1)\, w_1 w_2\, dV_1\, dV_2 = \bar{n}^2 \left[\iint w_1 w_2\, dV_1\, dV_2 + \iint \delta_1 w_1 w_2\, dV_1\, dV_2 \right]$$

$$= \bar{n}^2 \left[\langle\langle w_1 w_2 \rangle\rangle + \psi_1 \langle\langle w_1 w_2 \rangle\rangle \right] = \bar{n}^2 (1 + \psi_1) \langle\langle w_1 w_2 \rangle\rangle$$

$$\Rightarrow \xi_H^{(2)}(r) = \frac{\cancel{\bar{n}^2} \cancel{\langle\langle w_1 w_2 \rangle\rangle} (1 + \psi_1 + \psi_2 + \xi^{(2)}) \cdot \cancel{\bar{n}^2} \cancel{\langle\langle w_1 w_2 \rangle\rangle}}{\cancel{\bar{n}^4} (1+\psi_1)^2 \cancel{\langle\langle w_1 w_2 \rangle\rangle^2}} = \frac{1 + \psi_1 + \psi_2 + \xi^{(2)}}{(1+\psi_1)^2}$$

Sezgo de la estimación Landy - Szalay

$$\xi^{(2)}_{LZ}(r) = 1 + \frac{1}{N^2_{est}} \frac{DD(r)}{RR(r)} - \frac{2}{N_{est}} \frac{DR(r)}{RR(r)}$$

Observamos que ya tenemos todos los términos, a excepción de N_{est}:

$$N_{est} = \frac{D(r)}{R(r)} = \frac{\int n w \, dv}{\int \bar{n} w \, dv} = \frac{\int \bar{n}(1+\delta) w \, dv}{\int \bar{n} w \, dv} = \frac{\langle w \rangle + \bar{\delta}\langle w \rangle}{\langle w \rangle} = 1 + \bar{\delta}$$

$$N_{est} = 1 + \bar{\delta}$$

$$\xi^{(2)}_{LZ}(r) = 1 + \frac{1}{(1+\bar{\delta})^2} \frac{\cancel{\bar{n}^2} \cancel{\langle\langle w_1 w_2 \rangle\rangle} (1 + \psi_1 + \psi_2 + \xi^{(2)})}{\cancel{\bar{n}^2} \cancel{\langle\langle w_1 w_2 \rangle\rangle}} - \frac{2}{(1+\bar{\delta})} \frac{\bar{n}^2 (1+\psi_1) \cancel{\langle\langle w_1 w_2 \rangle\rangle}}{\bar{n}^2 \cancel{\langle\langle w_1 w_2 \rangle\rangle}}$$

$$= 1 + \frac{1 + \psi_1 + \psi_2 + \xi^{(2)}}{(1+\bar{\delta})^2} - 2 \frac{1+\psi_1}{1+\bar{\delta}}$$

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