$$PnL(T,t) = PnL_P(T,t) + PnL_Q(T,t)$$

$$= \xi\left(\left[C \cdot Wt_P \, \Delta MV_P\right] - \left[C \, Wt_Q \, \Delta MV_Q\right]\right)$$

(using the definition of Δ in market vol)

$$= \xi\left(\left[C \cdot Wt_P \cdot \frac{P_T - P_t}{P_t}\right] - \left[C \cdot Wt_Q \cdot \frac{Q_T - Q_t}{Q_t}\right]\right)$$

(using $\log\left(\frac{P_T}{P_t}\right) \approx$ return)

$$\approx \xi\left(\left[C \cdot Wt_P \cdot \log\left(\frac{P_T}{P_t}\right)\right] - \left[C \cdot Wt_Q \cdot \log\left(\frac{Q_T}{Q_t}\right)\right]\right)$$

$$= \xi\left(C\left[\frac{1}{1+\beta} \cdot \log\left(\frac{P_T}{P_t}\right) - \frac{\beta}{1+\beta} \cdot \log\left(\frac{Q_T}{Q_t}\right)\right]\right)$$

$$= \xi\left(\frac{C}{1+\beta}\left[\log(P_T) - \log(P_t) - \beta\log(Q_T) - \beta\log(Q_t)\right]\right)$$

$$= \xi\left(\frac{C}{1+\beta}\left[\left(\log(P_T) - \beta\log(Q_T)\right) - \left(\log(P_t) - \beta\log(Q_t)\right)\right]\right)$$

(subbing in values from equation (1))

$$= \xi\left(\frac{C}{1+\beta}\left[\alpha + \varepsilon_T - \alpha - \varepsilon_t\right]\right)$$

$$= \xi\, C \cdot Wt_P \left(\varepsilon_T - \varepsilon_t\right)$$