

(* Bug: The first line is valid only if $0(e^{P_0}) = e^{0(P_0)}$. *)

(* Bug: ξ must be a symbol. *)

Exp $_{U_{-i}, \theta}[\xi_{-}, P_{-}] := \text{Module}[\{\text{LQ} = \text{Normal}@P /. \epsilon \rightarrow \theta\},$

$\mathbb{E}[\xi \text{LQ} /. (\mathbf{x} | \mathbf{y})_i \rightarrow \theta, \xi \text{LQ} /. (\mathbf{t} | \mathbf{a})_i \rightarrow \theta, 1]];$

Exp $_{U_{-i}, k_{-}}[\xi_{-}, P_{-}] := \text{Block}[\{\$U = U, \$k = k\},$

Module $[\{P_0, \varphi, \varphi_S, F, j, \text{rhs}, \text{at}_0, \text{at}_\xi\},$

$P_0 = \text{Normal}@P /. \epsilon \rightarrow \theta;$

$\varphi_S = \text{Flatten}@Table[\varphi_{j_1, j_2, j_3}[\xi], \{j_2, \theta, k\},$

$\{j_1, \theta, 2k + 1 - j_2\}, \{j_3, \theta, 2k + 1 - j_2 - j_1\}];$

$F = \text{Normal}@Last@Exp_{U_i, k-1}[\xi, P] +$

$\epsilon^k \varphi_S. (\varphi_S /. \varphi_{j_S}[\xi] \Rightarrow \text{Times}@@\{\mathbf{y}_i, \mathbf{a}_i, \mathbf{x}_i\}^{j_S});$

$\text{rhs} =$

Normal@

Last@

$m_{i, j \rightarrow i}[\mathbb{E}[\xi P_0 /. (\mathbf{x} | \mathbf{y})_i \rightarrow \theta, \xi P_0 /. (\mathbf{t} | \mathbf{a})_i \rightarrow \theta, F + \theta_k]$

$m_{i \rightarrow j}@\mathbb{E}[\theta, \theta, P + \theta_k]]];$

$\text{at}_0 = (\# == \theta) \& /@$

Flatten@CoefficientList $[F - 1 /. \xi \rightarrow \theta, \{\mathbf{y}_i, \mathbf{a}_i, \mathbf{x}_i\}];$

$\text{at}_\xi = (\# == \theta) \& /@$

Flatten@CoefficientList $[(\partial_\xi F) + P_0 F - \text{rhs},$

$\{\mathbf{y}_i, \mathbf{a}_i, \mathbf{x}_i\}];$

$\mathbb{E}[\xi P_0 /. (\mathbf{x} | \mathbf{y})_i \rightarrow \theta, \xi P_0 /. (\mathbf{t} | \mathbf{a})_i \rightarrow \theta, F + \theta_k] /.$

DSolve $[\text{And}@@(\text{at}_0 \cup \text{at}_\xi), \varphi_S, \xi][[1]]]]$