

Appendix 2.2—India Poultry-Feed Model: Equations and Variable List

Model Equations¹

Poultry Block (PL)

- 1) $PLDemand = PL^1 * PCGDP + PL^2 * PLPrice_R + \text{constant}$
- 2) $PLDemand_D = PLDemand * PLDresspercent$
- 3) $PLProd = PLDemand$
- 4) $PLProd_D = PLProd * PLDresspercent$
- 5) $PLFeeduse_T = PLProd * PLFCR$
- 6) $PLFeeduse_{CO} = PLFeeduse_T * PLRS_{CO}$
- 7) $PLFeeduse_{SM} = PLFeeduse_T * PLRS_{SM}$

Egg Block (EG)

- 8) $EGDemand = EG^1 * PCGDP + EG^2 * EGPrice_R + \text{constant}$
- 9) $EGProd = EGDemand$
- 10) $EGFeeduse_T = EGProd * EGFCR$
- 11) $EGFeeduse_{CO} = EGFeeduse_T * EGRS_{CO}$
- 12) $EGFeeduse_{SM} = EGFeeduse_T * EGRS_{SM}$

Corn Block (CO)

- 13) $COProd = COArea * COYield$
- 14) $COArea = CO^1 * COArea_{t-1} + CO^2 * \sum_{i=1}^5 COPrice_{F, t-i} + \text{constant}$
- 15) $COYield = CO^3 * COPrice_{F, t-1} + CO^4 * COYield_{t-1} + \text{constant}$
- 16) $CODemand_{FD} = CODemand_{FD, t-1} * \text{Trend}$
- 17) $CODemand_{ST} = CODemand_{ST, t-1} * \text{Trend}$
- 18) $CODemand_{SW} = COProd * Seedwastepercent_{CO}$
- 19) $CODemand_T = CODemand_{FD} + CODemand_{ST} + CODemand_{SW} + PLFeeduse_{CO} + EGFeeduse_{CO}$
- 20) $CONetimports = CODemand_T - COProd$

Soybean and Meal Block

- 21) $SBProd = SBArea * SBYield$
- 22) $SBArea = SBArea_{t-1} * \text{Trend}$
- 23) $SBYield = SBYield_{t-1} * \text{Trend}$
- 24) $SBCrush = SBProd * SBCrushshare$
- 25) $SMProd = SBCrush * SMExtractionrate$
- 26) $SMDemand_T = PLFeeduse_{SM} + EGFeeduse_{SM}$
- 27) $SMNetexports = SMProd - SMDemand_T$

¹Variables in boldface are exogenous.

Poultry Price Block

$$\begin{aligned}
 28) \quad PLPrice_F &= PLCOP + \mathbf{PLMargin}_F \\
 29) \quad PLPrice_R &= PLPrice_F + \mathbf{PLMargin}_{FR} \\
 30) \quad PLCOP &= PLFeedcost + PLDOCcost + PLOthercost \\
 31) \quad PLFeedcost &= \mathbf{PLFCR} * (COPrice_W * \mathbf{PLRS}_{CO} + SMPrice_W * \mathbf{PLRS}_{SM} + \\
 &\quad OFCost_{PL}) + \mathbf{PLFeedmargin} \\
 32) \quad PLDOCCOP &= \mathbf{PLDOCcostfactor} * (\mathbf{PLRS}_{CO} * COPrice_W + \mathbf{PLRS}_{SM} * \\
 &\quad SMPrice_W + OFCost_{PL} + \mathbf{PLFeedmargin}) + PLDOCOthercost \\
 33) \quad PLDOCcost &= PLDOCCOP + PLDOCMargin \\
 34) \quad PLDOCOthercost &= PLDOCOthercost_{t-1} * \mathbf{Trend} \\
 35) \quad PLOthercost &= PLOthercost_{t-1} * \mathbf{Trend} \\
 36) \quad OFCost_{PL} &= OFCost_{PL,t-1} * \mathbf{Trend}
 \end{aligned}$$

Egg Price Block

$$\begin{aligned}
 37) \quad EGPrice_R &= COPrice_W * \mathbf{EGRS}_{CO} + SMPrice_W * \mathbf{EGRS}_{SM} + EGOthercost + \\
 &\quad \mathbf{EGMargin}_{FR} \\
 38) \quad EGOthercost &= EGOthercost_{t-1} * \mathbf{Trend}
 \end{aligned}$$

Corn Price Block

$$\begin{aligned}
 39) \quad COPrice_F &= COPrice_W - \mathbf{COMargin}_{FW} \\
 40) \quad COPrice_W &= \text{Free Trade: } \min\{COPrice_A, COPrice_B + \mathbf{COHandling}_{BF}\} \\
 &= \text{TRQ—Quota Not Operative: } \min\{COPrice_A, \\
 &\quad \mathbf{COPrice}_B * (1 + \mathbf{COTariff}) + \mathbf{COHandling}_{BF}\} \\
 &\quad \text{where, } \mathbf{COTariff} = \mathbf{COTariff}_{IQ} \text{ within quota} \\
 &\quad \mathbf{COTariff} = \mathbf{COTariff}_{AQ} \text{ above quota} \\
 &= \text{TRQ—Quota Operative:}^2 \quad COPrice_Q
 \end{aligned}$$

Soybean Meal Price Block

$$41) \quad SMPrice_W = SMPrice_B - SMHandling_{BW}$$

²When quota is operative, corn price is formed in manner consistent with Figure C.

Variable List

<u>Variable</u>	<u>Description</u>	<u>Unit</u>
COArea	Corn area harvested	1,000 ha.
CODemand	Corn demand	1,000 tons
COHandling	Corn handling costs	Rs/ton
COMargin	Corn marketing margin	Rs/ton
CONetimports	Corn net imports	1,000 tons
COPrice	Corn price	Rs/ton
COProd	Corn production	1,000 tons
COTariff	Corn tariff (ad valorem)	Percent
COTRQ	Corn tariff rate quota	1,000 tons
COYield	Corn yield	Tons/ha.
EGDemand	Egg demand	Million eggs
EGFCR	Egg feed conversion rate	Kg/egg
EGFeeduse	Egg feed use	1,000 tons
EGMargin	Egg marketing margin	Rs/egg
EGOthercost	Egg other costs of production	Rs/egg
EGPrice	Egg price	Rs/egg
EGProd	Egg production	Million eggs
EGRS	Egg feed ingredient ration share	Percent
OFCost _{PL}	Cost of feed ingredients other than corn and soybean meal	Rs/ton
PCGDP	Real GDP per capita	Rs/capita
PLCOP	Poultry cost of production	Rs/ton, live wght
PLDemand	Poultry demand	1,000 tons, live wght
PLDresspercent	Poultry meat dressing percentage	Percent
PLDOCCOP	Poultry DOC cost of production	Rs/ton, live wght
PLDOCcost	Poultry DOC cost	Rs/ton, live wght
PLDOCcostfactor	Factor for computing DOC costs	Ratio
PLDOCmargin	Poultry DOC marketing margin	Rs/ton, live wght
PLFCR	Poultry feed conversion rate	Feed/live wght production
PLFeedcost	Poultry feed cost	Rs/ton, live wght
PLFeedmargin	Poultry feed marketing margin	Rs/ton, live wght
PLFeeduse	Poultry feed use	1,000 tons
PLMargin	Poultry marketing margin	Rs/ton
PLOthercost	Poultry grower other costs	Rs/ton, live wght
PLPrice	Poultry price	Rs/ton
PLProd	Poultry production	1,000 tons
PLRS	Poultry feed ingredient ration share	Percent
Seedwastepersent	Seed and waste percent of production	Percent
SBArea	Soybean area harvested	1,000 ha.
SBCrush	Soybean crush	1,000 tons
SBCrushshare	Share of soybean production crushed	Percent
SBProd	Soybean production	1,000 tons
SBYield	Soybean yield	Tons/ha.
SMDemand	Soybean meal demand	1,000 tons

<u>Variable</u>	<u>Description</u>	<u>Unit</u>
SMExtractionrate	Soybean meal extraction rate	Percent
SMHandling	Soybean meal handling costs	Rs/ton
SMNetexports	Soybean meal net exports	1,000 tons
SMProd	Soybean meal production	1,000 tons
Subscript A	Autarchy	
Subscript AQ	Above quota	
Subscript B	Border	
Subscript BF	Border farm	
Subscript BW	Border wholesale	
Subscript CO	Corn	
Subscript D	Dressed weight basis	
Subscript F	Farm	
Subscript FD	Food	
Subscript FR	Farm retail	
Subscript FW	Farm wholesale	
Subscript IQ	In quota	
Subscript OT	Other feed	
Subscript R	Retail	
Subscript SM	Soybean meal	
Subscript ST	Starch	
Subscript T	Total	
Subscript W	Wholesale	
Subscript SW	Seed and waste	

Note: All prices are in 2001 Rs.