APPENDIX – SECTOR MAP AND EQUATION LISTING

The model was built using ithink (High Performance Inc, 2003). All parameter values were deleted for confidentiality purposes. The equations are ordered by sector.

**Market**

Price\_attracted\_users\_branded\_Liquid\_Soap = \text{GRAPH}((\text{VR\_Carex\_Effective\_Retail\_Price}/\text{VR\_Lever\_Liquid\_Soap\_Effective\_Retail\_Price}))

\text{Liquid\_Soap\_Volume\_Switched\_due\_to\_Price} = \text{IF}(\text{Price\_attracted\_users\_branded\_Liquid\_Soap}>0) \text{ THEN}(-\text{VR\_Lever\_Liquid\_Soap\_Volume}\times\text{Price\_attracted\_users\_branded\_Liquid\_Soap})\text{ ELSE}(-\text{VR\_Carex\_Volume}\times\text{Price\_attracted\_users\_branded\_Liquid\_Soap})

\text{New\_Product\_Consumers\_Response\_to\_Marketing\_Actions} = \text{Advertising\_attracted\_users\_liquid\_soap}+\text{Liquid\_Soap\_Volume\_Switched\_due\_to\_Price}
Advertising_attracted_users_liquid_soap = Total_Volume_Liquid_Soap_Market * 
(\textit{VR\_Lever\_Liquid\_Soap\_Expected\_Effect\_of\_Advertising} * 
\textit{(Lever\_Faberge\_Liquid\_Soap\_Effect\_of\_Share\_of\_Display)}) - 
\textit{VR\_Carex\_Expected\_Effect\_of\_Advertising} * \textit{(VR\_Carex\_Effect\_of\_Share\_of\_Display)})

\textit{VR\_Carex\_Effect\_of\_Share\_of\_Display} = \text{GRAPH}(\textit{VR\_Carex\_Share\_of\_Display})

\textit{VR\_Lever\_Liquid\_Soap\_Effect\_of\_Share\_of\_Display} = 
\text{GRAPH}(\textit{VR\_Lever\_Liquid\_Soap\_Share\_of\_Display})

\text{Saturation\_Effect\_on\_Adoption\_Rate} = \frac{(\text{Total\_Volume\_Liquid\_Soap\_Market})}{\text{New\_Product\_Expected\_Maximum\_Market\_Size}}

\textit{VR\_Cussons\_New\_to\_Old\_Product\_Price\_Ratio} = 
\frac{\text{\textit{VR\_Carex\_Retail\_Price}}}{\text{\textit{VR\_Imperial\_Leather\_Bar\_Soap\_Retail\_Price}}}

\text{New\_Product\_Estimated\_Market} = \text{GRAPH}(\textit{VR\_Cussons\_New\_to\_Old\_Product\_Price\_Ratio})

\text{Branded\_Bar\_Soap\_User\_response\_to\_price} = \text{GRAPH}(\frac{\text{\textit{VR\_Imperial\_Leather\_Bar\_Soap\_Effective\_Retail\_Price}}}{\text{\textit{VR\_Dove\_Bar\_Soap\_Effective\_Retail\_Price}}})

\text{Branded\_Bar\_Soap\_Volume\_switched\_due\_to\_price} = \text{IF} 
(\text{\textit{Branded\_Bar\_Soap\_User\_response\_to\_price}} > 0) \newline \text{THEN}(-\text{\textit{VR\_Dove\_Bar\_Soap\_Volume}} \cdot \text{\textit{Branded\_Bar\_Soap\_User\_response\_to\_price}}) \newline \text{ELSE}(-\text{\textit{VR\_Imperial\_Leather\_Bar\_Soap\_Volume}} \cdot \text{\textit{Branded\_Bar\_Soap\_User\_response\_to\_price}})

\text{Branded\_Bar\_Soap\_Users\_Response\_to\_Marketing\_Actions} = 
\text{\textit{Branded\_Bar\_Soap\_Users\_response\_to\_advertising}} + \text{\textit{Branded\_Bar\_Soap\_Volume\_switched\_due\_to\_price}}
Branded Bar Soap Users response to advertising = Total Volume Bar Soap Market * 
(VR Dove Expected Effect of Advertising *((VR Dove Bar Soap Effect of Share of Display)) - VR Imperial Leather Expected Effect of Advertising * 
(VR Imperial Leather Bar Soap Effect of Share Display))

VR Imperial Leather Bar Soap Effect of Share Display = 
GRAPH(VR Imperial Leather Bar Soap Share of Display Shelf)

VR Dove Bar Soap Effect of Share of Display = 
GRAPH(VR Dove Bar Soap Share of Display Shelf)
VR_Carex_Volume(t) = VR_Carex_Volume(t - dt) + (VR_Carex_adoption_rate - Branded_Liquid_Soap_Users_Switch_Rate - Price_Sensitive_VR_Carex_Users_Switch_Rate) * dt
INIT VR_Carex_Volume =

INFLOWS:
VR_Carex_adoption_rate = Adoption_Rate_of_VR_Carex_by_Imperial_Leather_users
OUTFLOWS:
Branded_Liquid_Soap_Users_Switch_Rate = New_Product_Consumers_Response_to_Marketing_Actions
Price_Sensitive_VR_Carex_Users_Switch_Rate = Liquid_Soap_Users_from_Carex_and_OL_Volume_switched_during_price

Own_Label_Liquid_Soap_Volume(t) = Own_Label_Liquid_Soap_Volume(t - dt) + (Price_Sensitive_VR_Carex_Users_Switch_Rate + Price_Sensitive_Lever_Liquid_Soap_UsersSwitch_Rate + Own_Label_Liquid_Soap_adoption_rates) * dt
INIT Own_Label_Liquid_Soap_Volume =

INFLOWS:
Price_Sensitive_VR_Carex_Users_Switch_Rate = Liquid_Soap_Users_from_Carex_and_OL_Volume_switched_during_price
Price_Sensitive_Lever_Liquid_Soap_UsersSwitch_Rate = Liquid_Soap_Users_from_Lever_and_OL_Volume_switched_during_to_price
Own_Label_Liquid_Soap_adoption_rates = Own_Label_Adoption_Rate_of_New_Product

VR_Lever__Liquid_Soap_Volume(t) = VR_Lever__Liquid_Soap_Volume(t - dt) + (VR_Lever_Liquid_Soap_adoption_rate + Branded_Liquid_Soap_Users_Switch_Rate - Price_Sensitive_Lever_Liquid_Soap_UsersSwitch_Rate) * dt
INIT VR_Lever__Liquid_Soap_Volume =

INFLOWS:
VR_Lever_Liquid_Soap_adoption_rate = Adoption_Rate_of_Liquid_Soap_by_Dove_users
Branded_Liquid_Soap_Users_Switch_Rate = New_Product_Consumers_Response_to_Marketing_Actions
OUTFLOWS:
Price_Sensitive_Lever_Liquid_Soap_UsersSwitch_Rate = Liquid_Soap_Users_from_Lever_and_OL_Volume_switched_during_to_price

VR_Imperial_Leather_Bar_Soap_Volume(t) = VR_Imperial_Leather_Bar_Soap_Volume(t - dt) + (- Branded_Bar_Soap_Users_Switch_Rate - Price_Sensitive_IL_Bar__Users_Switch_Rate - IL_to_Radox_Substitution_rate - VR_Carex_adoption_rate) * dt
INIT VR_Imperial_Leather_Bar_Soap_Volume =

OUTFLOWS:
Branded_Bar_Soap_Users_Switch_Rate = Branded_Bar_Soap_Users_Response_to_Marketing_Actions
Price_Sensitive_IL_Bar__Users_Switch_Rate = Bar_Soap_Users__from_IL_and_Own_labe_Volume_switched_during_to_price
IL_to_Radox_Substitution_rate = VR_Imperial_Leather_Bar_Soap_Volume*Management_Estimated_Rate_of_Substitution
VR_Carex_adoption_rate = Adoption_Rate_of_VR_Carex_by_Imperial_Leather_users

Own_Label_Bar_Soap__Volume(t) = Own_Label_Bar_Soap__Volume(t - dt) + (Price_Sensitive_IL_Bar__Users_Switch_Rate + Price_Sensitive_Dove_Bar__Users_Switch_Rate - OL_to_Radox_Substitution_Rate - Own_Label__Liquid_Soap_adoption_rate) * dt
INIT Own_Label_Bar_Soap__Volume =

INFLOWS:
Price_Sensitive_IL_Bar__Users_Switch_Rate = Bar_Soap_Users__from_IL_and_Own_labe_Volume_switched_during_to_price
Price_Sensitive_Dove_Bar__Users_Switch_Rate = Bar_Soap_Users__from_Dove_and_OL_Volume_switched_during_to_price
OUTFLOWS:
OL_to_Radox_Substitution_Rate = Own_Label_Bar_Soap__Volume*Management_Estimated_Rate_of_Substitution
Own_Label__Liquid_Soap_adoption_rate = Own_Label_Adoption_Rate_of_New_Product

VR_Dove_Bar_Soap_Volume(t) = VR_Dove_Bar_Soap_Volume(t - dt) +
(Branded_Bar_Soap_Users_Switch_Rate - Price_Sensitive_Dove_Bar__Users_Switch_Rate -
Dove_to_Radox_Substitution_rate - VR_Lever_Liquid_Soap_adoption_rate) * dt

INIT VR_Dove_Bar_Soap_Volume =

INFLOWS:
Branded_Bar_Soap_Users_Switch_Rate =
Branded_Bar_Soap_Users_Response_to_Marketing_Actions

OUTFLOWS:
Price_Sensitive_Dove_Bar__Users_Switch_Rate =
Bar_Soap_User_Users_from_Dove_and_OL_Volume_switched_due_to_price
Dove_to_Radox_Substitution_rate =
VR_Dove_Bar_Soap_Volume*Management_Estimated_Rate_of_Substitution
VR_Lever_Liquid_Soap_adoption_rate = Adoption_Rate_of_Liquid_Soap_by_Dove_users

Management_Estimated_Rate_of_Substitution =

Own_Label_Bar_Soap_Volume_real_data = GRAPH(TIME)
Own_Label_Liquid_Soap_Real_Data = GRAPH(TIME)
VR_Carex_Volume_Real_Data = GRAPH(TIME)
VR_Dove_Bar_Soap_Volume_real_data = GRAPH(TIME)
VR_Imperial_Leather_Bar_Soap_Volume_real_data = GRAPH(TIME)
VR_Lever__Liquid_Soap__Real_Data = GRAPH(TIME)

VR-Lever
VR_Lever_Liquid_Soap_Retail_Price(t) = VR_Lever_Liquid_Soap_Retail_Price(t - dt) +
(VR_Lever_Liquid_Soap__Retail_Price_Adjustment_Rate) * dt
INIT VR_Lever_Liquid_Soap_Retail_Price =
INFLOW:
VR_Lever_Liquid_Soap__Retail_Price_Adjustment_Rate =
(VR_Lever_Liquid_Soap_Retail_Price_Suggested -
VR_Lever_Liquid_Soap_Retail_Price)/VR_Lever_Time_to_Adjust_Retail_Price
VR_Lever_Liquid_Soap_Retail_Price_Suggested =
VR_Lever_Liquid_Soap_Wholesale_Price*(1+VR_Lever__Liquid_Soap_Trade_Margin)
VR_Lever_Liquid_Soap_Market_Share_Goal_Attainment =
VR_Lever_Liquid_Soap_Market_share_Short_term_Evolution /
VR_Lever__Short_term_Market_Share_Goal
VR_Lever_Liquid_Soap_Market_share_Short_term_Evolution =
SMTH1(VR_Lever_Liquid_Soap_Market_Share,VR_Lever_Short_Term_Time_Horizon)
VR_Lever_Short_Term_Time_Horizon =
VR_Lever__Short_term_Market_Share_Goal =
VR_Lever_Liquid_Soap_Effect_of_Market_Performance =
GRAPH(VR_Lever_Liquid_Soap_Market_Share_Goal_Attainment)
VR_Lever_Liquid_Soap_Short_term_Consumer_Promotions =
GRAPH(VR_Lever_Liquid_Soap_Effect_of_Market_Performance)
VR_Lever_Liquid_Soap_Effective_Retail_Price = VR_Lever_Liquid_Soap_Retail_Price*(1-
VR_Lever_Liquid_Soap_Short_term_Consumer_Promotions)
VR_Lever_Liquid_Soap_Actual_Expenditure_on_Advertising =
VR_Lever_Liquid_Soap_Average_Expenditure_on_Advertising *
VR_Lever_Liquid_Soap_Effect_of_Market_Performance
VR_Lever_Liquid_Soap_Average_Expenditure_on_Advertising = GRAPH(TIME)
VR_Lever_Liquid_Soap_Expected_Effect_of_Advertising =
GRAPH(SMTH1(VR_Lever_Liquid_Soap_Actual_Expenditure_on_Advertising,))
VR_Lever_Liquid_Soap_real_retail_price = GRAPH(TIME)
Adoption Rate of Liquid Soap by Dove users =
(\text{VR}_\text{Dove Bar Soap Volume} \times \text{VR}_\text{Lever Old Product Consumers attracted by price} \times 
\text{VR}_\text{Lever Effect of Share of Voice on Adoption} ) \times (1 - \text{Saturation Effect on Adoption Rate})

\text{VR}_\text{Lever Old Product Consumers attracted by price} =
\text{GRAPH}(\text{VR}_\text{Lever Old to New product price ratio})

\text{VR}_\text{Lever Old to New product price ratio} =
\text{VR}_\text{Lever Liquid Soap Retail Price} / \text{VR}_\text{Dove Bar Soap Retail Price}

\text{VR}_\text{Lever Effect of Share of Voice on Adoption} =
\text{GRAPH}(\text{VR}_\text{Lever Share of Voice New vs Old Product})

\text{VR}_\text{Lever Share of Voice New vs Old Product} =
\text{VR}_\text{Lever Liquid Soap Actual Expenditure on Advertising} / 
\text{VR}_\text{Lever Actual Advertising Investment on Dove Bar}

\text{VR}_\text{Lever Liquid Soap Trade Margin}(t) = \text{VR}_\text{Lever Liquid Soap Trade Margin}(t - dt) + 
(\text{VR}_\text{Lever Change in Liquid Soap Trade Margin}) \times dt
\text{INIT VR}_\text{Lever Liquid Soap Trade Margin} =
\text{INFLOWS:}
\text{VR}_\text{Lever Change in Liquid Soap Trade Margin} =
\text{VR}_\text{Lever Liquid Soap Adjustment Trade Margin} / 
\text{VR}_\text{Lever Time to Implement new trade margin}
VR_Lever_Liquid_Soap_Adjustment_Trade_Margin = (VR_Cussons_Carex_Trade_Margin +
VR_Lever_Normal_Increment_over_VR_Cussons_Trade_Margin) -
VR_Lever_Liquid_Soap_Trade_Margin

LIquid_Soap_Customers_from_Lever_and_OL_Response_to_Price_Change =
GRAPH((VR_Lever_Liquid_Soap_Effective_Retail_Price/Own_Label_Liquid_Soap_Retail_Price))

Liquid_Soap_Users_from_Lever_and_OL_Volume_switched_due_to_price =
IF(LIquid_Soap_Customers_from_Lever_and_OL_Response_to_Price_Change>=0)
THEN-(Own_Label_Liquid_Soap_Volume*LIquid_Soap_Users_from_Lever_and_OL_Response_to_Price_Change)
ELSE (-VR_Lever__Liquid_Soap_Volume*LIquid_Soap_Users_from_Lever_and_OL_Response_to_Price_Change)

VR_Lever_New_Product_Capacity(t) = VR_Lever_New_Product_Capacity(t - dt) +
(VR_Lever_New_Product_Capacity_Adjustment_rate) * dt
INIT VR_Lever_New_Product_Capacity =
INFLOWS:

\[ VR_{\text{Lever New Product Capacity Adjustment rate}} = \frac{VR_{\text{Lever New Product Capacity Adjustment}}}{VR_{\text{Lever Time to Adjust Capacity}}} \]

\[ VR_{\text{Lever New Product Capacity Adjustment}} = (VR_{\text{Lever Liquid Soap Volume}} \ast (1 + VR_{\text{Lever New Product Volume Growth Rate}} \ast VR_{\text{Lever Expected Time to reach Capacity Saturation}}) - VR_{\text{Lever New Product Capacity}} \ast VR_{\text{Lever Capacity Saturation Threshold}}) \]

\[ VR_{\text{Lever New Product Volume Growth Rate}} = \text{TREND}(VR_{\text{Lever Liquid Soap Volume}}, VR_{\text{Lever Averaging Time for Market Information}}) \]

\[ VR_{\text{Lever Old Product Capacity}}(t) = VR_{\text{Lever Old Product Capacity}}(t - dt) + (- VR_{\text{Lever Old Product Capacity Adjustment rate}}) \ast dt \]

INIT \( VR_{\text{Lever Old Product Capacity}} \)

OUTFLOWS:

\[ VR_{\text{Lever Old Product Capacity Adjustment rate}} = \frac{VR_{\text{Lever Old Product Capacity Adjustment}}}{VR_{\text{Lever Time to Adjust Capacity}}} \]

\[ VR_{\text{Lever Old Product Capacity Adjustment}} = VR_{\text{Lever Old Product Capacity}} - \text{SMTH1}(VR_{\text{Dove Bar Soap Volume}}, VR_{\text{Lever Capacity Planning Horizon}}, VR_{\text{Lever Old Product Capacity}}) \]

\[ VR_{\text{Lever Time to Adjust Capacity}} = \]

\[ VR_{\text{Lever Expected Time to reach Capacity Saturation}} = \]

\[ VR_{\text{Lever Averaging Time for Market Information}} = \]

\[ VR_{\text{Lever Capacity Planning Horizon}} = \]

\[ VR_{\text{Lever Capacity Saturation Threshold}} = \]

\[ VR_{\text{Lever Wholesale Price Setting Decision Making Process}} \]

\[ VR_{\text{Dove Bar Soap Wholesale Price}} = VR_{\text{Dove Bar Soap Cost of Goods Sold}} \ast (1 + VR_{\text{Lever Old Product Actual Gross Margin}}) \]

\[ VR_{\text{Dove Bar Soap Cost of Goods Sold}} = \text{GRAPH}(VR_{\text{Lever Old Product Capacity}}) \]

\[ VR_{\text{Lever Liquid Soap Wholesale Price}} = VR_{\text{Lever Liquid Soap Cost of Goods Sold}} \ast (1 + VR_{\text{Lever New Product Actual Gross Margin}}) \]

\[ VR_{\text{Lever Liquid Soap Cost of Goods Sold}} = \text{GRAPH}(VR_{\text{Lever New Product Capacity}}) \]
VR_Lever__Long_Term_Target_Market_Share =

**VR Lever Gross Margin Setting Decision Making Process**

VR_Lever_New_Product_Actual_Gross_Margin =
VR_Lever_New_Product_Initial_Gross_Margin*
VR_Lever_New_Product_Goal_Attainment_effect_Initial_Gross_Margin

VR_Lever_New_Product_Initial_Gross_Margin =
VR_Lever_New_Product_Goal_Attainment_effect_Initial_Gross_Margin =
GRAPH(VR_Lever_New_Product_Goal_Attainment)

VR_Lever_New_Product_Goal_Attainment =
VR_Lever_New_Product_Long_term_Market_Share/
VR_Lever__Long_Term_Target_Market_Share

VR_Lever_Old_Product_Actual_Gross_Margin =
VR_Lever_Old_Product_Initial_Gross_Margin*
VR_Lever_Old_Product_Goal_Attainment_effect_Initial_Gross_Margin

VR_Lever_Old_Product_Initial_Gross_Margin =
VR_Lever_Old_Product_Goal_Attainment_effect_Initial_Gross_Margin =
GRAPH(SMTH1(VR_Dove_Bar_Soap_Market_Share /
VR_Lever__Long_Term_Target_Market_Share,VR_Lever_Long_Term_Horizon))

VR_Lever_Long_Term_Horizon =

Bar_Soap_User_Users_from_VR_Dove_and_OL_Volume_switched_due_price =
IF(Old_Product_Users_from_VR_Dove_and_OL_Response_to_price_change>=0)
THEN (-Own_Label_Bar_Soap__Volume*
Old_Product_Users_from_VR_Dove_and_OL_Response_to_price_change)
ELSE (-VR_Dove_Bar_Soap_Volume*
Old_Product_Users_from_VR_Dove_and_OL_Response_to_price_change)

Old_Product_Users_from_VR_Dove_and_OL_Response_to_price_change =
GRAPH((VR_Dove_Bar_Soap_Effective_Retail_Price/Own_Label_Bar_Soap__Retail_Price))
VR_Lever_Bar_Soap_Trade_Margin(t) = VR_Lever_Bar_Soap_Trade_Margin(t - dt) +
(VR_Lever_Old_Product_Change_in_Trade_Margin) * dt
INIT VR_Lever_Bar_Soap_Trade_Margin

INIFOWS:
VR_Lever_Old_Product_Change_in_Trade_Margin =
VR_Lever_Old_Product_Adjustment_Trade_Margin/
VR_Lever_Time_to_Implement_new_trade_margin

VR_Lever_Old_Product_Adjustment_Trade_Margin = (VR_Cussons_Bar_Soap_Trade_Margin +
VR_Lever_Normal_Increment_over_VR_Cussons_Trade_Margin) -
VR_Lever_Bar_Soap_Trade_Margin

VR_Lever_Normal_Increment_over_VR_Cussons_Trade_Margin =

VR_Lever_Time_to_Implement_new_trade_margin =
VR_Dove_Bar_Soap_Retail_Price(t) = VR_Dove_Bar_Soap_Retail_Price(t - dt) +
(VR_Dove_Bar_Soap_Retail_Price_Adjustment_Rate) * dt
INIT VR_Dove_Bar_Soap_Retail_Price =

INFLows:
VR_Dove_Bar_Soap_Retail_Price_Adjustment_Rate =
(VR_Dove_Bar_Soap_Retail_Suggested_Price-VR_Dove_Bar_Soap_Retail_Price)
/VR_Lever_Time_to_Adjust_Retail_Price

VR_Dove_Bar_Soap_Retail_Suggested_Price = VR_Dove_Bar_Soap_Wholesale_Price*
(1+VR_Lever_Bar_Soap_Trade_Margin)

VR_Lever_Time_to_Adjust_Retail_Price =

VR_Dove_Bar_Soap_Market_share_short_term_Evolution =
VR_Dove_Bar_Soap_Past_Period_market_share / VR_Dove_Bar_Soap_Target_Market_Share

VR_Dove_Bar_Soap_Target_Market_Share =

VR_Dove_Bar_Soap_Past_Period_market_share =
SMTH1(VR_Dove_Bar_Soap_Market_Share,VR_Lever_Short_Term_Time_Horizon)

VR_Dove_Bar_Soap_Effect_of_Market_Performance =
GRAPH(VR_Dove_Bar_Soap_Market_share_short_term_Evolution)

VR_Dove_Bar_Soap_Effect_of_Market_Performance =
GRAPH(VR_Dove_Bar_Soap_Market_share_short_term_Evolution)

VR_Dove_Bar_Soap_Short_term_Consumer_Promotions =
GRAPH(VR_Dove_Bar_Soap_Effect_of_Market_Performance)

VR_Dove_Bar_Soap_Effective_Retail_Price = VR_Dove_Bar_Soap_Retail_Price* (1-
VR_Dove_Bar_Soap_Short_term_Consumer_Promotions)

VR_Lever_Actual_Advertising_Investment_on_Dove_Bar =
VR_Dove_Bar_Soap_Effect_of_Market_Performance*
VR_Lever_Average_Expenditure_on_Advertising_on_Dove_Bar

VR_Lever_Average_Expenditure_on_Advertising_on_Dove_Bar = GRAPH(TIME)

VR_Dove_Expected_Effect_of_Advertising =
GRAPH(SMTH1(VR_Lever_Actual_Advertising_Investment_on_Dove_Bar,))

VR_Dove_Bar_Soap_real_retail_price = GRAPH(TIME)
VR-Cussons

VR_Carex_Retail_Price(t) = VR_Carex_Retail_Price(t - dt) + (VR_Carex_New_Product_Retail_Price_Adjustment_Rate) * dt
INIT VR_Carex_Retail_Price =
INFLOWS:
VR_Carex_New_Product_Retail_Price_Adjustment_Rate = (VR_Carex_Retail_Suggested_Price - VR_Carex_Retail_Price)/VR_Cussons_Time_to_adjust_Retail_Price

VR_Carex_Retail_Suggested_Price =
VR_Carex_Wholesale_Price*(1+VR_Cussons_Carex_Trade_Margin)

VR_Cussons_Time_to_adjust_Retail_Price =

VR_Carex_Short_term_Market_Performance = VR_Carex_Volume/VR_Carex_Past_Period_Volume

VR_Carex_Past_Period_Volume =
SMTH1(VR_Carex_Volume,VR_Cussons_Short_term_Time_Horizon)

VR_Cussons_Short_term_Time_Horizon =

VR_Carex_Effect_of_Market_Performance = GRAPH(VR_Carex_Short_term_Market_Performance)

VR_Carex_Short_term_Consumer_Promotions =
GRAPH(VR_Carex_Effect_of_Market_Performance)

VR_Carex_Effective_Retail_Price =VR_Carex_Retail_Price* (1 - VR_Carex_Short_term_Consumer_Promotions)

VR_Carex_real_retail_price = GRAPH(TIME)

VR_Cussons_Actual_Expenditure_on_Carex_Advertising =
VR_Cussons_Average_Expenditure_on_Carex_Advertising* VR_Carex_Effect_of_Market_Performance

VR_Cussons_Average_Expenditure_on_Carex_Advertising = GRAPH(TIME)
VR_Carex__Expected_Effect_of_Advertising =
GRAPH(SMTH1(VR_Cussons_Actual_Expenditure_on__Carex_Advertising,))

VR_Imperial_Leather__Consumers__in_Trial_Phase(t) =
VR_Imperial_Leather__Consumers__in_Trial_Phase(t - dt) +
(Adopters_of_VR_Carex_from_trial - Rejectors_of_VR_Carex_from_Trial) * dt
INIT VR_Imperial_Leather__Consumers__in_Trial_Phase =
INFLOWS:
VR_Imperial_Leather__Consumers__in_Trial_Phase =
VR_Imperial_Leather_Bar_Soap_Volume*VR_Imperial_Leather__volume_reached_by_trialling_effort
OUTFLOWS:
Adopters_of_VR_Carex_from_trial =
(VR_Imperial_Leather__Consumers__in_Trial_Phase/Time_in_Trial_Phase)*(1-Saturation_Effect_on__Adoption_Rate)
Rejectors_of_VR_Carex_from_Trial =
(VR_Imperial_Leather__Consumers__in_Trial_Phase/Time_in_Trial_Phase)*Saturation_Effect_on__Adoption_Rate

Time_in_Trial_Phase =

VR_Imperial_Leather__volume_reached_by_trialling_effort =
GRAPH(VR_Cussons_Investment_to_switch_customers)

VR_Cussons_Investment_to_switch_customers = GRAPH(VR_Carex_Market_Size_Attainment)

Adoption_Rate_of_VR_Carex_by_Imperial_Leather_users =
(VR_Imperial_Leather_Bar_Soap_Volume*Imperial_Leather_users__attracted_to_VR_Carex_by_price* VR_Cussons_Effect_of_Share_of_Voice__on_Adoption_of_Carex) * (1-Saturation_Effect_on__Adoption_Rate) + Adopters_of_VR_Carex_from_trial

Share_of_Voice_Carex_vs_Imperial_Leather =
VR_Cussons_Actual_Expenditure_on__Carex_Advertising/
VR_Cussons_Actual_Expenditure_on__Imperial_Leather_Advertising

Imperial_Leather_users_attracted_to_VR_Carex_by_price =
GRAPH(VR_Cussons_New_to_Old_Product_Price_Ratio)
VR_Cussons_Effect_of_Share_of_Voice__on_Adoption_of_Carex =
GRAPH(Share_of_Voice_Carex_vs_Imperial_Leather)

VR_Cussons_Carex_Trade_Margin(t) = VR_Cussons_Carex_Trade_Margin(t - dt) +
(VR_Cussons_Carex_Trade_Margin_Adjustment_Rate) * dt
INIT VR_Cussons_Carex_Trade_Margin =
INFLOWS:
VR_Cussons_Carex_Trade_Margin_Adjustment_Rate =
(VR_Cussons_New_Product_Defined_Trade_margin-VR_Cussons_Carex_Trade_Margin) / VR_Cussons_Time_to_Implement_new_trade_margin

VR_Cussons_New_Product_Defined_Trade_margin =

Liquid_Soap_Users_from_Carex_and_OL__Volume_switched_due_price =
IF(New_Product_Customers_from_Carex_and_OL_Response_to_Price_Change>=0)
THEN(-Own_Label_Liquid_Soap_Volume * Liquid_Soap_Customers_from_Carex_and_OL_Response_to_Price_Change)
ELSE(-VR_Carex_Volume*New_Product_Customers_from_Carex_and_OL_Response_to_Price_Change)

New_Product_Customers_from_Carex_and_OL_Response_to_Price_Change =
GRAPH((VR_Carex_Effective_Retail_Price/Own_Label_Liquid_Soap_Retail_Price))

Own_Label_Liquid_Soap_real_retail_price = GRAPH(TIME)
VR_Cussons New Product Capacity(t) = VR_Cussons New Product Capacity(t - dt) + 
(VR_Cussons New Product Capacity_Adjustment_rate) * dt 
INIT VR_Cussons New Product Capacity = 
INFLOWS: 
VR_Cussons New Product Capacity_Adjustment_rate = 
VR_Cussons New Product Capacity_Adjustment/VR_Cussons Time_to_Adjust_Capacity 

VR_Cussons New Product Capacity_Adjustment = ((VR_Carex Volume* 
(1+VR_Cussons New Product Growth Rate * Expected_Time_to_reach_Capacity_Saturation))- 
(VR_Cussons New Product Capacity * VR_Cussons Capacity Saturation_Threshold)) 

VR_Cussons New Product Growth Rate = 
TREND(VR_Carex Volume,VR_Cussons Averaging_Time_for_Market_Information) 

Expected_Time_to_reach_Capacity_Saturation = 

VR_Cussons Averaging_Time_for_Market_Information = 

VR_Cussons New Product Capacity_Utilization_ratio = 
VR_Carex.Volume/VR_Cussons New Product Capacity 

VR_Cussons Bar Soap Capacity(t) = VR_Cussons Bar Soap Capacity(t - dt) + (- 
VR_Cussons Bar Soap Capacity_Adjustment_rate) * dt 
INIT VR_Cussons Bar Soap Capacity = 
OUTFLOWS: 
VR_Cussons Bar Soap Capacity_Adjustment_rate = 
VR_Cussons Bar Soap Capacity_Adjustment/VR_Cussons Time_to_Adjust_Capacity 

VR_Cussons Bar Soap Capacity_Adjustment = VR_Cussons Bar Soap Capacity - 
SMTH1(VR_Imperial_Leather_Bar Soap Volume,VR_Cussons Capacity_Planning_Horizon, 
VR_Cussons Bar Soap Capacity) 

VR_Cussons Capacity_Planning_Horizon = 

VR_Cussons Capacity Saturation_Threshold =
VR_Cussons_Old_Product_Capacity_Utilization_ratio =
VR_Imperial_Leather_Bar_Soap_Volume/VR_Cussons_Bar_Soap_Capacity

VR_Cussons_Time_to_Adjust_Capacity =

VR_Imperial_Leather_Bar_Soap_Wholesale_Price =
VR_Imperial_Leather_Bar_Soap_Effective_Cost_of_Goods_Sold * (1+Firm_A_Old_product_Actual_Gross_Margin)

VR_Imperial_Leather_Bar_Soap_Effective_Cost_of_Goods_Sold =
VR_Imperial_Leather_Bar_Soap_Cost_of_Goods_Sold*(1+
VR_Imperial_Leather_Bar_Soap_Capacity_Utilization_on_Costs)

VR_Imperial_Leather_Bar_Soap_Cost_of_Goods_Sold = GRAPH(VR_Cussons_Bar_Soap_Capacity)

VR_Imperial_Leather_Bar_Soap_Capacity_Utilization_on_Costs =
GRAPH(VR_Cussons_Old_Product_Capacity_Utilization_ratio)

VR_Carex_Wholesale_Price =
VR_Carex_Effective_Cost_of_Goods_Sold*(1+VR_Carex_Gross_Margin)

VR_Carex_Effective_Cost_of_Goods_Sold =
VR_Carex_Cost_of_Goods_Sold*(1+VR_Carex_Effect_of_Capacity_Utilization__on_Costs)

VR_Carex_Cost_of_Goods_Sold = GRAPH(VR_Cussons_New_Product_Capacity)

VR_Carex_Effect_of_Capacity_Utilization__on_Costs =
GRAPH(VR_Cussons_New_Product_Capacity_Utilization_ratio)

VR Cussons Gross Margin Setting Decision Making process
VR_Carex_Gross_Margin(t) = VR_Carex_Gross_Margin(t - dt) + (-
VR_Carex_Change_in_Gross_Margin) * dt
INIT VR_Carex_Gross_Margin =
OUTFLOWS:
VR_Carex_Change_in_Gross_Margin = ((VR_Carex_Gross_Margin*
VR_Cussons_New_Product_Gross_Margin_Adjust_from_Size_Attainment)-
VR_Carex_Gross_Margin)/VR_Cussons_Time_to_Adjust_New_product_Gross_Margin

VR_Cussons_Time_to_Adjust_New_product_Gross_Margin =
VR_Cussons_New_Product_Gross_Margin_Adjust_from_Size_Attainment =
VR_Cussons_New_to_Old_Product_Price_Ratio /
VR_Cussons_Definition_Price_Ratio_New_to_Old_Product

VR_Cussons_Definition_Price_Ratio_New_to_Old_Product(t) =
VR_Cussons_Definition_Price_Ratio_New_to_Old_Product(t - dt) +
(- VR_Cussons_Change_in_Defined_Price_Ratio) * dt
INIT VR_Cussons_Definition_Price_Ratio_New_to_Old_Product =
OUTFLOWS:
VR_Cussons_Change_in_Definition_Price_Ratio =
VR_Cussons_Adjustment_of_Definition_Price_Ratio/
VR_Cussons_Time_to_Adjust_Ratio

VR_Cussons_Time_to_Adjust_Ratio =

VR_Cussons_Adjustment_of_Definition_Price_Ratio =
VR_Cussons_Definition_Price_Ratio_New_to_Old_Product *
VR_Cussons_New_product_Effect_of_Market_Size_Attainment_on_Ratio

VR_Cussons_New_product_Effect_of_Market_Size_Attainment_on_Ratio =
GRAPH(VR_Carex_Market_Size_Attainment)

VR_Carex_Market_Size_Attainment = VR_Cussons_New_Product_Long_term_Market_Size / Management_Expected_New_Product_Market_Size

VR_Cussons_New_Product_Long_term_Market_Size(t) =
VR_Cussons_New_Product_Long_term_Market_Size(t - dt) +
(VR_Cussons_New_Product_Adjustment_of_Market_Size) * dt
INIT VR_Cussons_New_Product_Long_term_Market_Size =
INFLOW:
VR_Cussons_New_Product_Adjustment_of_Market_Size = (VR_Carex_Volume -
VR_Cussons_New_Product_Long_term_Market_Size)/VR_Cussons_Long_Term_Horizon

Management_Expected_New_Product_Market_Size =

VR_Cussons_Long_Term_Horizon =

VR_Cussons_Old_product_Actual_Gross_Margin =
VR_Cussons_Old_Product_Initial_Gross_Margin *
VR_Cussons_Old_Product_Effect_of_Market_Evolution_on_Gross_Margin

VR_Cussons_Old_Product_Effect_of_Market_Evolution_on_Gross_Margin =
GRAPH(VR_Imperial_Leather_Bar_Soap_Volume/VR_Imperial_Leather_Bar_Soap_Long_Term_Market_Size_Evolution)

VR_Cussons_Old_Product_Initial_Gross_Margin =
VR_Imperial_Leather_Bar_Soap_Long_Term_Market_Size_Evolution =
SMTH1(VR_Imperial_Leather_Bar_Soap_Volume, VR_Cussons_Long_Term_Horizon)
Bar Soap Users from IL and Own label Volume switched due price = IF(Old Product Users from IL and Own Label Response to price change>=0) THEN(-Own Label Bar Soap__Volume* Old Product Users from IL and Own Label Response to price change) ELSE(-VR Imperial Leather Bar Soap Volume* Old Product Users from IL and Own Label Response to price change)

Old Product Users from IL and Own Label Response to price change = GRAPH((VR Imperial Leather Bar Soap Effective Retail Price/Own Label Bar Soap__Retail_Price))

Own Label Bar Soap__real_retail_price = GRAPH(TIME)

VR_Cussons_Old_Product_Trade_Margin(t) = VR_Cussons_Old_Product_Trade_Margin(t - dt) + (VR_Cussons_Old_Product__Trade_Margin_Adjustment_Rate) * dt
INIT VR_Cussons_Bar_Soap_Trade_Margin = INFLOWS:
VR_Cussons_Old_Product__Trade_Margin_Adjustment_Rate = (VR_Cussons_Old_Product__Defined_Trade_Margin-VR_Cussons_Bar_Soap_Trade_Margin)/ VR_Cussons_Time_to_Implement_new_trade_margin

VR_Cussons_Old_Product__Defined_Trade_Margin =

VR_Cussons_Time_to_Implement_new_trade_margin =
VR_Imperial_Leather_Bar_Soap_Retail_Price(t) = VR_Imperial_Leather_Bar_Soap_Retail_Price(t - dt) + (VR_Imperial_Leather_Bar_Soap_Retail_Price__Adjustment_Rate) * dt
INIT VR_Imperial_Leather_Bar_Soap_Retail_Price =

INFLOWS:
VR_Imperial_Leather_Bar_Soap_Retail_Price__Adjustment_Rate =
(VR_Imperial_Leather_Bar_Soap_Suggested_Retail_Price - VR_Imperial_Leather_Bar_Soap_Retail_Price) / VR_Cussons_Time_to_adjust_Retail_Price

VR_Imperial_Leather_Bar_Soap_Suggested_Retail_Price =
VR_Imperial_Leather_Bar_Soap_Wholesale_Price * (1 + VR_Cussons_Bar_Soap_Trade_Margin)

VR_Imperial_Leather_Bar_Soap_Short_term_Market_Performance =
VR_Imperial_Leather_Bar_Soap_Volume / VR_Imperial_Leather_Bar_Soap_Past_Period_Volume

VR_Imperial_Leather_Bar_Soap_Past_Period_Volume =
SMTH1(VR_Imperial_Leather_Bar_Soap_Volume, VR_Cussons_Short_term_Time__Horizon)

VR_Imperial_Leather_Bar_Soap_Effect_of_Market_Performance =
GRAPH(VR_Imperial_Leather_Bar_Soap_Short_term_Market_Performance)

VR_Imperial_Leather_Bar_Soap_Short_term_Consumer_Promotions =
GRAPH(VR_Imperial_Leather_Bar_Soap_Effect_of_Market_Performance)

VR_Imperial_Leather_Bar_Soap_Effective_Retail_Price =
VR_Imperial_Leather_Bar_Soap_Retail_Price * (1 - VR_Imperial_Leather_Bar_Soap_Short_term_Consumer_Promotions)

VR_Imperial_Leather_Bar_Soap_real_retail_price = GRAPH(TIME)
VR_Cussons_Actual_Expenditure_on__Imperial_Leather_Advertising =
VR_Cussons_Average_Expenditure_on_Imperial_Leather_Advertising*
VR_Imperial_Leather_Bar_Soap_Effect_of_Market_Performance

VR_Cussons_Average_Expenditure_on_Imperial_Leather_Advertising = GRAPH(TIME)

VR_Imperial_Leather_Expected_Effect_of_Advertising =
GRAPH(SMTH1(VR_Cussons_Actual_Expenditure_on__Imperial_Leather_Advertising,))

**Own-labels**

Own_Label_Adoption_Rate_of_New_Product =
(Own_Label_Bar_Soap__Volume*Own_Label_Old_Product_Consumers_attracted_by_price)*(1-
Saturation_Effect_on__Adoption_Rate)

Own_Label_Old_Product_Consumers_attracted_by_price =
GRAPH(Own_Label_New_to_Old_Product_Price_Ratio)

Own_Label_New_to_Old_Product_Price_Ratio =
Own_Label_Liquid_Soap_Retail_Price/Own_Label_Bar_Soap__Retail_Price
VR_Carex_Share_of_Display(t) = VR_Carex_Share_of_Display(t - dt) +
(VR_Carex_Change_in_Share_of_Display) * dt
INIT VR_Carex_Share_of_Display =
INFLOWS:
VR_Carex_Change_in_Share_of_Display =
VR_Carex_Share_of_Display_Adjustment/Time_to_Adjust_Share_of_display

Time_to_Adjust_Share_of_display =
VR_Carex_Share_of_Display_Adjustment =

VR_Cussons_Share_of_Display_as_function_of_Market_Share =
GRAPH(VR_Cussons_New_Product_Total_market_share)

New_Product_Effect_of_Trade_Margin_on_Share_of_Display =
GRAPH(VR_Cussons_Carex_Trade_Margin/VR_Lever_Liquid_Soap_Trade_Margin)
VR_Lever_Liquid_Soap_Share_of_Display =
SMTIH1(New_Product_Effect_of_Trade_Margin_on_Share_of_Display *
VR_Lever_Liquid_Soap_Share_of_Display_as_function_of_Market_Share,
Time_to_Adjust_Share_of_display)

VR_Lever_Liquid_Soap_Share_of_Display_as_function_of_Market_Share =
GRAPH(VR_Lever_New_Product_Total_market_share)

Own_Label_Share_of_Display_as_function_of_Market_Share =
GRAPH(Own_Labels_New_Product_Total_market_share)

Own_Label_Liquid_Soap_Retail_Price(t) = Own_Label_Liquid_Soap_Retail_Price(t - dt) +
(Own_Label_New_Product__Change_in_Retail_Price) * dt
INIT Own_Label_Liquid_Soap_Retail_Price =
INIFLOWS:
Own_Label_New_Product__Change_in_Retail_Price = (Own_Label_Liquid_Soap_Retail_Price*
Own_Labels_New_Product_Effect_of_Trade_Margin_Income_on_Price)*
Own_Label_New_Product_Price_Adjustment_Allowed +
(Own_Label_Liquid_Soap_Retail_Price*Own_Label_Liquid_Soap_Effect_of_Market_Share_on_Price)*
Own_Label_New_Product_Price_Adjustment_Allowed

Own_Labels_New_Product_Effect_of_Trade_Margin_Income_on_Price =
GRAPH((Income_from_Trade_Margin_Branded_Liquid_Soap/
Own_Label_Branded_Liquid_Soap_Expected_Trade_Margin))

Own_Label_New_Product_Price_Adjustment_Allowed =
GRAPH(Own_Label_Liquid_Soap_Retail_Price/Own_Label_New_Product_Minimum_Retail_Price)

Own_Label_New_Product_Minimum_Retail_Price =
Own_Label_New_Product_Cost_of_Goods_Sold*
(1+Own_Label_Branded_Liquid_Soap_Expected_Trade_Margin)

Own_Label_New_Product_Cost_of_Goods_Sold =

Own_Label_Liquid_Soap_Effect_of_Market_Share_on_Price =
GRAPH(Own_Label_Liquid_Soap_Market_Share/Own_Label_New_Product__Market_Share_Goal)

Own_Label_New_Product__Market_Share_Goal =

Own_Label__Branded_Liquid_Soap_Expected_Trade_Margin(t) =
Own_Label__Branded_Liquid_Soap_Expected_Trade_Margin(t - dt) +
(Own_Label_New_Product_Trade_Margin_Adjustment_Rate) * dt
INIT Own_Label__Branded_Liquid_Soap_Expected_Trade_Margin =
INIFLOWS:
Own_Label_New_Product_Trade_Margin_Adjustment_Rate =
(Income_from_Trade_MARGIN_Branded_Liquid_Soap-
Own_Label_Branded_Liquid_Soap_Expected_Trade_Margin)/
Own_Label_Time_to_Adjust_Expectations

Income_from_Trade_Margin_Branded_Liquid_Soap =
(VR_Cussons_Carex_Trade_Margin*VR_Carex_Market_Share)
+(VR_Lever__Liquid_Soap_Trade_Margin*VR_Lever_Liquid_Soap_Market_Share)
VR Imperial Leather Bar Soap Share of Display Shelf(t) =
VR Imperial Leather Bar Soap Share of Display Shelf(t - dt) +
(Own Label Bar Soap Share of Display Shelf Change in Share of Display Shelf) * dt
INIT VR Imperial Leather Bar Soap Share of Display Shelf =
INFLOW:
VR Imperial Leather Share of Display Shelf Change in Share of Display Shelf =
VR Imperial Leather Share of Display Shelf Adjustment/Time to Adjust Share of Display

VR Imperial Leather Share of Display Shelf Adjustment =
(Own Label Bar Soap Trade Margin as a function of Market Share) *
VR Imperial Leather Effect of Trade Margin on Share of Display -
VR Imperial Leather Bar Soap Share of Display Shelf

VR Imperial Leather Effect of Trade Margin on Share of Display =
GRAPH(VR Cussons Bar Soap Trade Margin/VR Lever Bar Soap Trade Margin)

VR Imperial Leather Display Shelf as a function of Market Share =
GRAPH(VR Imperial Leather Bar Soap Total market share)
VR_Dove_Bar_Soap_Share_of_Display_Shelf =
    SMT\text{H1}(\text{VR_Dove_Bar_Soap_Share_of_Display_as_a_function_of_Market_Share} * \\
    \text{VR_Imperial_Leather_Effect_of_Trade_Margin_on_Share_Display,Time_to_Adjust_Share_of_display})

VR_Dove_Bar_Soap_Share_of_Display_as_a_function_of_Market_Share =
    \text{GRAPH}(\text{VR_Dove_Bar_Soap_Total_Market_Share})

Own_Label_Bar_Soap__Share_of_Display__as_function_Market_Share =
    \text{GRAPH}(\text{Own_Label_Bar_Soap_Total_Market_Share})

Own_Label_Bar_Soap__Retail_Price(t) = Own_Label_Bar_Soap__Retail_Price(t - dt) +
    (Own_Label_Bar_Soap_Rate_of_Change_Price) * dt
INIT Own_Label_Bar_Soap__Retail_Price =
INFLOWS:
    Own_Label_Bar_Soap_Rate_of_Change_Price = ((Own_Label_Bar_Soap__Retail_Price * \\
    Own_Label_Bar_Soap_Effect_of_Trade_margin_Income_on_Price) + \text{Own_Label_Bar_Soap__Retail_Price} * \\
    Own_Label_Bar_Soap_Effect_of_Market_Share_on_Price) * \text{Own_Label_Bar_Soap_Price_Adjustment_Allowed}

Own_Label_Bar_Soap_Effect_of_Trade_margin_Income_on_Price =
    \text{GRAPH}(\text{Income_from__Branded_Bar_Soap_Trade_Margin/} \\
    \text{Own_Label_Bar_Soap_Expected_Trade_Margin})

Own_Label_Bar_Soap__Price_Adjustment_Allowed =
    \text{GRAPH}(\text{Own_Label_Bar_Soap__Retail_Price/Own_Label_Bar_Soap_Minimum_Retail_Price})

Own_Label_Bar_Soap_Minimum_Retail_Price = Own_Label_Bar_Soap_Cost_of_Goods_Sold * 
    (1 + Own_Label_Bar_Soap_Expected_Trade_Margin)

Own_Label_Bar_Soap_Cost_of_Goods_Sold =

Own_Label_Bar_Soap_Effect_of_Market_Share_on_Price =
    \text{GRAPH}(Own_Label_Bar_Soap_Market_Share/Own_Label_Bar_Soap_Market_Share_Goal)

Own_Label_Bar_Soap_Market_Share_Goal =

Own_Label_Bar_Soap_Expected_Trade_Margin(t) =
    Own_Label_Bar_Soap_Expected_Trade_Margin(t - dt) + 
    (Own_Label_Expected__Trade_Margin_Adjustment_Rate) * dt
INIT Own_Label_Bar_Soap_Expected_Trade_Margin =
INFLOWS:
    Own_Label_Expected__Trade_Margin_Adjustment_Rate = \text{(Income_from__Branded_Bar_Soap_Trade_Margin-} \\
    \text{Own_Label_Bar_Soap_Expected_Trade_Margin)/Own_Label_Time_to_Adjust_Expectations}

Income_from__Branded_Bar_Soap_Trade_Margin = (\text{VR_Cussons_Bar_Soap_Trade_Margin} * \\
    \text{VR_Imperial_Leather_Bar_Soap_Market_Share}) + (\text{VR_Lever_Bar_Soap_Trade_Margin} * \\
    \text{VR_Dove_Bar_Soap_Market_Share})

Own_Label_Time_to_Adjust_Expectations =