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A New Food Demand Model for GCAM

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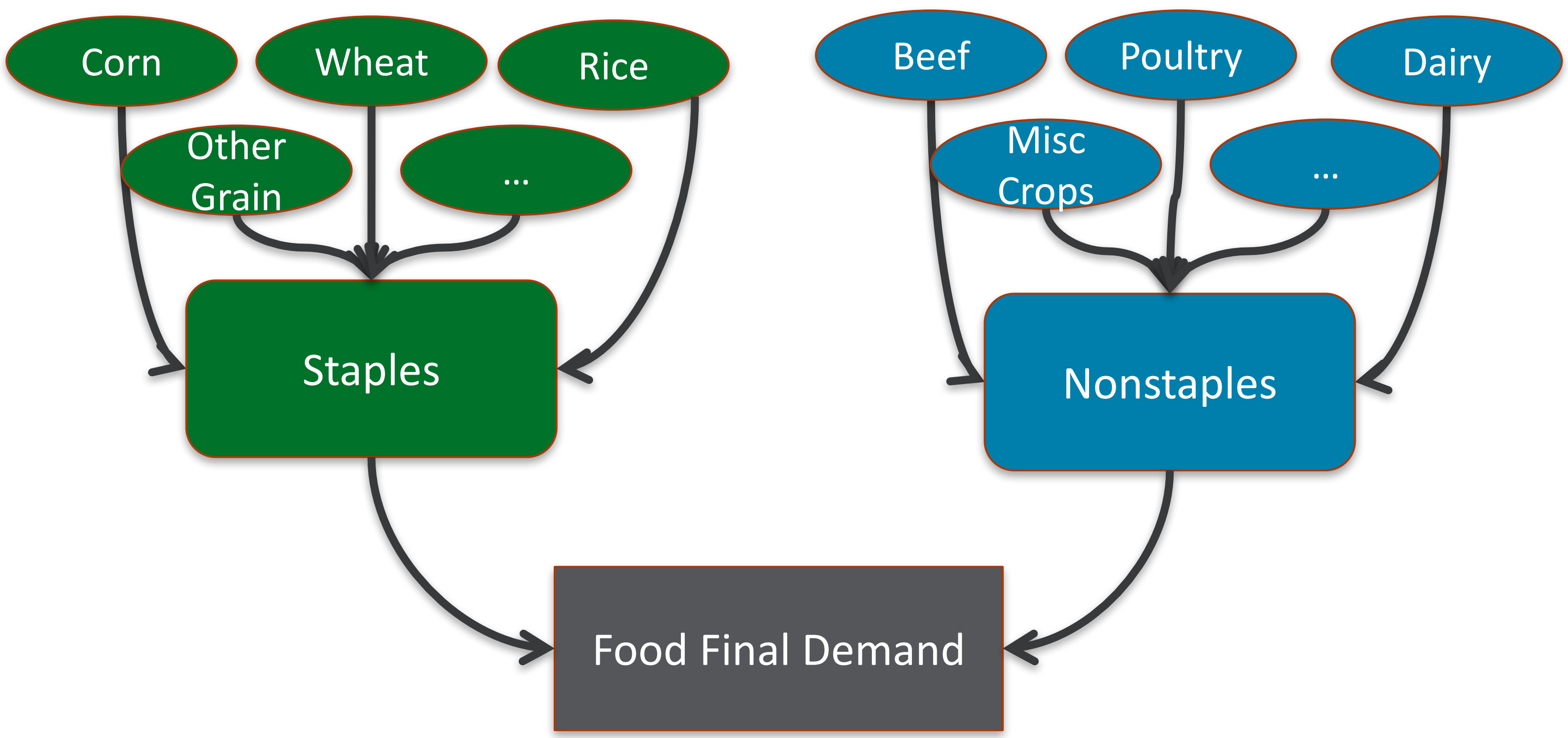
Makeup of Food Demand Sectors



The Food Demand Model

$$q_s = A_s x^{h_s(x)} w_s^{e_{ss}(x)} w_n^{e_{sn}(x)}$$

$$q_n = A_n x^{h_n(x)} w_s^{e_{ns}(x)} w_n^{e_{nn}(x)}$$

$$e_{ij}(x) = g_{ij} - \eta_i \alpha_j$$

$$\eta_i = \frac{\partial \ln x^{h_i(x)}}{\partial \ln x}$$

$$h_s(x) = \frac{\lambda}{x}\left(1 + \frac{\kappa}{\ln x}\right)$$

$$h_n(x) = \frac{\nu}{1 - x}$$

- *x:* dimensionless income, Y/P_m
- *w:* dimensionless price, P_s/P_m, P_n/P_m
- *α:* budget fraction, *wq/x*

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Food Demand Income Dependence

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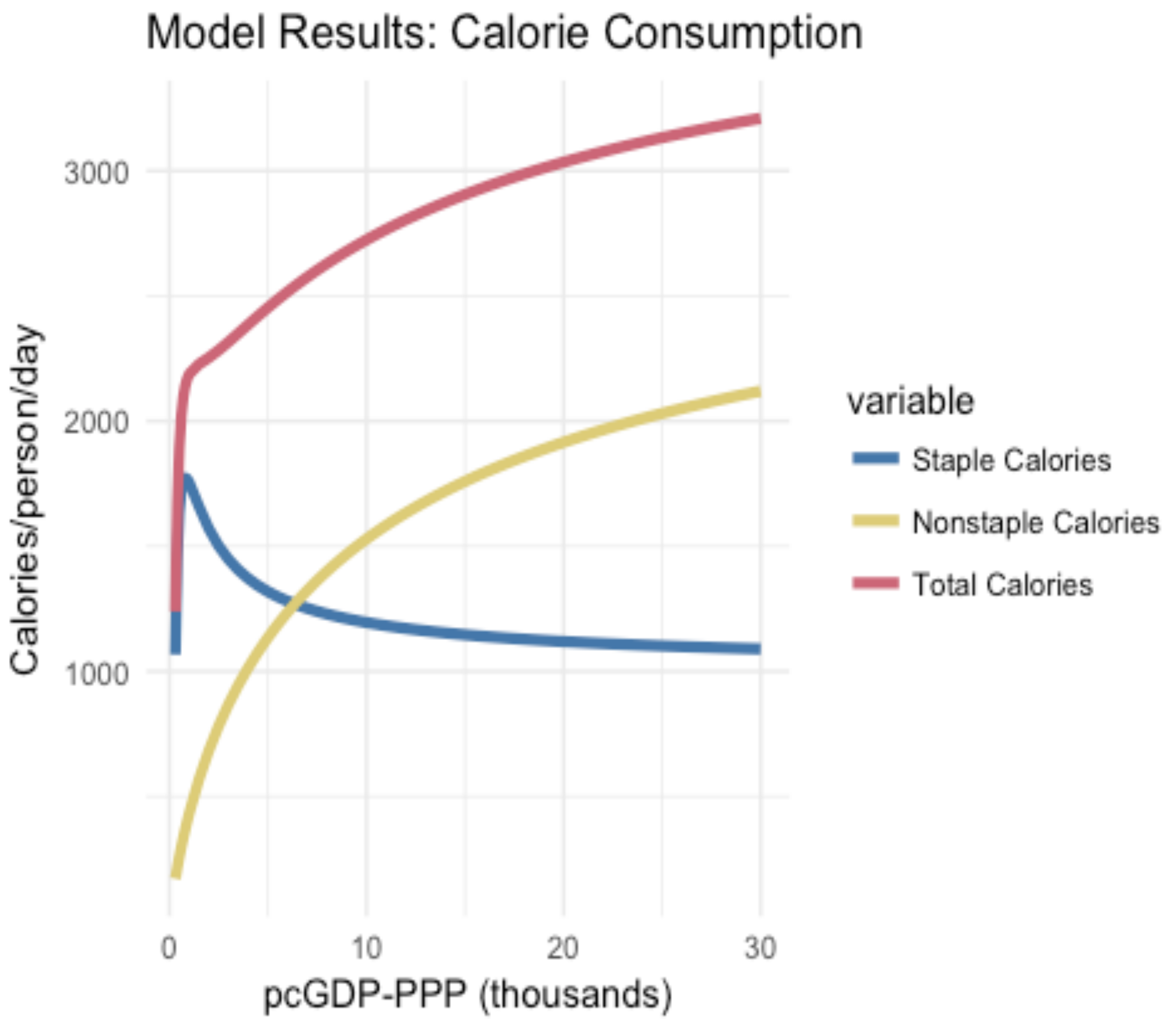
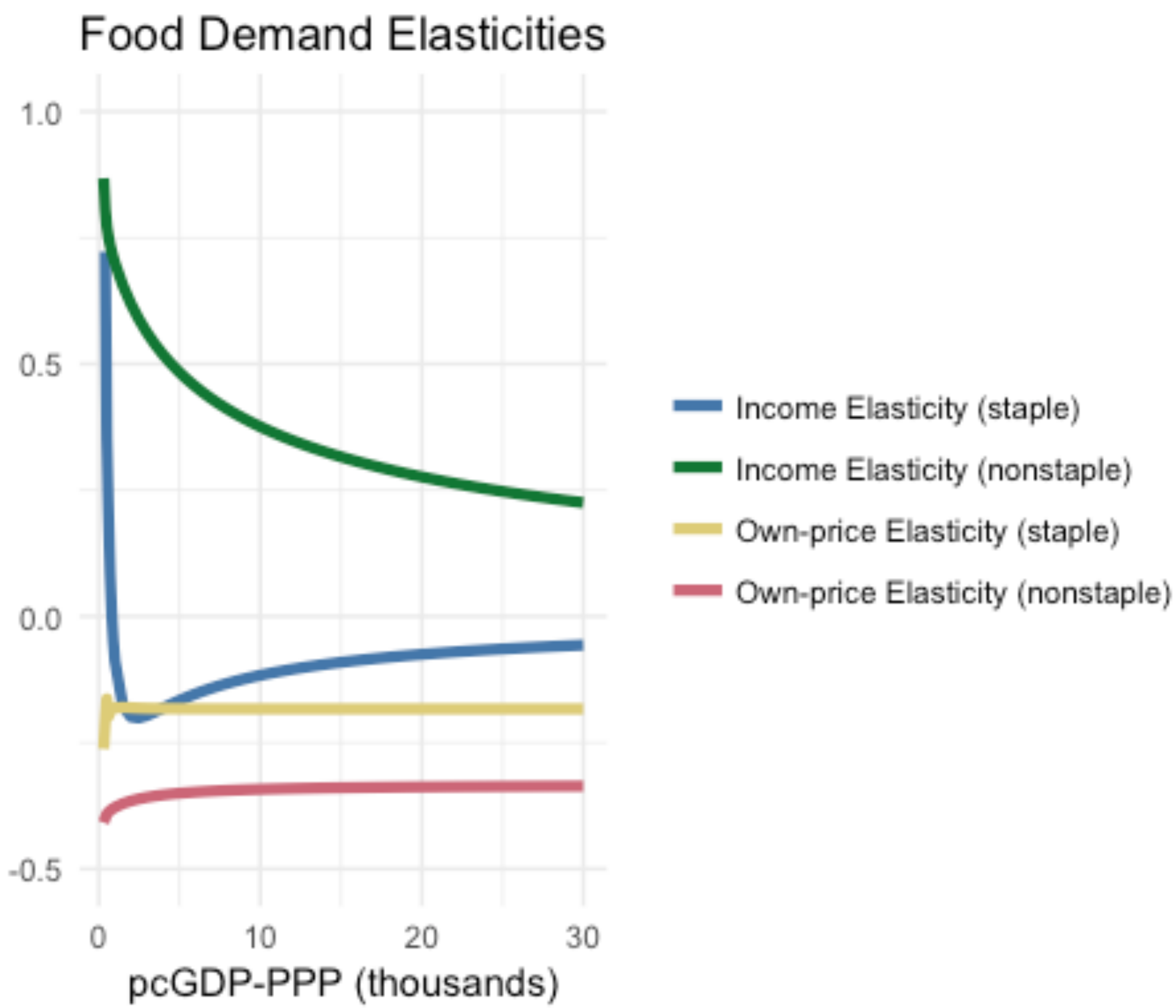


Food Demand Elasticities



Bayesian Monte Carlo Calibration

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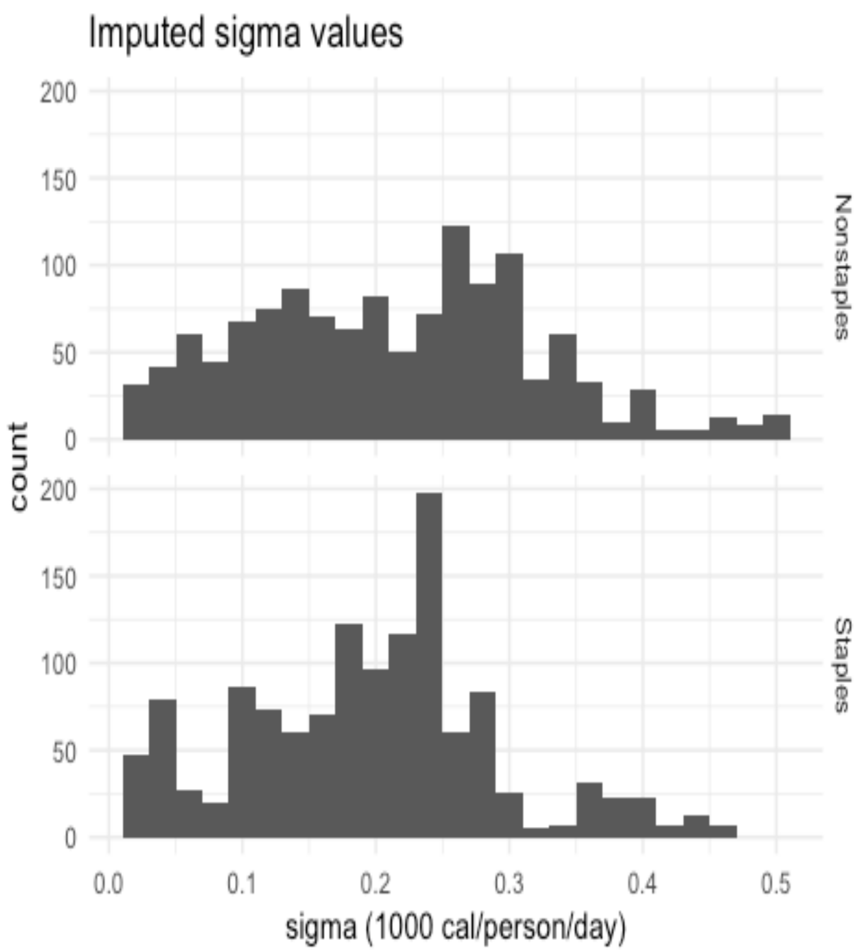
Likelihood Function:

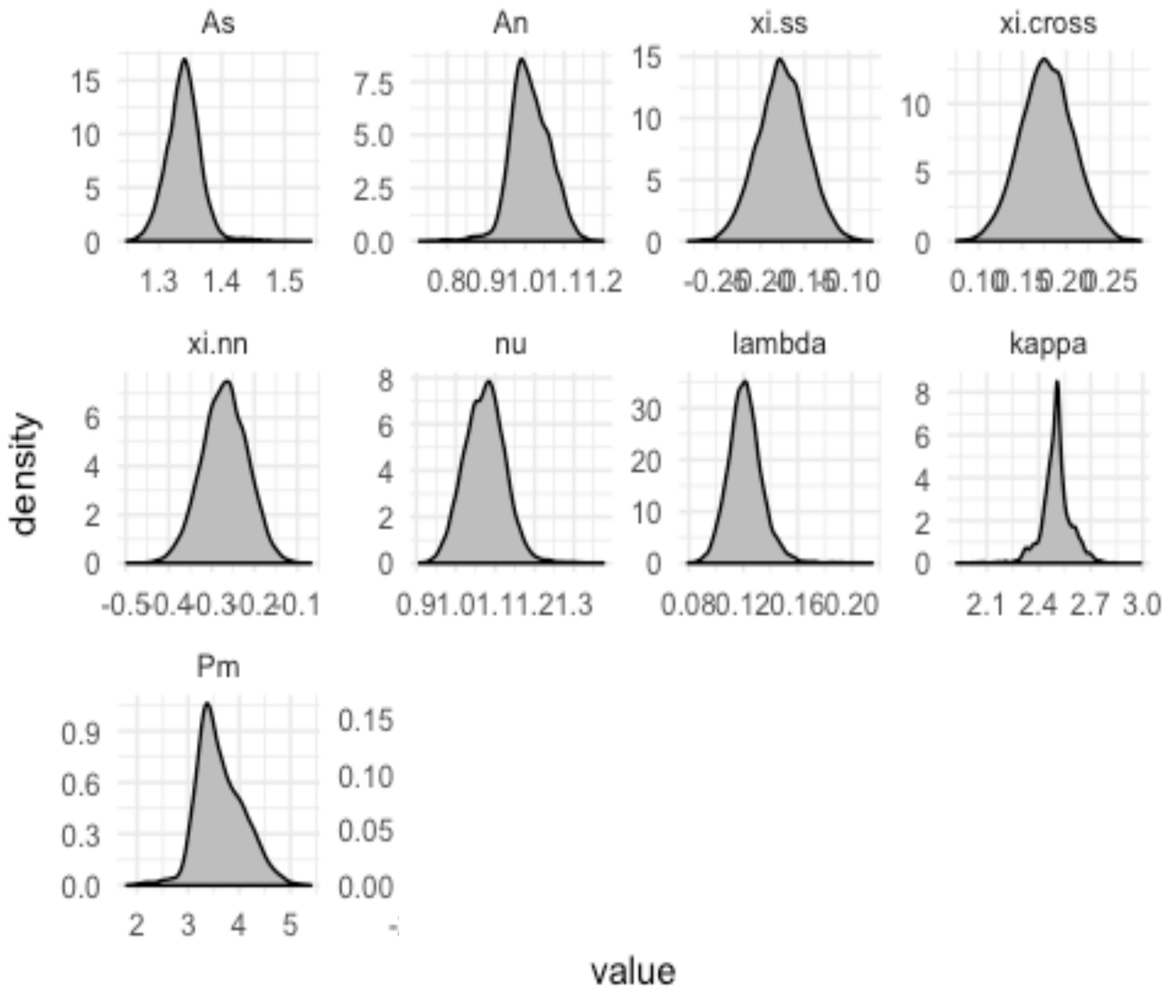
$$L(\vartheta) = \ln P(\hat{y} \mid \vartheta) = \sum_i \frac{(y_i(\vartheta) - \hat{y}_i)^2}{2\sigma_i^2}$$

Bayes' Theorem:

$$P(\vartheta \mid \hat{y}) \propto P(\hat{y} \mid \vartheta) P(\vartheta)$$



Monte Carlo Parameter results



Comparing Model to Observations

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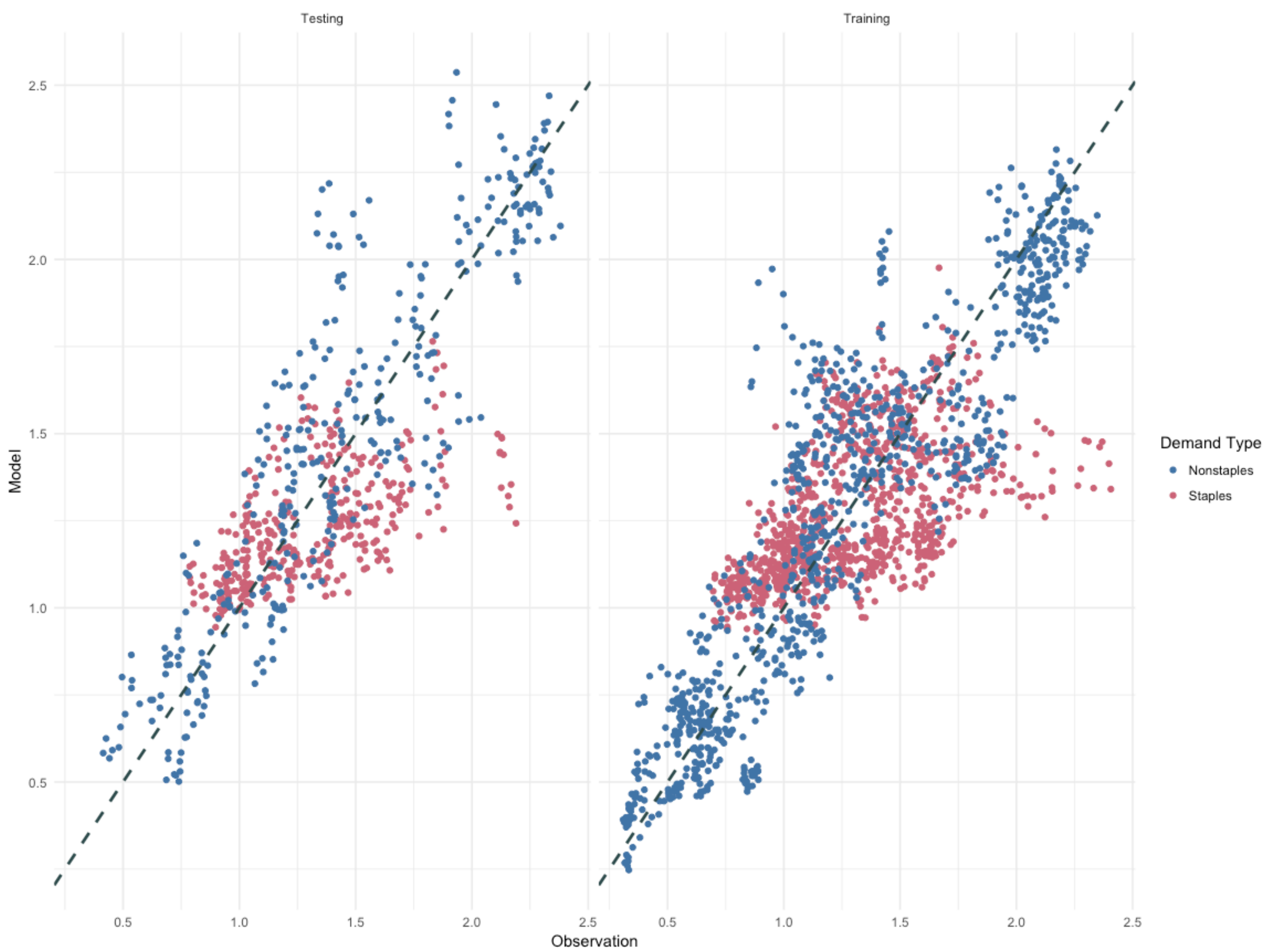

Comparing Model to Observations

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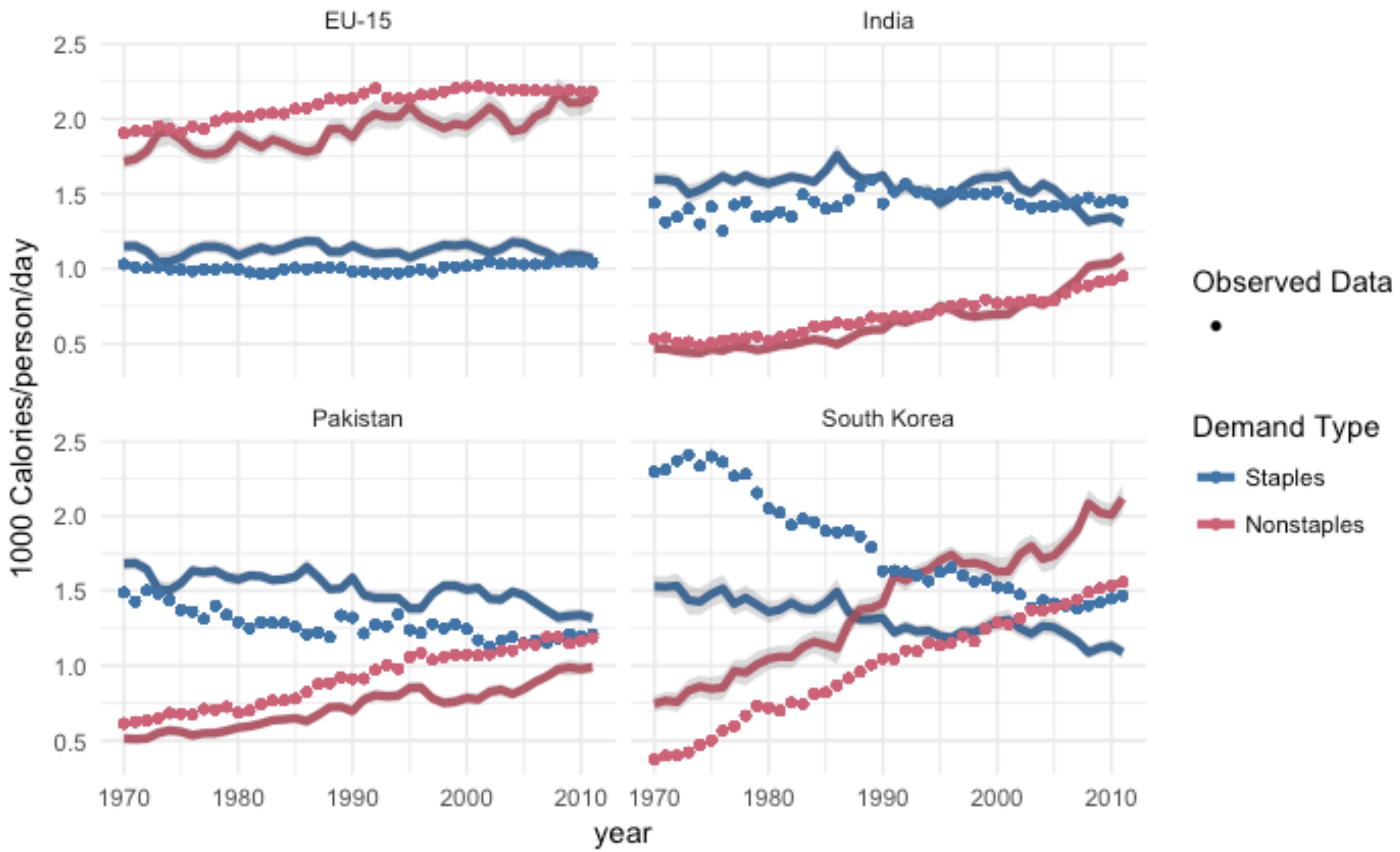
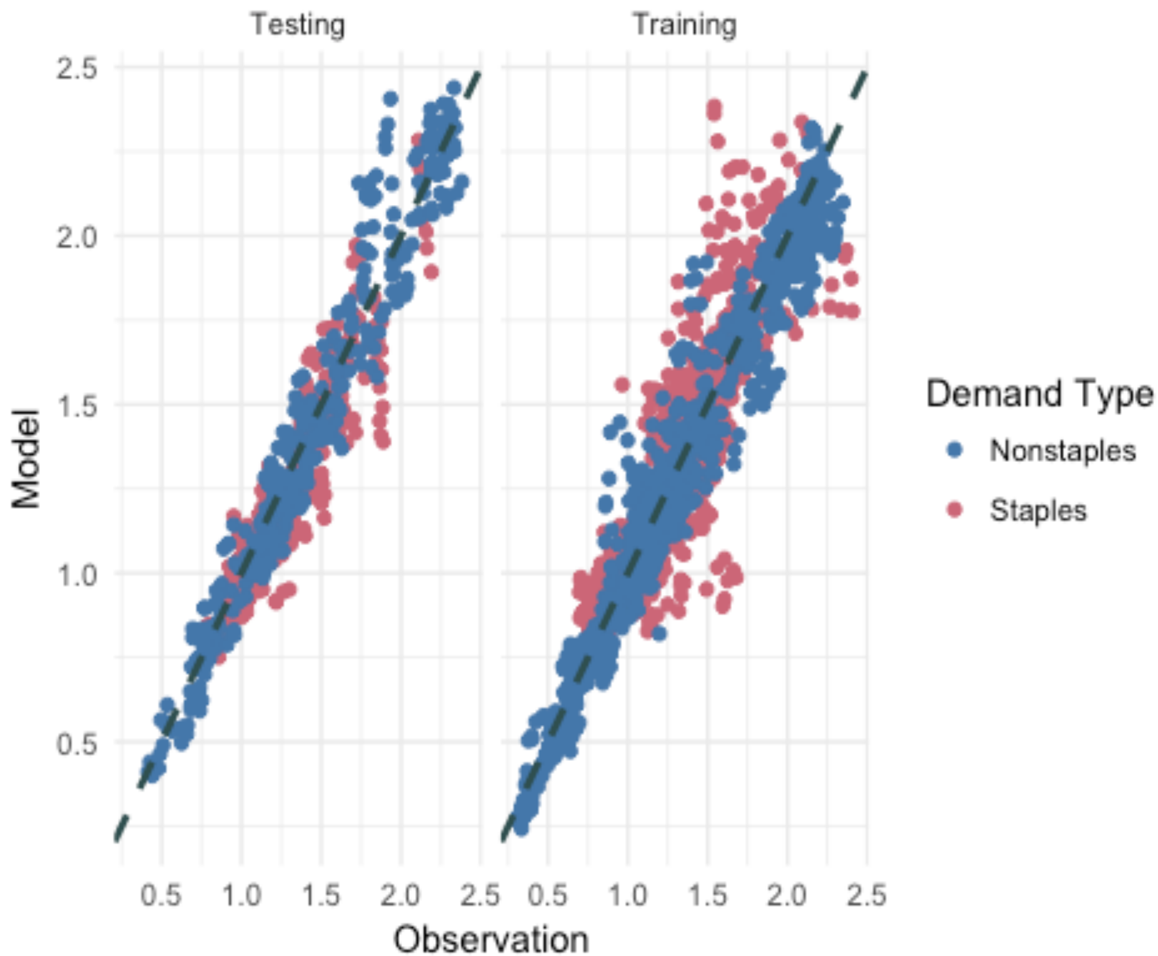
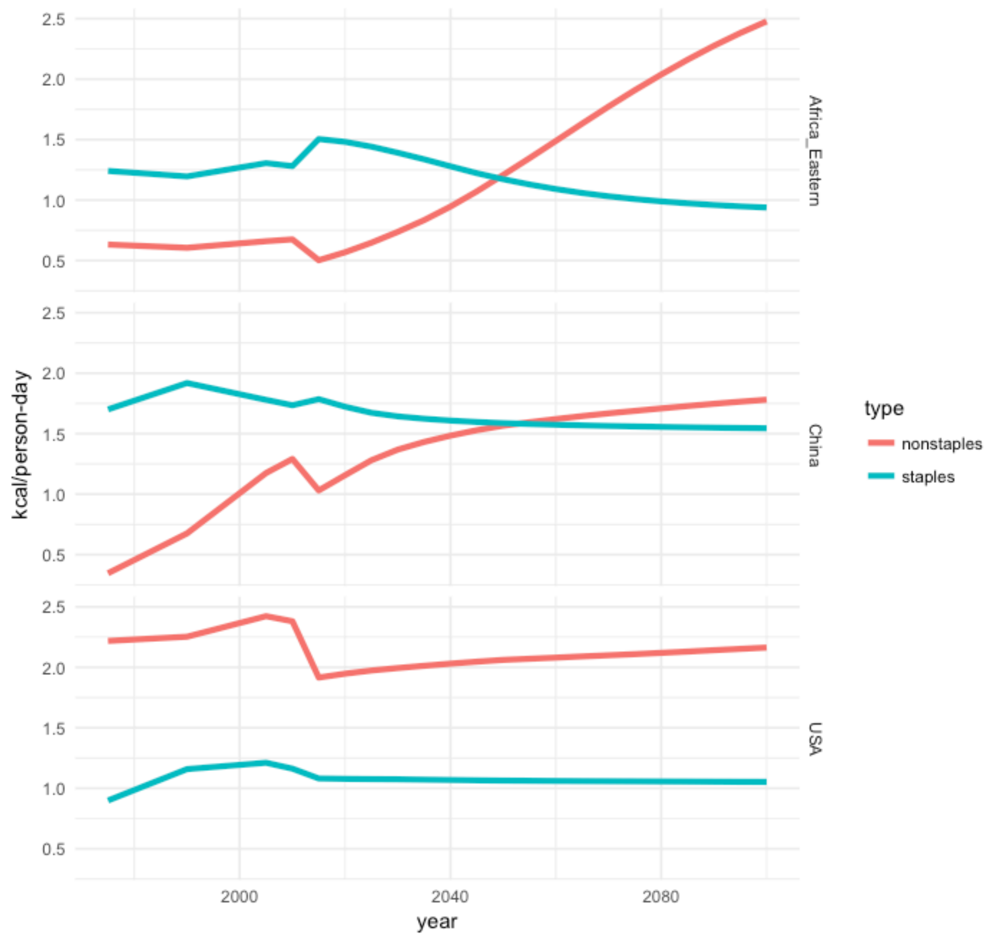


After Regional Bias Correction



GCAM Results



GCAM Results