Exploratory Models

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1 Notation

notation in rscript is not up to date

satisfied contraceptive limiting = cl

satisfied contraceptive spacing = cs

unmet limiting = ul

unmet spacing = us

unmet = ul + us

total limiting = cl + ul

total space = cs + us

total demand = cl + cs + ul + us

limiting out of demand(PDL, formerly luup) = $\frac{cl+ul}{cl+cs+ul+us} = \frac{totalLimiting}{totalDemand}$

limiting out of Unmet (LUP, formerly lup) = $\frac{ul}{ul+us} = \frac{unmetLimiting}{unmet}$

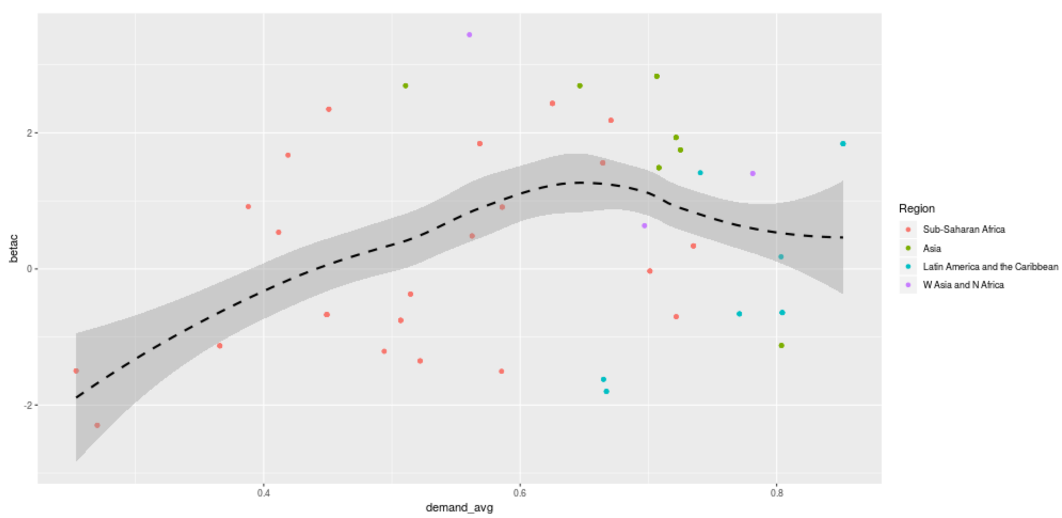
ratio of satisfied needs (ratio, formerly ratio) = $\frac{\frac{cl}{cl+ul}}{\frac{cs}{cs+us}} = \frac{\frac{satisfiedLimiting}{totalLimiting}}{\frac{satisfiedSpacing}{totalSpacing}}$

2 PDL Varying Intercept Models And Slope(without shrinkage on slope)

$y_i|\mu_{ct}, \sigma_y \sim N(\mu_{ct}, \sigma_y)$
$logit(\mu_{ct}) = \pi_{ct}$
$\pi_{ct} = \alpha_c + \beta_c * demand_{ct}$

$\beta_c \sim N(0, 100)$
$\alpha_c|\alpha_r, \sigma_{c\alpha} \sim N(\alpha_r, \sigma_{c\alpha})$
$\alpha_r|\alpha_w, \sigma_{r\alpha} \sim N(\alpha_w, \sigma_{r\alpha})$
$\alpha_w \sim N(0, 100)$

$\sigma_y \sim U(0, 2)$
$\sigma_{c\alpha} \sim U(0, 2)$
$\sigma_{r\alpha} \sim U(0, 2)$



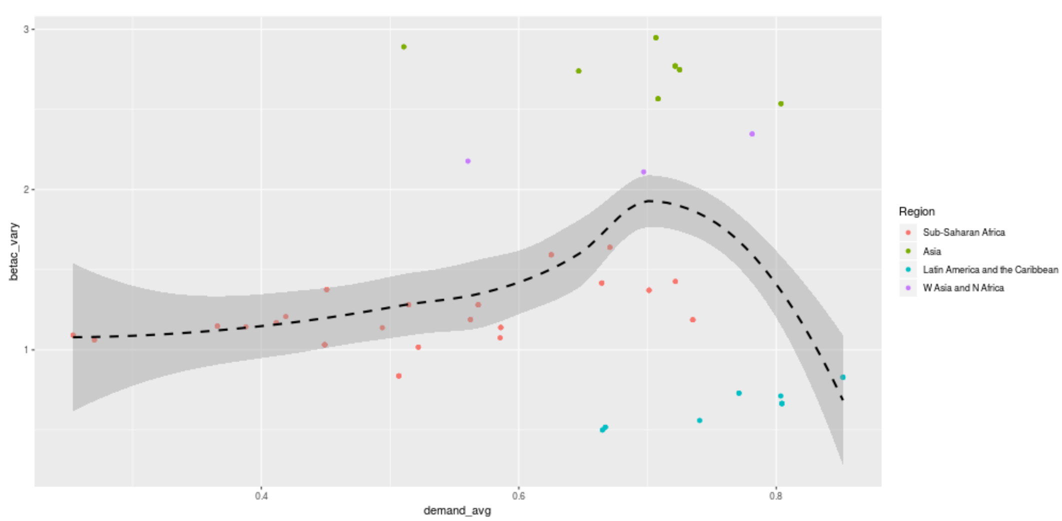
3 PDL Varying Intercept and Slope Models

3.1 without correlation

$y_i|\mu_{ct}, \sigma_y \sim N(\mu_{ct}, \sigma_y)$
$logit(\mu_{ct}) = \pi_{ct}$
$\pi_{ct} = \alpha_c + \beta_c * demand_{ct}$

$\beta_c|\beta_r, \sigma_{c\beta} \sim N(\beta_r, \sigma_{c\beta})$
$\beta_r|\beta_w, \sigma_{r\beta} \sim N(\beta_w, \sigma_{r\beta})$
$\beta_w \sim N(0, 100)$
$\alpha_c|\alpha_r, \sigma_{c\alpha} \sim N(\alpha_r, \sigma_{c\alpha})$
$\alpha_r|\alpha_w, \sigma_{r\alpha} \sim N(\alpha_w, \sigma_{r\alpha})$
$\alpha_w \sim N(0, 100)$

$\sigma_y \sim U(0, 2)$
$\sigma_{c\alpha} \sim U(0, 2)$
$\sigma_{r\alpha} \sim U(0, 2)$



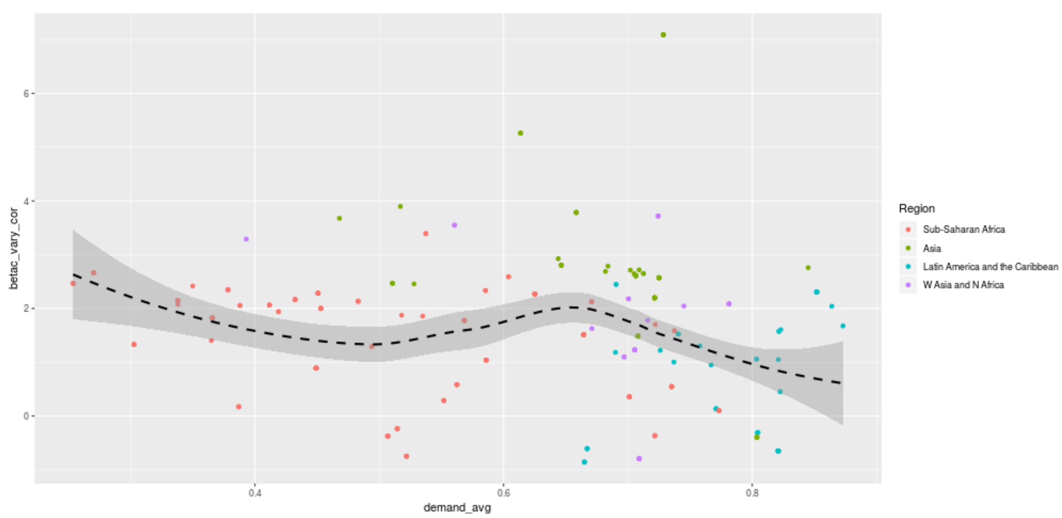
3.2 with correlation

$y_i|\mu_{ct}, \sigma_y \sim N(\mu_{ct}, \sigma_y)$
$logit(\mu_{ct}) = \pi_{ct} + \delta_{ct}$
$\pi_{ct} = \alpha_c + \beta_c * demand_{ct}$

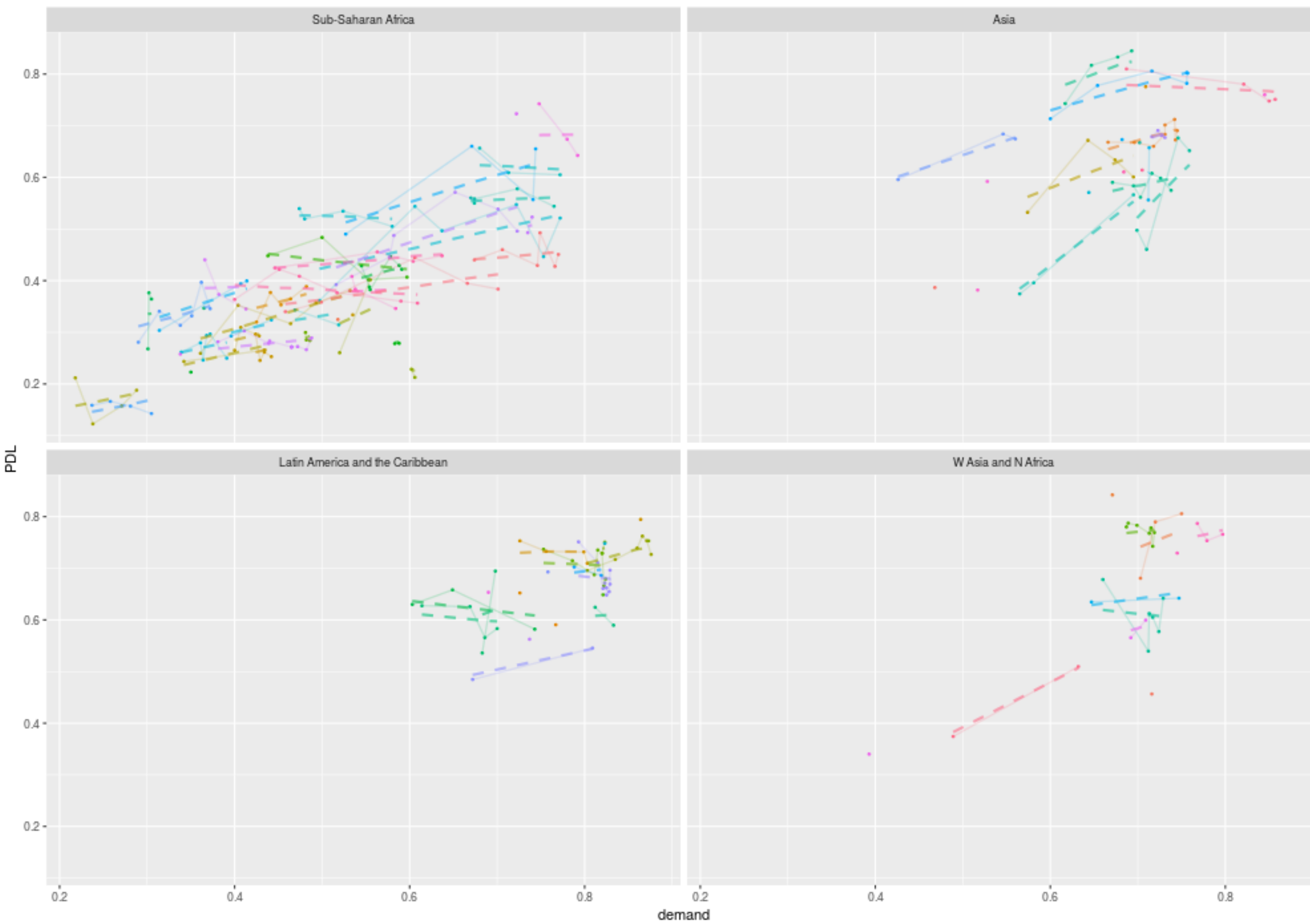
$$\begin{pmatrix}\alpha_c \\ \beta_c\end{pmatrix} \sim N_2\left(\begin{pmatrix}\alpha_{r1} \\ \alpha_{r2}\end{pmatrix}\begin{pmatrix}\sigma_{c\alpha}^2 & \rho_{\alpha\beta} * \sigma_{c\alpha} * \sigma_{c\beta} \\ \rho_{\alpha\beta} * \sigma_{c\alpha} * \sigma_{c\beta} & \sigma_{c\beta}^2\end{pmatrix}\right)$$

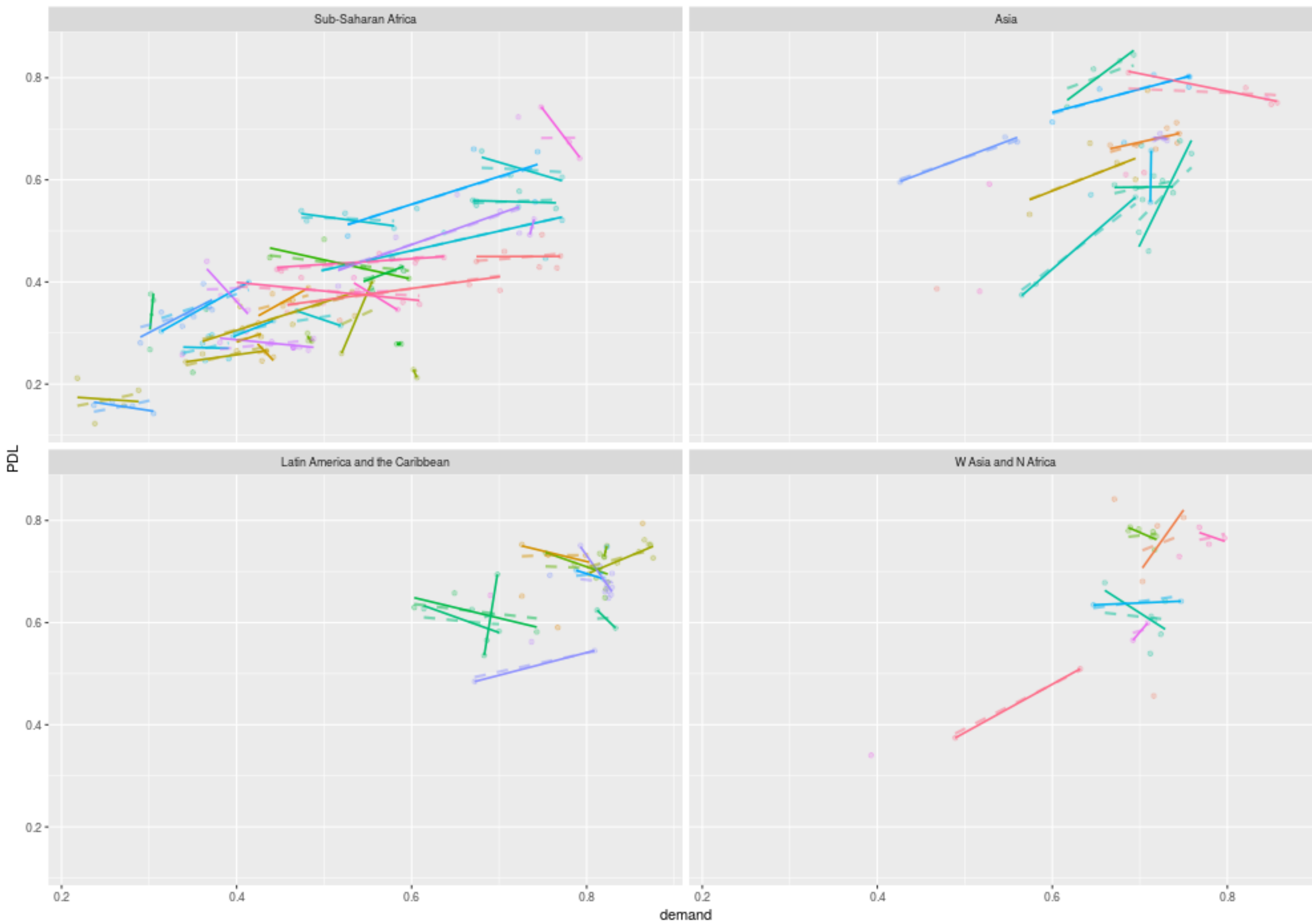
$\alpha_{r1}|\alpha_{w1}, \sigma_{r1} \sim N(\alpha_{w1}, \sigma_{r1})$
$\alpha_{r2}|\alpha_{w2}, \sigma_{r2} \sim N(\alpha_{w2}, \sigma_{r2})$
$\alpha_{w1} \sim N(0, 100)$
$\alpha_{w2} \sim N(0, 100)$

$\sigma_y \sim U(0, 2)$
$\sigma_{c\alpha} \sim U(0, 3)$
$\sigma_{c\beta} \sim U(0, 3)$
$\rho_{\alpha\beta} \sim U(-.95, 1)$
$\sigma_{r1} \sim U(0, 3)$
$\sigma_{r2} \sim U(0, 3)$



3.3 prediction plots





Sub-Saharan Africa
Asia
Latin America and the Caribbean
W Asia and N Africa
PDL
demand
0.8
0.6
0.4
0.2