## 1. Structure of the spectrum simulation model

The differences in the level of per capita income across countries can be examined by backward tracing to examine the child marriage status of a given population. This is based on the argument that in any given time, a girl married as a child would have faced demographic, health, education and labour force participation penalties that would have impacted her education, wages, income and savings, thereby having implications for economic growth and per capita GDP.<sup>34</sup> To estimate this, it is assumed that aggregate income can be represented by the Cobb-Douglas production function:

$$Y = M \times (A_{w} \times hc)^{\sigma} K^{1-\sigma}$$
<sup>(1)</sup>

Where Y is aggregate income; M is the residual total productivity factor;  $A_w$  is the number of workers; hc is human capital per worker; K is the aggregate physical capital; and is the elasticity of income with respect to aggregate human capital.

In log term, the equation can be specified as:

$$Iny = InM + \sigma lnA_w + \sigma lnhc + (1-\sigma) InK$$
<sup>(2)</sup>

We assume that human capital, in turn, is a function of education and health and is specified as:

$$Inhc = rE_{w} + \delta H_{w} \tag{3}$$

Where  $E_w$  is education completed in years; r is the returns to an additional year of education;  $H_w$  is the health;  $\delta$  is the returns to an additional gain in health.

Substituting equation (3) into (2) produces the following equation:

$$Iny = InM + \sigma lnA_{w} + \sigma [rE_{w} + \delta H_{w}] + (1-\sigma) InK$$
(4)

The percentage effect on income due to a change in the rate of child marriage can be derived using the total differential of equation (4) for a fraction of the workforce at time t that was child married  $(CM_w)$  as:

$$\Delta lny_{(t)} = \sigma \left[ r \frac{\Delta E_w}{\Delta CM_w} + \delta \frac{\Delta H_w}{\Delta CM_w} \right] \Delta CM_w$$
(5)

Where  $\Delta Iny$  is the difference in income at time t;  $\sigma$  is elasticity of income with respect to human capital;  $\Delta E_{\psi} \Delta CM_{\psi}$  is the loss in years of schooling due to child marriage; r is the average returns lost for an additional year of schooling unattained;  $\Delta H_{\psi} \Delta CM_{\psi}$  is the loss in health due to child marriage; and  $\delta$  is the average labour market premium lost for additional unattained health outcomes.