$H(\mathbf{N},\boldsymbol{\lambda}) \equiv f(\mathbf{N}) + \lambda_1 a(\mathbf{N}) + \lambda_2 b(\mathbf{N})$

$H_i(\mathbf{N},\boldsymbol{\lambda}) = f_i + \lambda_1 a_i + \lambda_2 b_i = \ln(N_i/g_i) + \lambda_1 + \lambda_2 \varepsilon_i \quad i = 1,2...m$

$f_i = \partial f/\partial N_i = (1+\ln g_i) - N_i\,(1/N_i) - \ln N_i = \ln g_i - \ln N_i = \ln(N_i/g_i)$ (6.9)

$a_i = \partial a/\partial N_i = \partial_i\,[\,\Sigma_j N_j - M] = 1$

$b_i = \partial b/\partial N_i = \partial_i\,[\Sigma_j \varepsilon_j N_j - U] = \varepsilon_i$ (6.10)

Therefore

$H_{ii} = f_{ii} + \lambda_1 a_{ii} + \lambda_2 b_{ii} = f_{ii}$

But

$f_i = (\ln g_i + 1) - N_i\,(1/N_i) - \ln N_i = \ln g_i - \ln N_i$

$f_{ii} = -1/N_i < 0$

Since $H_{ii} = -1/N_i < 0$, for every (large) **N** the function H(**N**) "cups down" in all dimensions 1,2...m. In particular, this is true for the solution **N**, and thus that solution is a maximum.