

## Indifference in the Non-economic Sectors

Financial intermediaries, governments, and dependent populations do not produce things that are 'economic' in the sense of creating an output having a measurable marginal cost of production that might be equated with a price adjudicated by a market. (The cost of annihilating governance, financial intermediation, or dependent populations would presumably be destruction of the civic context in which economic order occurs.)

Expressing the interaction of these sectors with the products of industries and households by way of SFEcon's geometry begins by recasting Equation 1-8 of the [hyperbola paper](#) so as to eliminate the term involving the dimension for production:

$$1 = \frac{U_1}{(U_1 + Q_1)} \cdot \frac{U_2}{(U_2 + Q_2)} \cdot \dots \cdot \frac{U_N}{(U_N + Q_N)} \quad \text{Eq. 1}$$

Inspection of this equation shows that at least some of the utility parameters  $U_j$  must be negative in order to sustain the equality. This has interesting interpretations that are best expressed in the visualizations below.

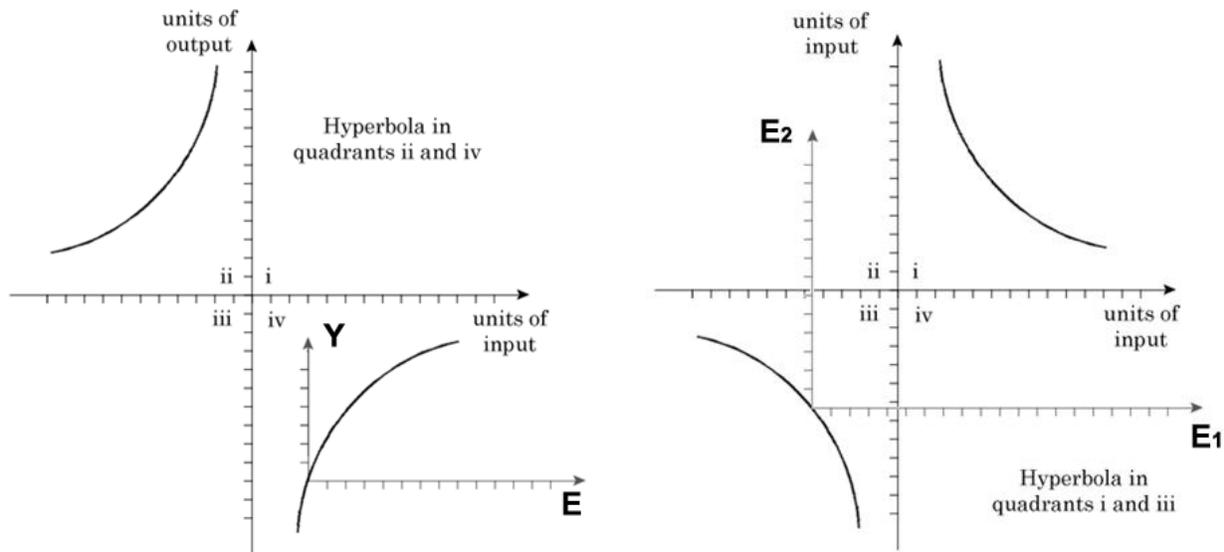


Fig. 1: Hyperbolae in Two Dimensions

The left side of this figure shows the production function for a generic industrial sector having just one input. This technical indifference surface is created by locating the function's origin on the hyperbolic form as it appears quadrant iv. The figure right side shows the tradeoffs between two inputs to an 'non-economic' sector. Note that the condition of negative utility parameters places the origin of the technical indifference surface in quadrant iii, while the surface itself is in quadrant i.

This feature establishes boundaries of minimal sustenance for at least some inputs: there are ranges of positive input  $E_J$  that are simply too low to sustain non-economic sectors; and, hence, irreducible amounts of the economic product that must be used-up in the what amounts to the overhead of a civil society. Specification of non-economic sectors in terms of negative utility parameters has further useful interpretations; but these only become apparent when such sectors enter re-formulations of SFEcon's emulation programs.

Referring back to Equation 2-3 of the [hyperbola paper](#), it is clear that negative  $U_J$  indicates  $\zeta < P_J Q_J$ . This brings-up some challenging issues when considered in light of the [hyperbola paper](#)'s Article 8 on the computation of utility parameters. Proceeding from Equation 1 above in the manner that followed from Equation 8-1 would lead to an equivalent of Equation 8-4 in which some of the products would be negative. This being the case, Equation 8-5's equivalent would be useless because there are no logarithms for negative numbers. Thus there can be no equivalent to Equation 8-9 with which to establish an initial estimate of  $\zeta$  for any iterative process that might lead to an exact  $\zeta$ . While it is not yet clear how this challenge will be resolved, there are promising alternatives requiring further evaluation.

Some further considerations are also required relative to the [hyperbola paper](#)'s determinations of  $\theta$  and  $\beta$  in Article 7. Since non-economic sectors have no product  $Y$ , their financial profile  $\phi$  is determined as negative  $\sigma$  by Equation 7-6. Substituting  $Y=0$  in Equation 7-10's determination of  $\beta$  therefore reduces this equation to the  $\theta$  of Equation 7-5.