Some Common Confusions about Hyperbolic Discounting

8 February 2008. Eric Rasmusen. Dan R. and Catherine M. Dalton Professor, Department of Business Economics and Public Policy, Kelley School of Business, Indiana University. visitor (07/08), Nuffield College, Oxford University. Office: 011-44-1865 554-163 or (01865) 554-163. Nuffield College, Room C3, New Road, Oxford, England, OX1 1NF. Erasmuse@indiana.edu. http://www.rasmusen.org. This paper: http://www.rasmusen.org/papers/hyperbolic-rasmusen.pdf.

(a) Hyperbolic discounting is not about the discount rate changing over time. A constant discount rate is not essential for time consistency, nor does a varying discount rate create time inconsistency.
(b) ''Hyperbolic discounting'' does not, as commonly used, mean discounting using a hyperbolic function.
(c) Hyperbolic discounting really isn't about the shape of the discount function anyway.
(d) Hyperbolic discounting is not about someone being very impatient.
(e) Hyperbolic discounting is not necessarily about lack of self- control, or irrationality.
(f) Hyperbolic discounting does not depend delicately on the length of the time period.

$$U_{2008} = C_{2008} + \delta_{2009}C_{2009} + \delta_{2009}\delta_{2010}C_{2010} + \delta_{2009}\delta_{2010}\delta_{2011}C_{2011}. \qquad (1)$$

Exponential utility with a constant discount factor δ has the form:

$$U_0 = C_0 + \delta C_1 + \delta^2 C_1 + \delta^3 C_2 + ..., \qquad (2)$$

Quasi-hyperbolic utility (also called ''Beta-Delta Utility'') has the form (with $0 \leq \beta \leq 1$):

$$U_0 = C_0 + \beta\delta C_1 + \beta\delta^2 C_1 + \beta\delta^3 C_2 + ... \qquad (3)$$

The functional form in equation (3) can also be written as: $U_0 = H * C_0 + \delta C_1 + \delta^2 C_1 + \delta^3 C_2 + ...$, where $H > 0$, and where $H > 1$ for a person who distinguishes sharply between current consumption and future consumption. True hyperbolic utility would have the form:

$$U_0 = C_0 + \left(\frac{1}{1+\alpha}\right) C_1 + \left(\frac{1}{1+2\alpha}\right) C_2 + ... \qquad (4)$$

An exponential utility function with the hyperbolic shape can be derived from $f(1) = \delta_1$, $f(2) = \delta_1\delta_2$, $f(3) = \delta_1\delta_2\delta_3$, ... $f(t) = \delta_1\delta_2\delta_3/cdot/cdot/cdot\delta_t$. so we can calculate $\delta_t = \frac{f(t)}{f(t-1)}$, and since $\delta_t = \frac{1}{1+\rho_t}$, we can calculate $\rho_t = \frac{1-\delta_t}{\delta_t}$.

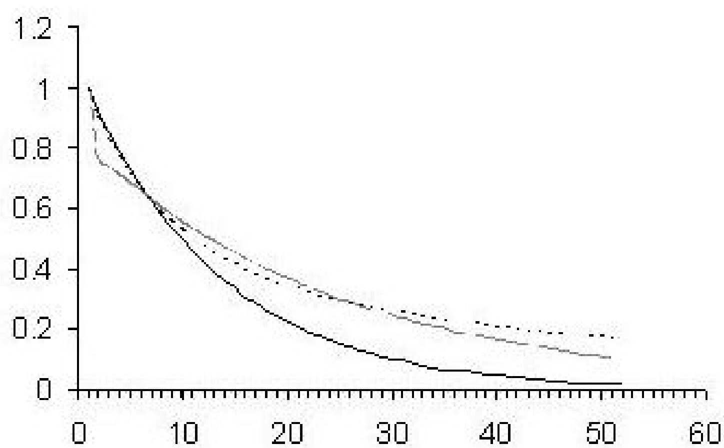

Figure 1:
The Shapes of Exponential (solid), Hyperbolic (dotted), and Quasi-Hyperbolic (dashed) Discounting
($\delta_{exp} = .92$, $f_h(\tau) = \frac{1}{1+.1\tau}$, $\beta = .8$ or $H = 1.25$ and $\delta_{qh} = .96$)