

THE EVOLUTION OF TIME PREFERENCE

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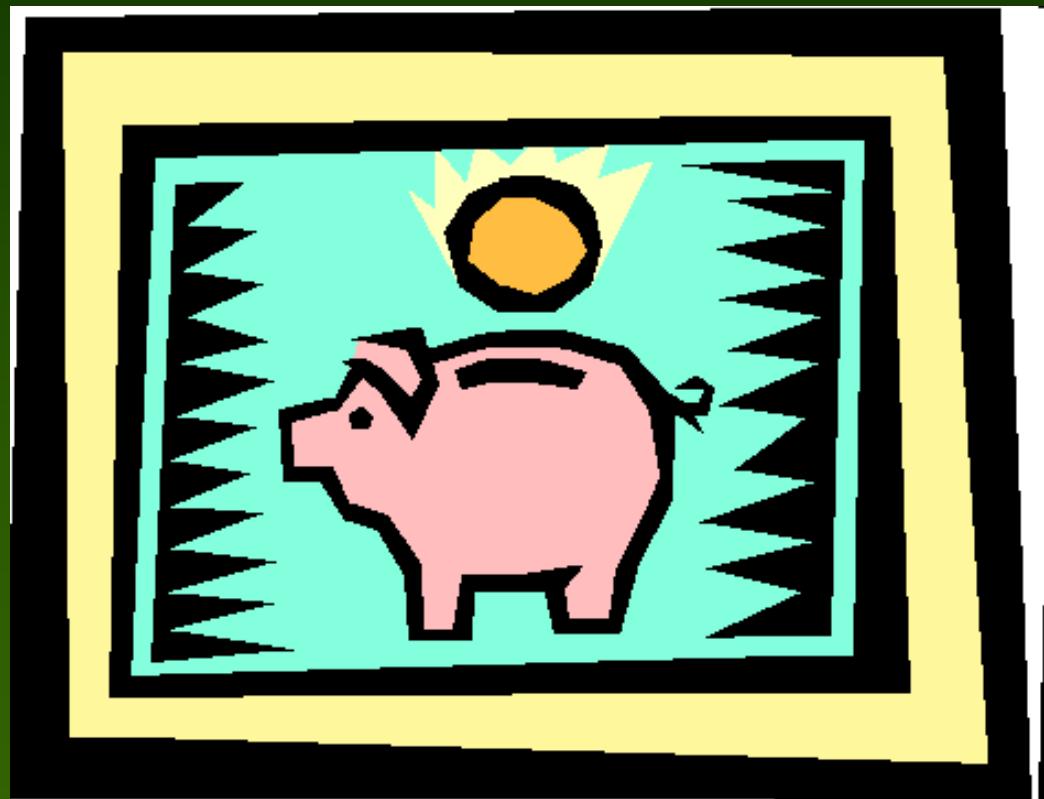
The Evolution of Intertemporal Preferences

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Euler-Lotka Equation

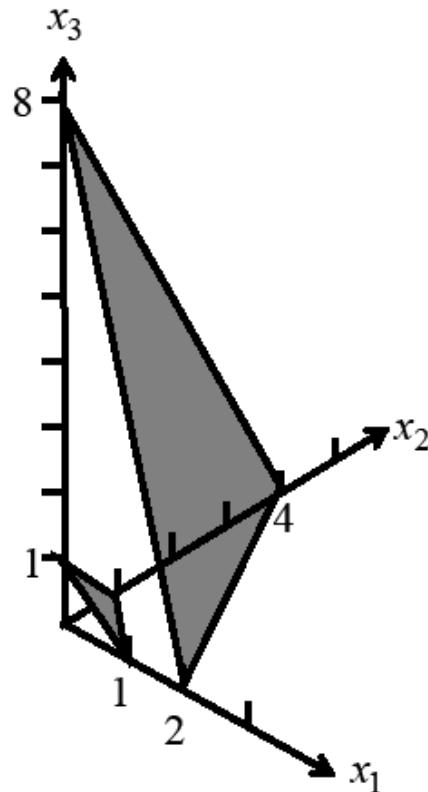
Death rate is δ

Fertility at age t is x_t

Growth factor is λ

$$1 = \frac{x_1}{e^\delta \lambda} + \frac{x_2}{(e^\delta \lambda)^2} + \dots + \frac{x_\ell}{(e^\delta \lambda)^\ell}$$

Intertemporal Tradeoffs and Impatience



Constant Rate of Time Preference

Fertility at t is now

$$f_t(c_t)$$

Consumption at t is

$$c_t$$

$$1 = \frac{f_1(c_1)}{e^\delta \lambda} + \frac{f_2(c_2)}{(e^\delta \lambda)^2} \dots + \frac{f_\ell(c_\ell)}{(e^\delta \lambda)^\ell}$$

Pure rate of time
preference

$$\delta + \ln \lambda$$

The Evolution of Time Preference with Aggregate Uncertainty

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*American Economic
Review 2009*



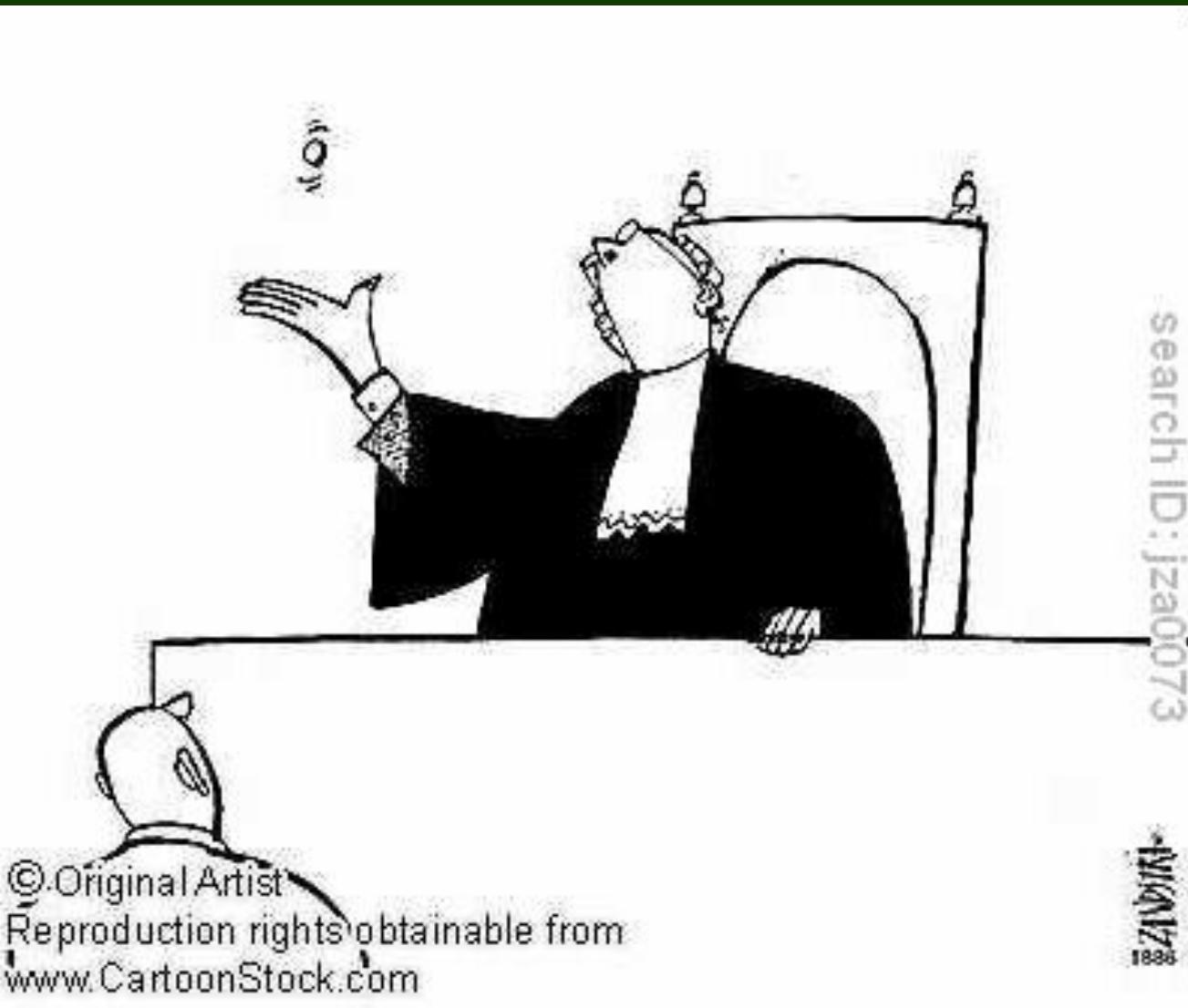
Shared Natural Risk- Fire



...and Ice



Idiosyncratic Coin Flips



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... and Aggregate Ones...





An Evolutionary Race

- Type 1 has 3 offspring with probability $1/2$, or 0 offspring also with probability $\frac{1}{2}$, independently across all individuals and dates.
- Type 2 has 3 offspring with probability $1/2$, or 0 offspring also with probability $\frac{1}{2}$, where all individuals at each date share the same outcome. Draw is independent across dates.

...An Evolutionary Race

- The number of type 1's at date T is straightforwardly

$$x(T) = x(0)(3/2)^T$$

- The type 2's however are evolutionarily doomed-there will be none of them the first time there is an adverse flip of the giant coin.
- Type 1 is the clear winner.

Aggregate Uncertainty and Growth

- If the risk concerning death is aggregate, the effect on the growth rate is more substantial than for comparable idiosyncratic risk.



Key Result

In a model with a general age structure, aggregate risk means that the rate of time preference can be substantially higher than that implied by typical mortality rates and average population growth rates close to zero. This would close the apparent gap between rates of time preference and mortality.

An Illustrative Case

- Consider the case in which there is an “equal opportunity” aggregate shock to all mortality rates.
- It can be shown that the rate of time preference stems from the hypothetical model with no mortality, but mortality can drive the observed growth rate to zero.

An Example

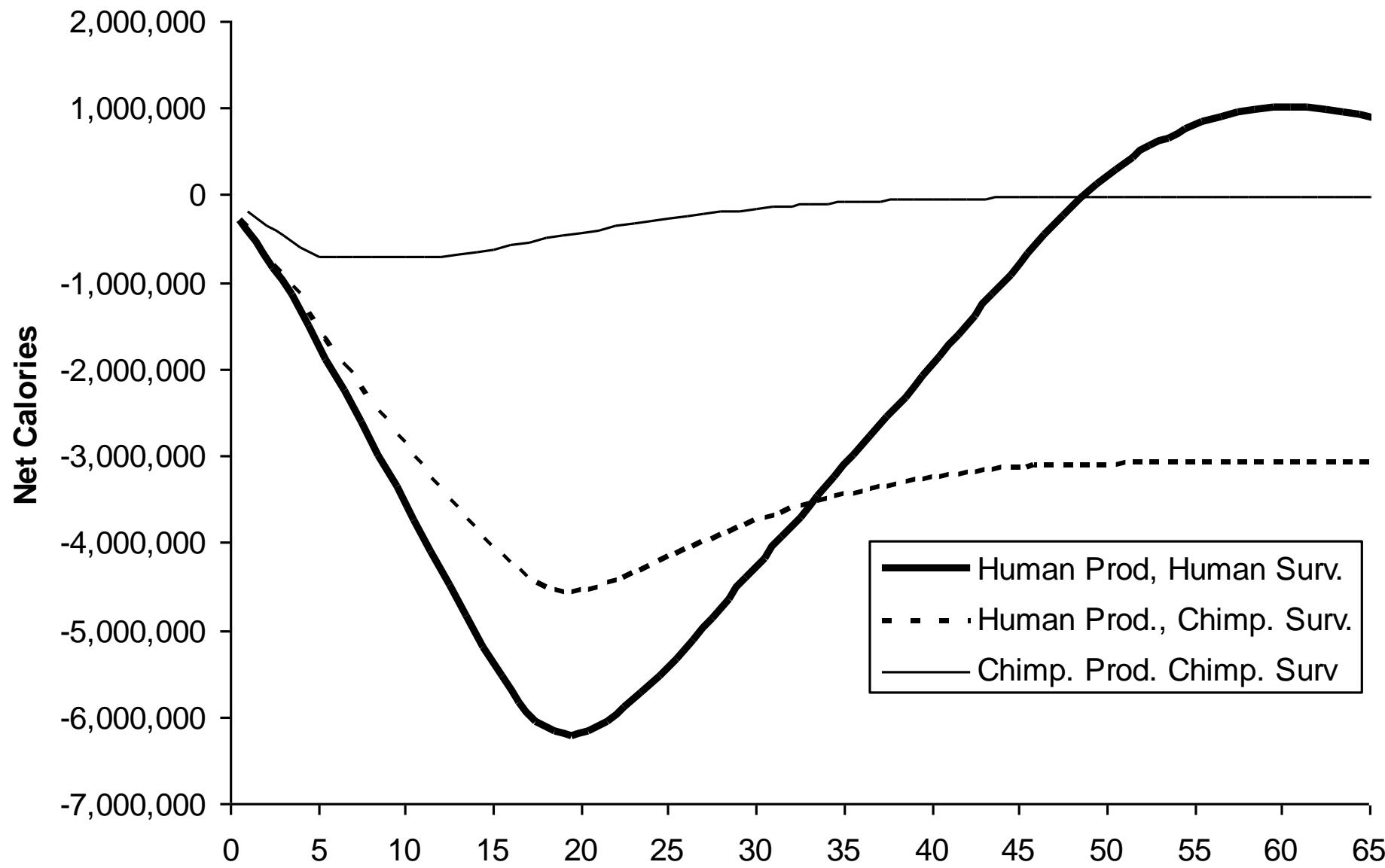
- If each woman produces 0.15 daughters per annum from age 15 to age 45, the population would grow at 5.5% per annum, in the absence of mortality.
- Thus the rate of time preference is 5.5%.
- There is only 2% background mortality per annum.

...Example

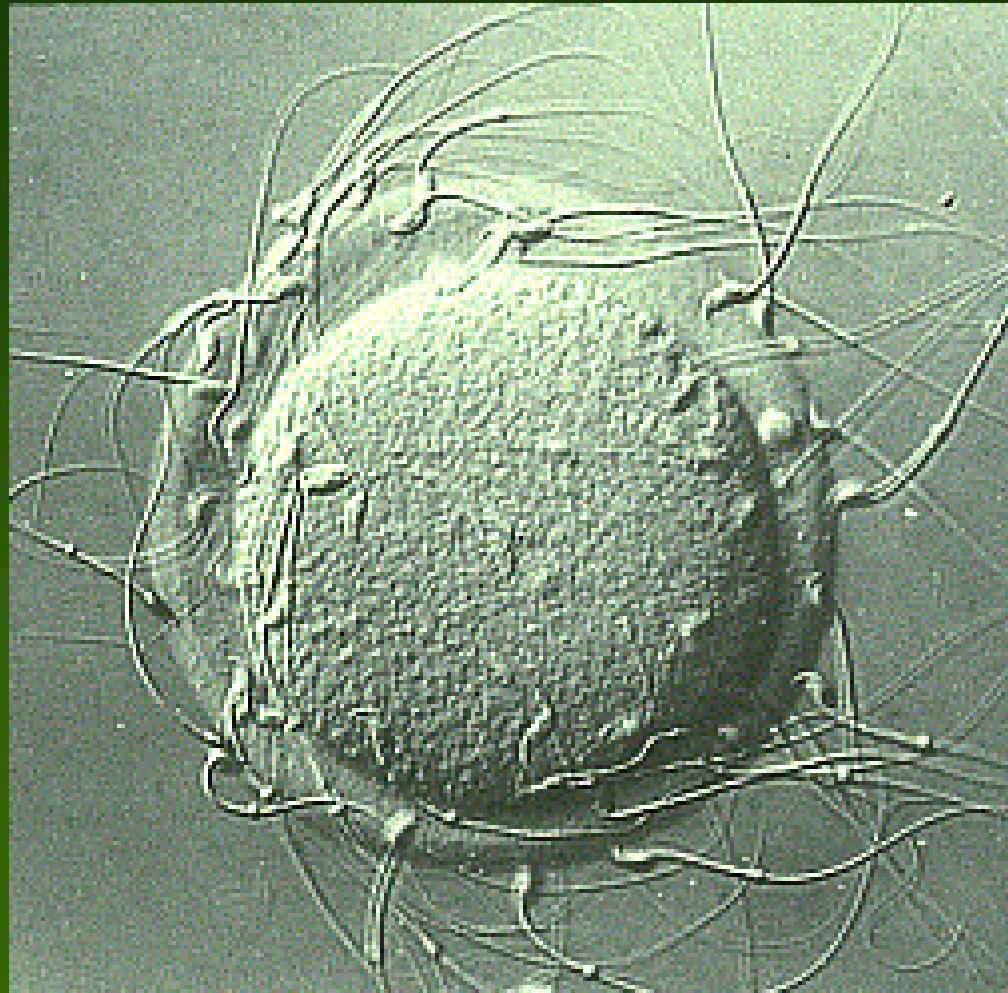
- In addition, however, a rare catastrophe wipes out 90% of the population once every 67 years on average.
- This is enough to get zero population growth on average.
- The rare catastrophe contributes only an extra 1.5% to the risk of death.
- It is the aggregate nature of the shock that explains the missing 2%.

Additional Considerations- Intergenerational Transfers...





... and Sex. Is Sex an Alternative Way to Close the Gap?



A landscape photograph showing a range of mountains in the foreground and middle ground, with a hazy, light-colored sky above.

THE END