# Exponential discounting examples

Notes on Behavioural Economics

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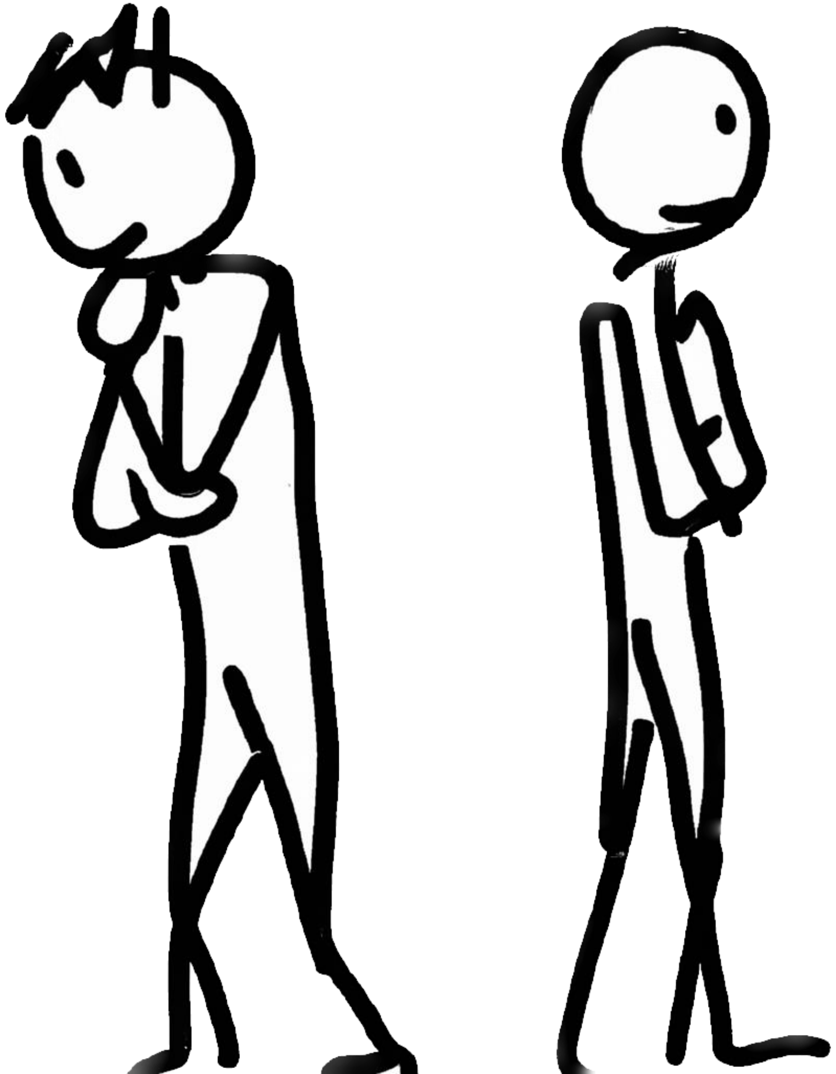

## $100 today or $110 next week

$$\delta = 0.95$$

$$u(x_n) = x_n$$

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$$\delta = 0.95$$

$$u(x_n) = x_n$$

Choice 1: $100 today or $110 next week

**$100 today or $110 next week**

$$
\begin{aligned}
U_0(0, \$100) &= u(\$100) \\
&= 100
\end{aligned}
$$

**$100 today or $110 next week**

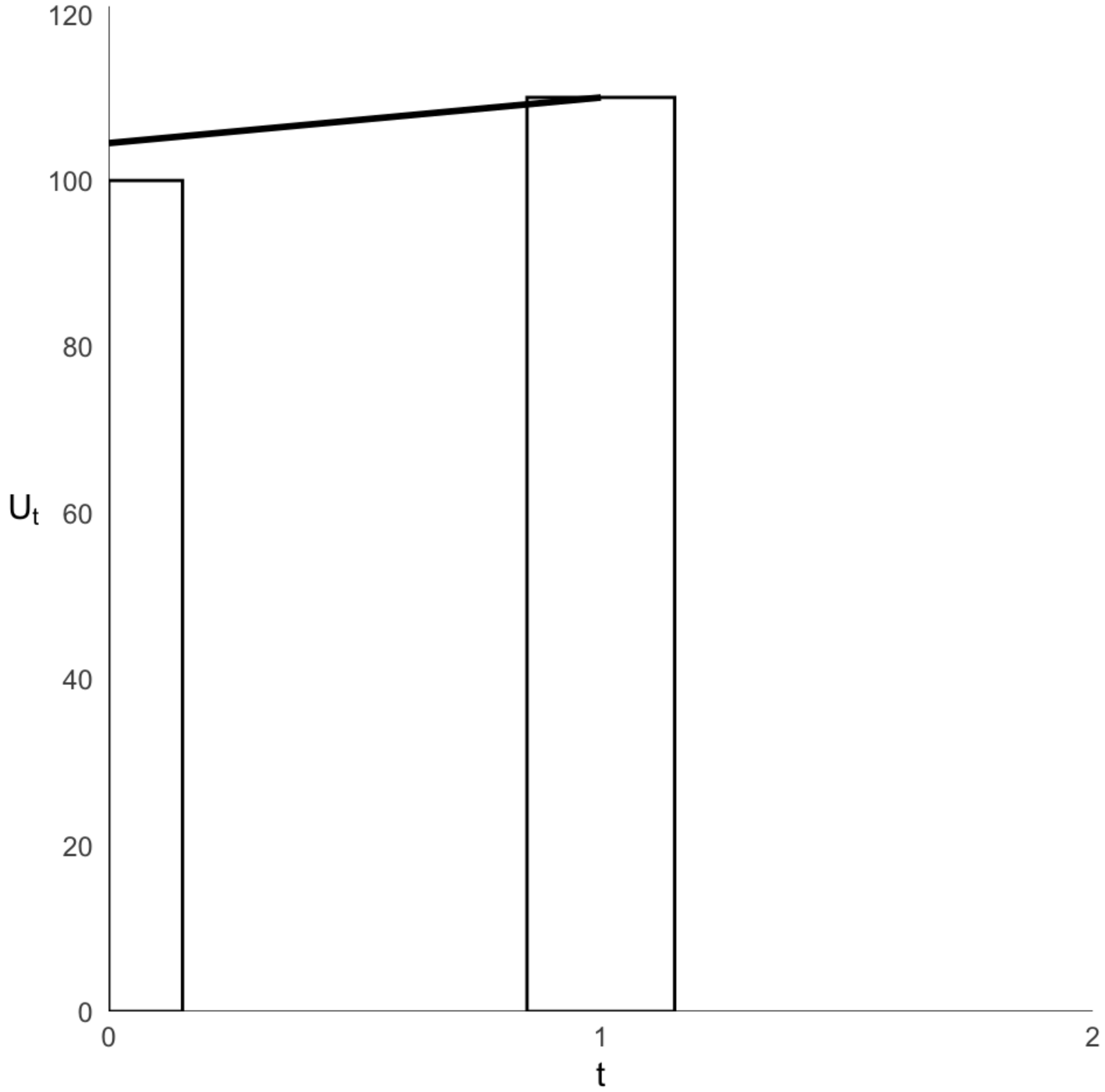
$$U_0(0, \$100) = u(\$100)$$
$$= 100$$

$$U_0(1, \$110) = \delta u(\$110)$$
$$= 0.95 \times 110$$
$$= 104.50$$

## $100 today or $110 next week

$$U_0(0, \$100) = 100 < 104.50 = U_0(1, \$110)$$

# $100 today or $110 next week



## $100 next week or $110 in two weeks

$$\delta = 0.95$$

$$u(x_n) = x_n$$

Choice 2: $100 next week or $110 in two weeks

## $100 next week or $110 in two weeks

$$
\begin{aligned}
U_0(1, \$100) &= \delta u(\$100) \\
&= 0.95 \times 100 \\
&= 95
\end{aligned}
$$

**$100 next week or $110 in two weeks**

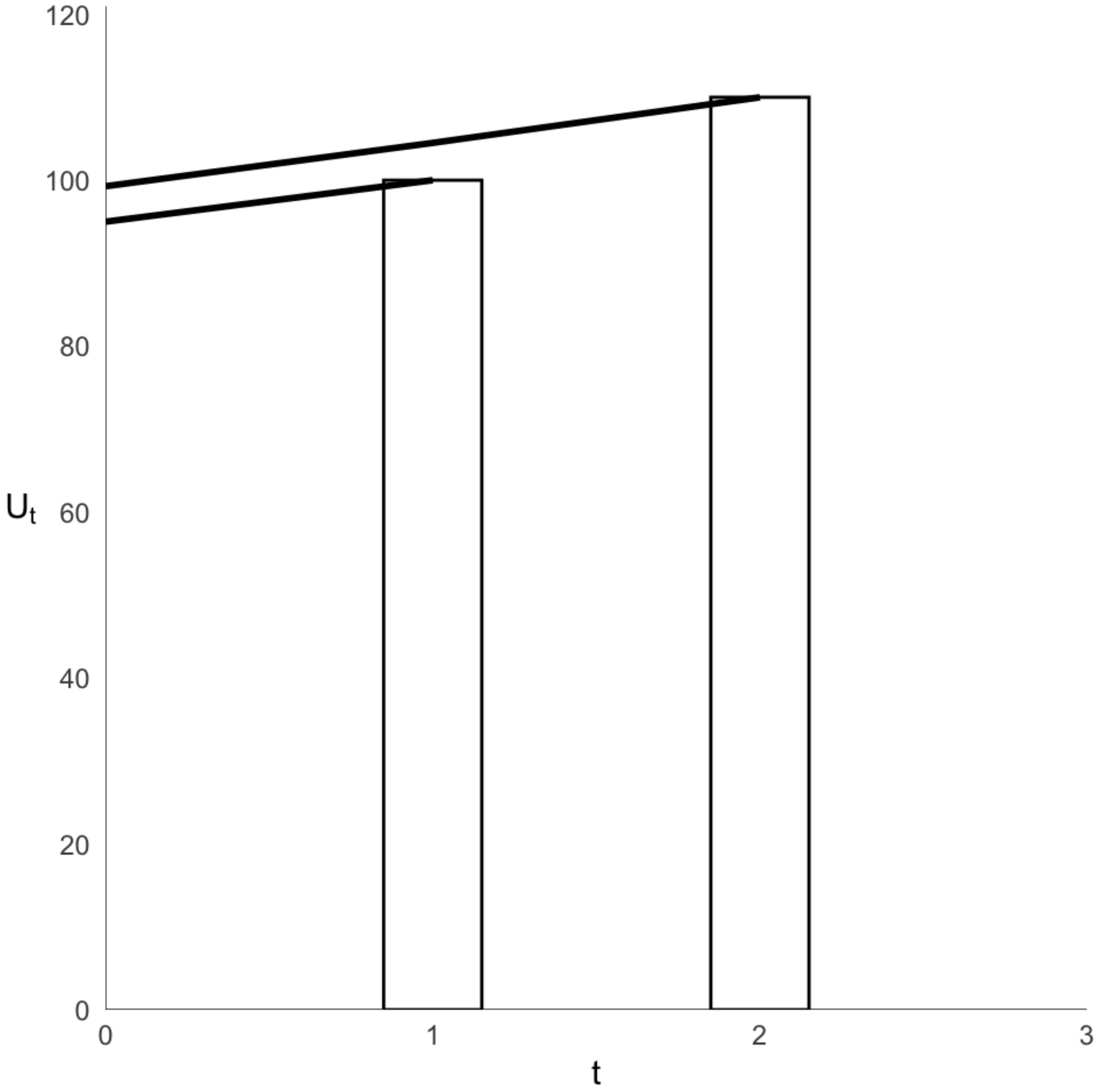
$$U_0(1, \$100) = \delta u(\$100)$$
$$= 0.95 \times 100$$
$$= 95$$

$$U_0(2, \$110) = \delta^2 u(\$110)$$
$$= 0.95^2 \times 110$$
$$= 99.275$$

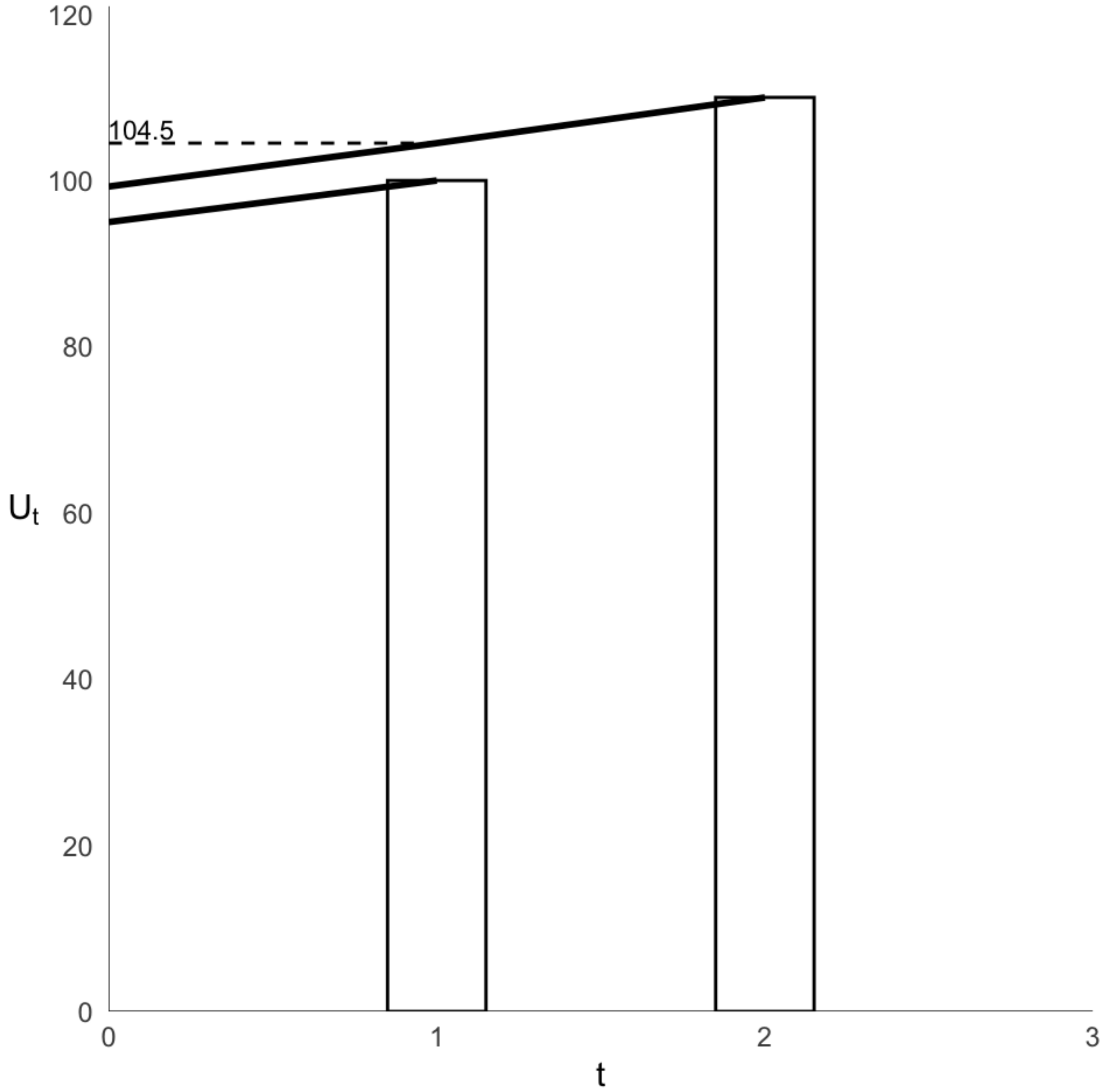
**$100 next week or $110 in two weeks**

$$U_0(1, \$100) = 95 < 99.275 = U_0(2, \$110)$$

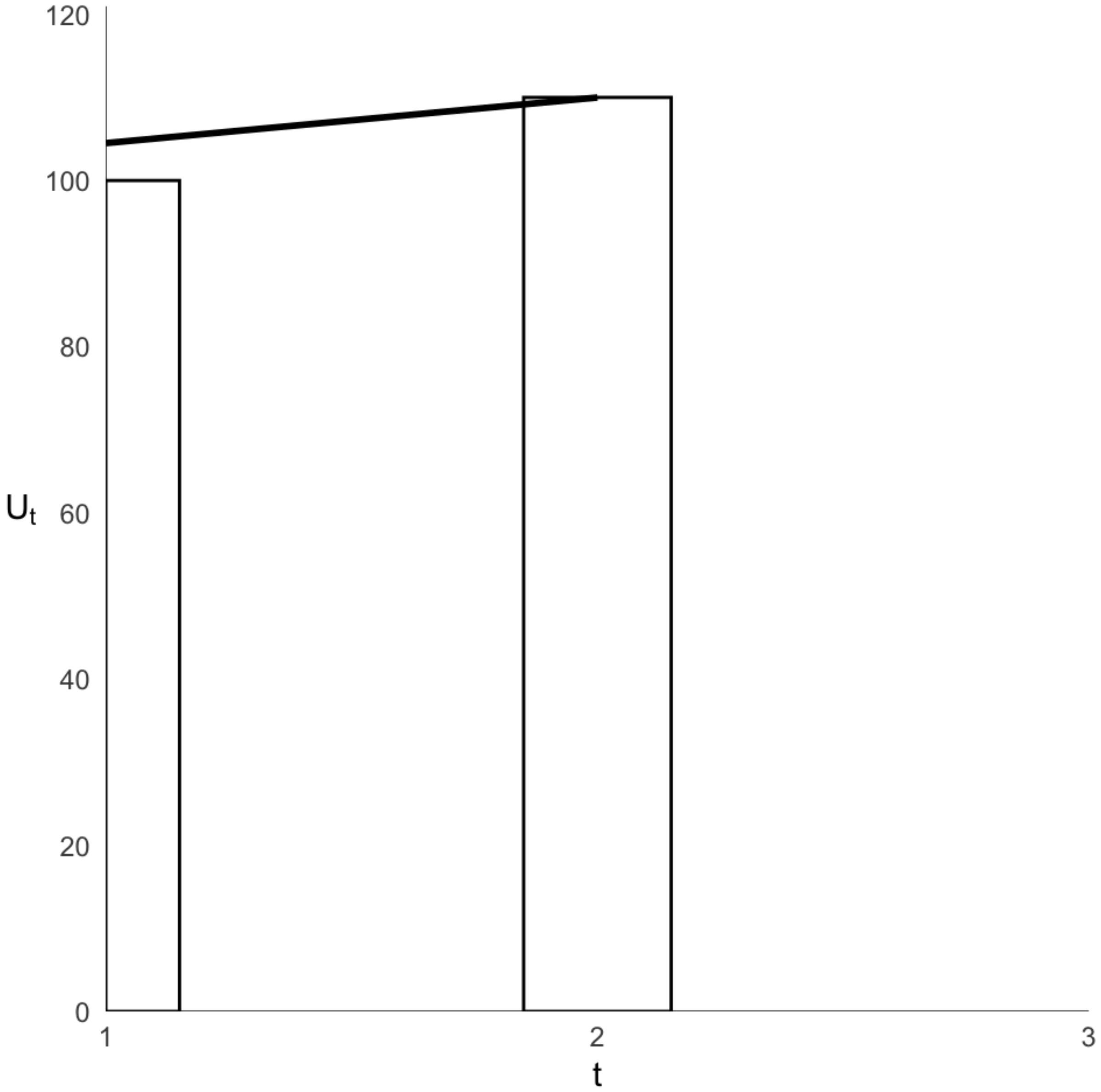
# $100 next week or $110 in two weeks



# $100 next week or $110 in two weeks



# $100 next week or $110 in two weeks



## How much for a one-year delay?

$$\delta = 0.95$$

$$u(x_n) = x_n$$

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$$\delta = 0.95$$

$$u(x_n) = x_n$$

What sum would she need to be offered in one year (52 weeks) to prefer that later payment to the $100 today?

## How much for a one-year delay?

$$U_0(0, \$100) = u(\$100)$$

$$= 100$$

## How much for a one-year delay?

$$U_0(0, \$100) = u(\$100)$$
$$= 100$$

$$U_0(52, \$y) = \delta^{52} u(\$y)$$
$$= 0.95^{52} \times y$$

## How much for a one-year delay?

$$U_0(52, \$y) > 100$$

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$$U_0(52, \$y) > 100$$

$$0.95^{52} \times y > 100$$

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$$y > \frac{100}{0.95^{52}}$$

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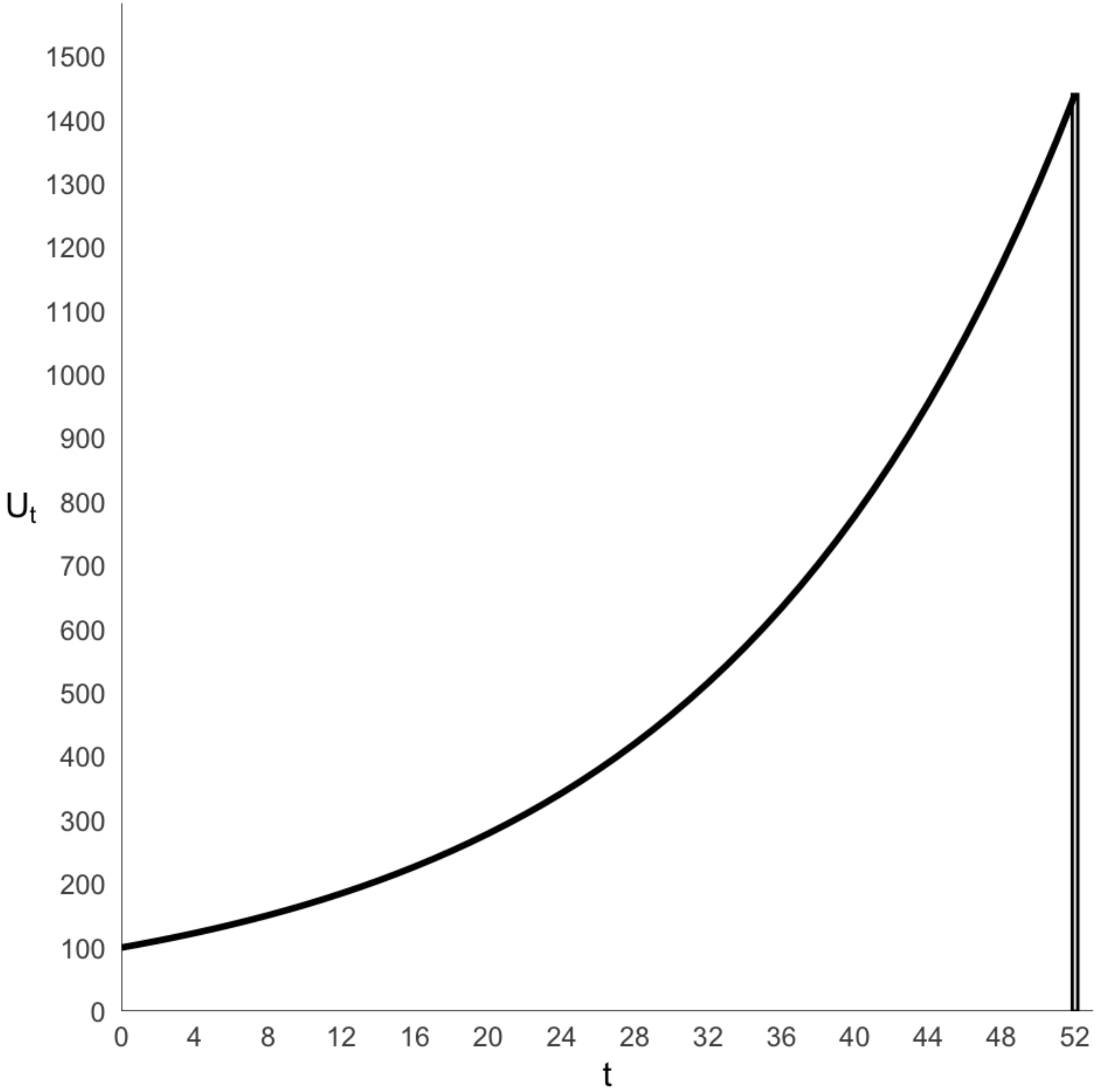
$$U_0(52, \$y) > 100$$

$$0.95^{52} \times y > 100$$

$$y > \frac{100}{0.95^{52}}$$

$$y > \$1440.03$$

## How much for a one-year delay?



## $10 in five days or $20 in 10 days?

$$\delta = 0.75$$

$$u(x_n) = x_n$$

## $10 in five days or $20 in 10 days?

$$\delta = 0.75$$

$$u(x_n) = x_n$$

$10 in five days ($t$ = 5) or $20 in 10 days ($t$ = 10)?

**$10 in five days or $20 in 10 days?**

$$
\begin{aligned}
U_0(5, \$10) &= \delta^5 u(\$10) \\
&= 0.75^5 \times 10 \\
&= 2.37
\end{aligned}
$$

**$10 in five days or $20 in 10 days?**

$$
\begin{aligned}
U_0(5, \$10) &= \delta^5 u(\$10) \\
&= 0.75^5 \times 10 \\
&= 2.37
\end{aligned}
$$

$$
\begin{aligned}
U_0(10, \$20) &= \delta^{10} u(\$20) \\
&= 0.75^{10} \times 20 \\
&= 1.13
\end{aligned}
$$

**$10 in five days or $20 in 10 days?**

$$U_0(5, \$10) = 2.37 > 1.13 = U_0(10, \$20)$$

## $10 in five days or $20 in 10 days?

$$\delta = 0.95$$

$$u(x_n) = x_n$$

$10 in five days ($t$ = 5) or $20 in 10 days ($t$ = 10)?

**$10 in five days or $20 in 10 days?**

$$
\begin{aligned}
U_0(5, \$10) &= \delta^5 u(\$10) \\
&= 0.95^5 \times 10 \\
&= 7.74
\end{aligned}
$$

**$10 in five days or $20 in 10 days?**

$$U_0(5,\$10) = \delta^5 u(\$10)$$

$$= 0.95^5 \times 10$$

$$= 7.74$$

$$U_0(10,\$20) = \delta^{10} u(\$20)$$

$$= 0.95^{10} \times 20$$

$$= 11.97$$

## $10 in five days or $20 in 10 days?

$$U_0(5, \$10) = 7.74 < 11.97 = U_0(10, \$20)$$

# $10 in five days or $20 in 10 days?