# Diamond and Dybvig basic model set up and optimization

1. Expected utility of agent at T = 0:

$U(c_1, c_2) = tu(c_1) + (1-t)\rho u(c_2)$

*where...*

$u'(0) = \infty$
$u'(\infty) = 0$
-c$\dfrac{u''(c)}{u'(c)}$ > 1

2. Optimal allocation:

$\max\limits_{x, c_1, c_2} [tu(c_1) + (1-t)\rho u(c_2)]$

...subject to resource constraints for periods 1 and 2:

$tc_1 \ \leq \ x$
$(1-t)c_2 \ \leq \ (1-x)R$

The resource constraints will be satisfied with equality since the function is strictly increasing. Therefore:

$\max\left[tu\dfrac{x}{t} + (1-t)\rho u\dfrac{(1-x)R}{1-t}\right]$

FOC...

$u'\Big(\dfrac{x}{t}\Big) = \rho R u'\Big(\dfrac{(1-x)R}{1-t}\Big)$
or

$u'(c_1) = \rho R u'(c_2)$

$\Rightarrow$ 0 $\leq$ $x$ $\leq$ 1 at the optimum, so $c_1$ > 0
$\Rightarrow$ Since $\rho R$ $\geq$ 0 and the function is strictly concave: $c_2$ $\geq$ $c_1$

Therefore, it is possible to say that this allocation is efficient and incentive compatible.

3. The optimum:

$c_1^*$ > 1
$c_2^*$ < $R$