

DAMAGED GOODS

A RESOURCE DEPLETION MODEL OF ADDICTIVE CONSUMPTION

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Overview

Not all goods are good

Previous models focus on addiction and information

Missing component: Health

Why Focus on Health?

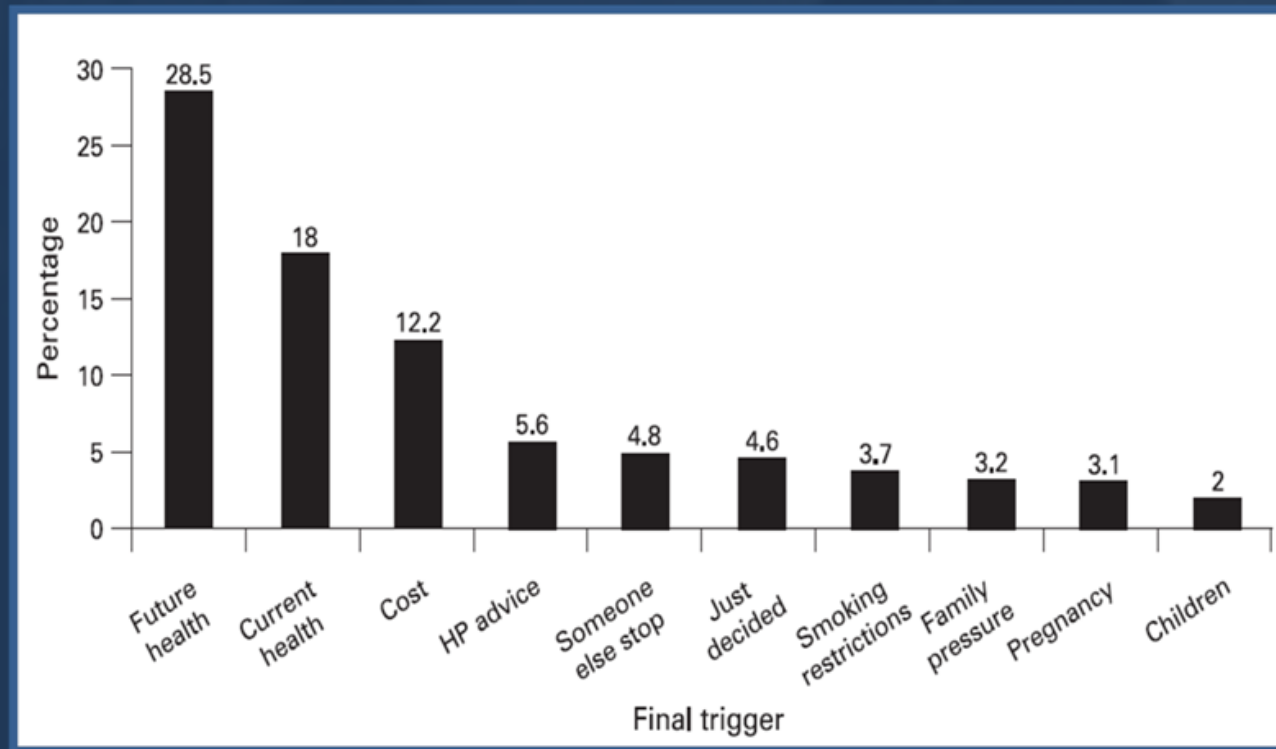
The health effects of common harmfully addictive goods:

- Alcohol – cirrhosis, risk of accident, cancer
- Cigarettes – COPD, lung cancer, other cancers

How do consumers decide how much of these goods to consume?

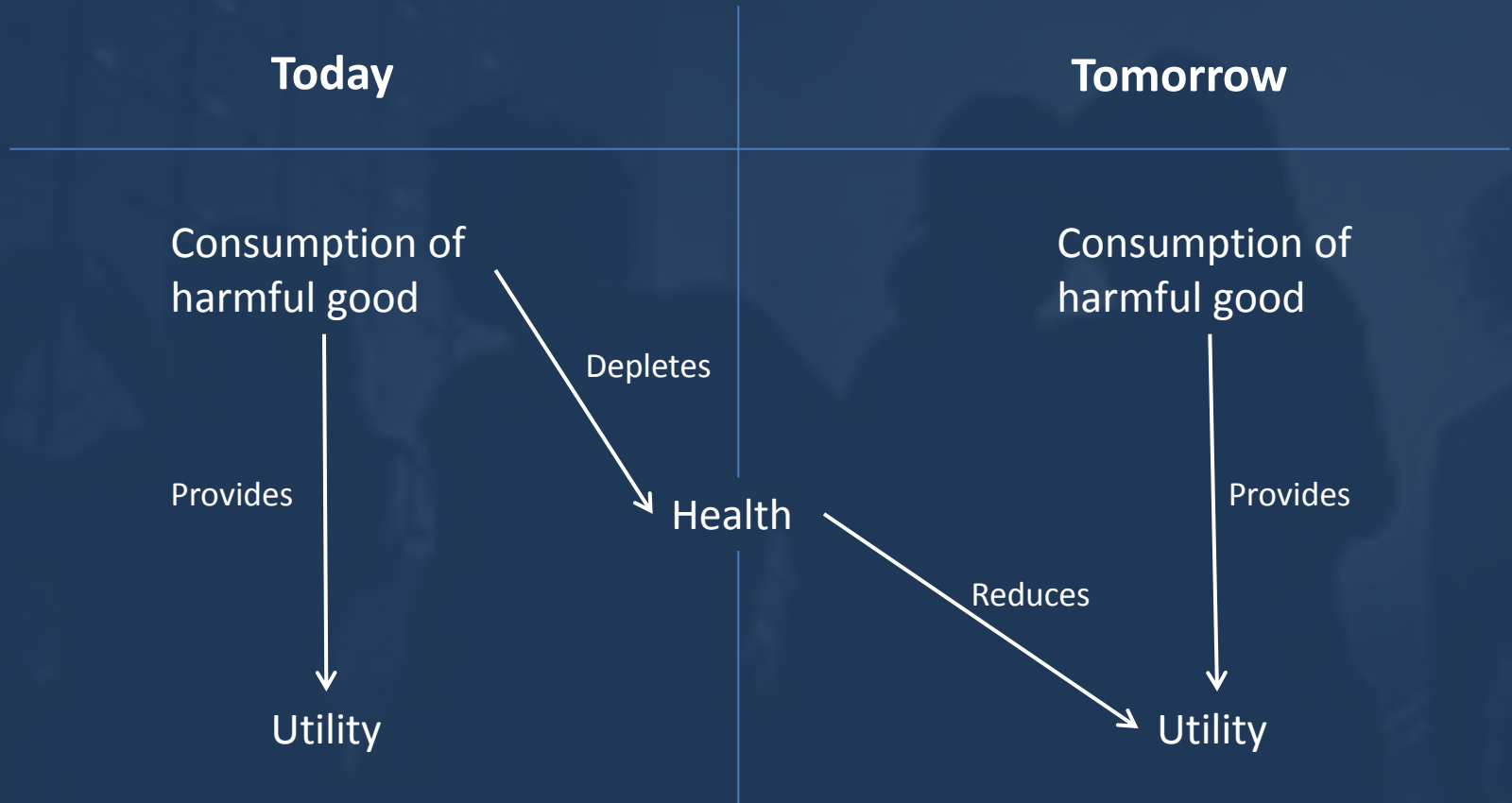
Why Do People Quit?

Most commonly cited reasons for quitting cigarettes



(Vangeli and West 2008)

Fundamental Trade-off



Consumption today reduces utility tomorrow

Defining Addiction

Economic addiction:

an increase in current consumption increases future consumption

(Becker and Murphy 1988)

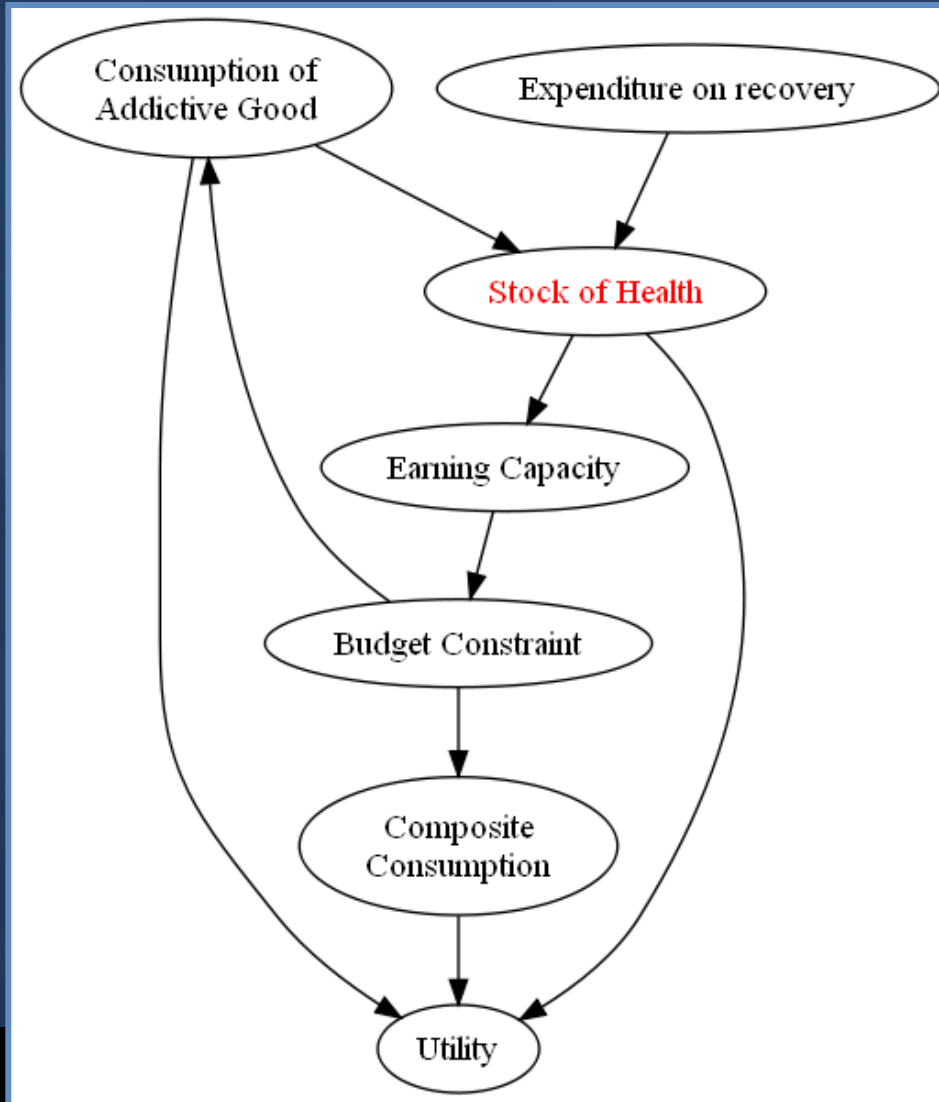
Defining Addiction

Medical addiction – Any three of:

- tolerance, withdrawal, using more than intended, desire to quit and/or difficulty quitting
- considerable time spent obtaining, using, or recovering from the drug
- interference with other activities
- persistent use despite problems caused by use

(American Psychiatric Association 2000)

Structure of the Model



Key Features

- Reduced health reduces utility
- Finite time horizon
- Terminal time uncertain
- Health can naturally regenerate

Health Depletion Model

$$\text{Maximise}_{y,c} U(0) = \int_0^T e^{-\sigma t} u(y(t), c(t), L(t)) \Phi(\psi(c(t), L(t), t)) dt$$

subject to

$$\dot{L} = g(L(t), t) - h(L(t), c(t), t) + k(d(t))$$

and

$$\int_0^T e^{-rt} [y(t) + p_c(t)c(t) + p_d(t)d(t)] dt \leq A_0 + \int_0^T e^{-rt} w(L(t)) dt$$

With $c(t), y(t), d(t) \geq 0; 0 \leq L(t) \leq \bar{L}; L(0) = L_0$

Simplifying Assumptions

- No budget constraint
- No composite consumption
- No uncertainty about time of death
- No ability to externally heal the body

Simplified Health Depletion Model

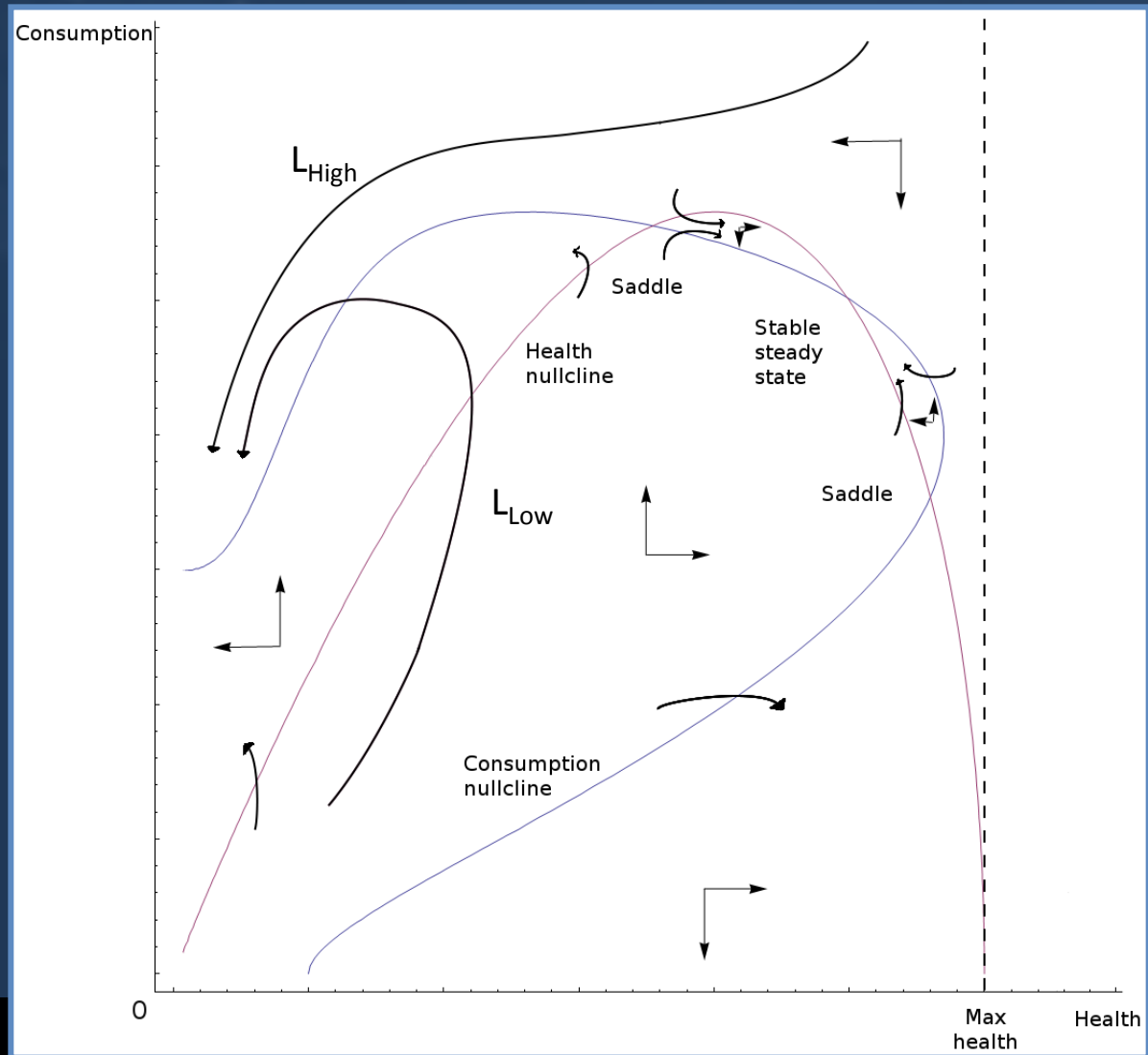
$$\text{maximise } \int_0^T e^{-\rho t} u(c, L) dt$$

subject to

$$\dot{L} = g(L) - h(L, c)$$

$$\text{and } c(t), L(t) > 0; L(0) = L_0$$

Results and Conclusions



Extensions

- Reinstate uncertainty
- Reinstate the composite good
- Reinstate budget
- Allow for ageing
- Combine with addiction

References

- American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (4th edition). Washington, DC.
- Becker, G. S. and Murphy, K. M. (1988). A Theory of Rational Addiction, *Journal of Political Economy*, 96(4), 675-700.
- Vangeli, E. and West, R. (2008). Sociodemographic differences in triggers to quit smoking: findings from a national survey, *Tobacco control*, 17(6), 410-415.

Rational Addiction Model

$$\text{Maximise}_{y,c} U(0) = \int_0^T e^{-\sigma t} u(y(t), c(t), s(t)) dt$$

subject to

$$\dot{s}(t) = c(t) - \delta s(t) - m[D(t)]$$

and

$$\int_0^T e^{-rt} [y(t) + p_c(t)c(t) + p_d(t)D(t)] dt \leq A_0 + \int_0^T e^{-rt} w(s(t)) dt$$

Mathematica Input

Input interpretation:

plot	$-0.05 \times \frac{y^2}{x^2} + x^{\frac{1}{2}} + \frac{y^2}{x^{2.5}} \left(1 - 2y + \frac{x^2}{y^2} \right) + 2x^{\frac{1}{2}}y \left(y(1-y) - \frac{x^2}{y} \right) = 0$	$x = 0 \text{ to } 1.5$
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Consumption Nullcline

Input interpretation:

plot	$x(1-x) - \frac{y^2}{x} = 0$	$x = 0 \text{ to } 1.5$
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Health Nullcline