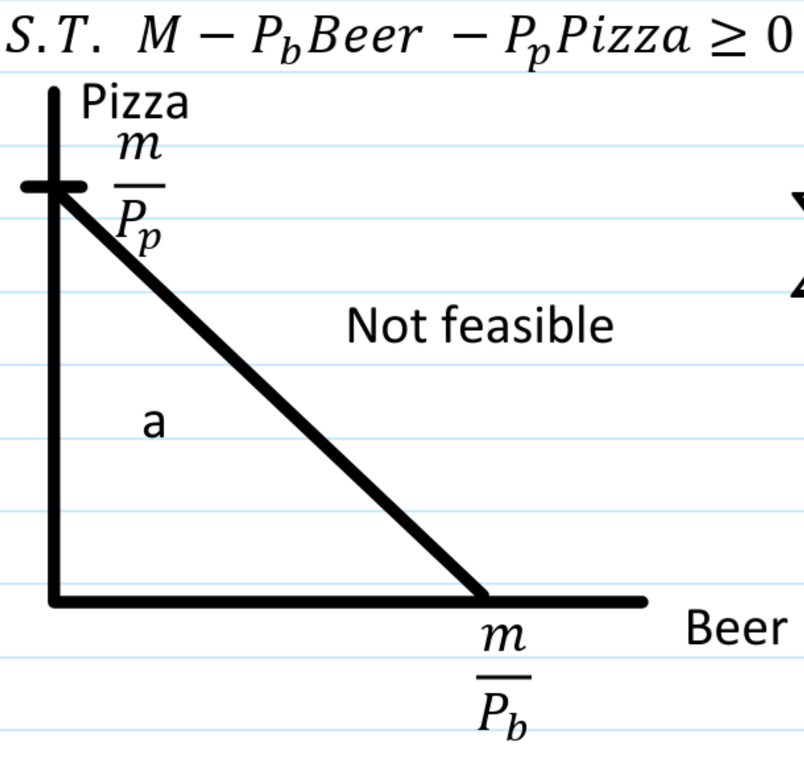
Optimization

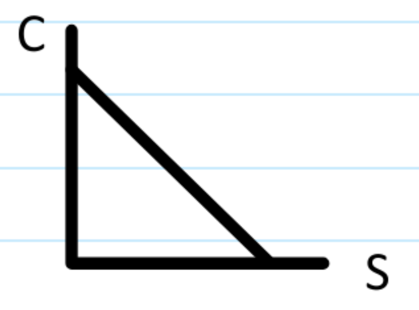
1. Math tool for finding choice to max objective
2. [find out later]

Consumer Optimization

$\max U(pizza, beer)$
$S.T.\ \ M - P_b Beer\ - P_p Pizza \geq 0$

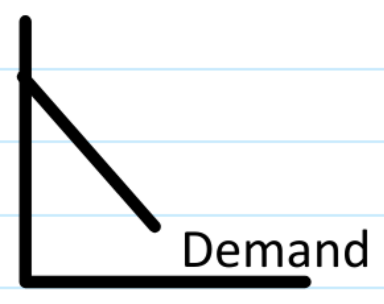


$$\sum_i P_i X_i + S = m$$



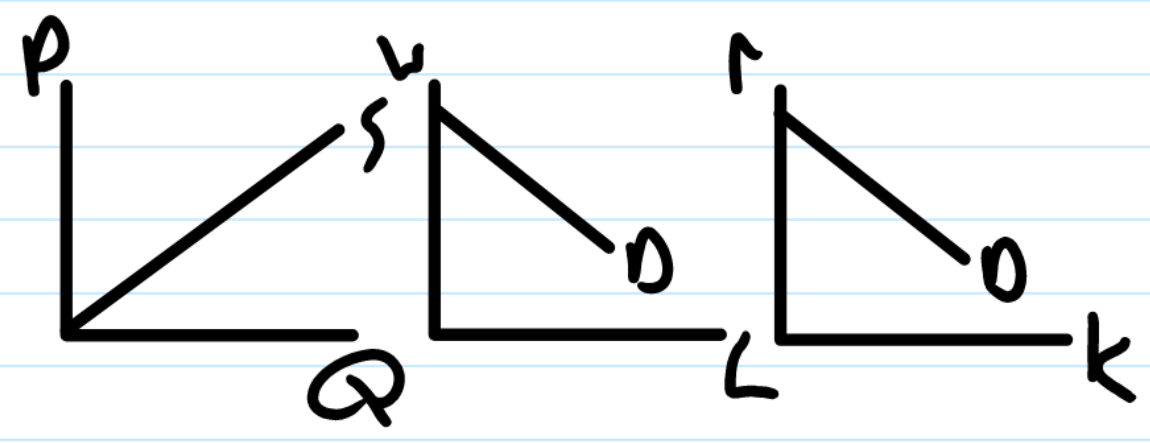
$$\sum_t \frac{\sum_i P_{it} X_{it}}{(1+r)^t} = \sum_t \frac{m_t}{(1+r)^t}$$

$\max u(x) s.t.\ m - \sum P_x \geq 0 \rightarrow x^D(m, p)$



Firm
$\max\ p * q(k, l) - wl - rk$
Price * quantity(capital, labor)-wage labor-return on capital

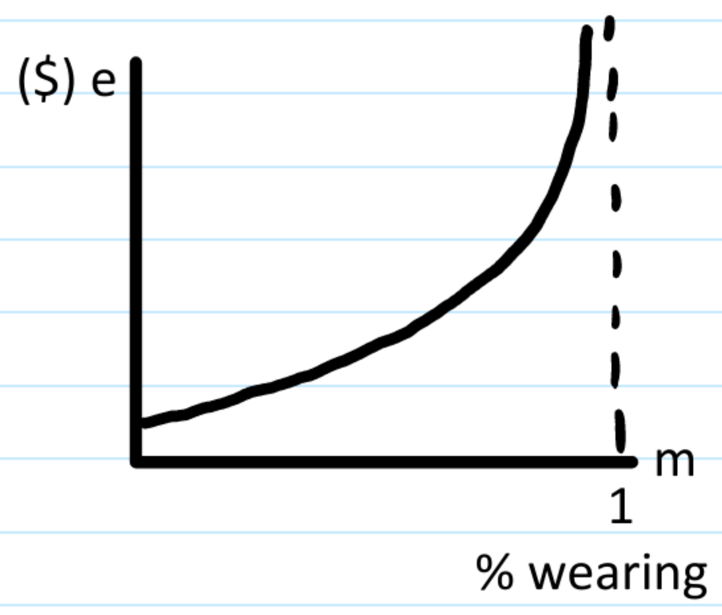
->
$L^D(w, r, p)$
$K^D(w, r, p)$
$q^S(w, r, p)$



Optimization applied to mask mandates

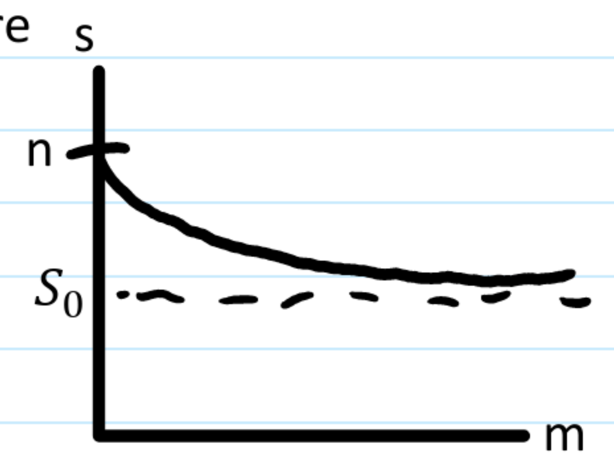
- n: # of people
- s: sick –> s_0 s_1
- h: healthy –> h_0 h_1
- m: # wearing
- e: enforcement
- c: cost of being sick

$\min c_s * s_1 + c_m m + e(m)$
s_1 depends on stuff



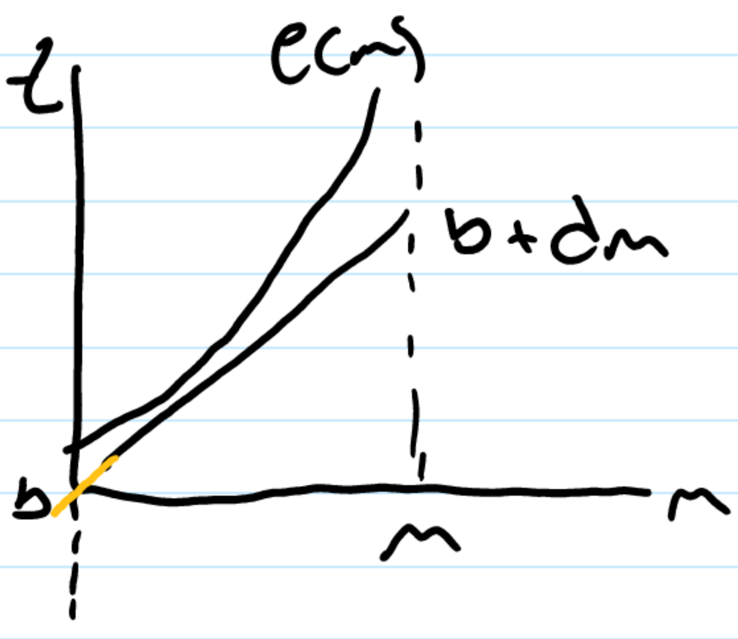
Ignore Cs if masks do not offer 100% protection. "They don't work anyways"
If we model at the exact point of the mandate, we can include s0 and s1 and h0 and h1
Don't use h because we can use n-s
Cs is a function of
protection ratio = m/n*(n-s)/n=m(n-s)/n2

- me[0,1] –> fraction wearing
- E = ne(m)
- m_{min} is the number of people that will always wear a mask
- p is probability you don't get it from 1 exposure
- e = equation
  - $\frac{m - m_{min}}{1 - m} * a$
  - $s_1(m)$
  - $s_0 + h[1 - p^{s_0}]$
  - $s_0 + h[1 - p^{s_0} e^{rm}]$
- **NOT QUITE RIGHT**



- $\lambda = e^{rm}$
- $m * ln(\lambda) = rm$
- $\ln(\lambda) = r$

- Talk through the basic economics of what are the tradeoffs in a mask mandate. Diff in ask vs enforce.
- λ is making masks more or less effective



b = Y intercept

Optimization Review

$u = 10q - \frac{1}{2}q^2 - Pq$ 1000 customers

$\frac{du}{dq} = 10 - q - P$ at $P = 0$ $q = 10 - P \rightarrow q = 10 - 0 \rightarrow q = 10$

$Q = (1000 \cdot 10) - 1000P$

$n = 10$ firms $MC = 2\ \ q \leq 100,\ 5\ \ q > 100$ $F = 100$
market supply?

$c(q) = 100 + 2q\ \ q \leq 100$
$100 + (100 + 2(100)) + 5(q - 100)\ \ q > 100$
↳ 200

$P = 2 + {}^{100}/_{\frac{Q}{n}}$