Econ 140, Lecture for Week 2 (Lecture notes by Jeffrey Clemens)

A Model of the Physician's Utility Function and Optimal Reimbursement Policy

The Setting: We're analyzing markets for health care goods and services:

A. Administratively set prices rather than freely adjusting prices (insurance arrangements).

B. *Key Management Question:* How should the insurance administrator design payments (which we often call "reimbursement rates") for physicians?

Why does the administrator care?

C. Physicians may not be profit maximizers.

Our analytic model is an attempt to capture these key aspects of the problem in which we're interested.

HOWEVER… IT'S JUST A MODEL.

A simple economic model will not give us specific policy recommendations

NONETHELESS… the model can give us insight into how policy recommendations should vary when key aspects of the environment vary:

Should we pay differently if the physicians in one part of the country are more profit oriented than the physicians in another?

Are the same payment structures suitable for paying for labor-intensive services like office visits vs. capital intensive services like MRIs?

The Physicians' Utility Function

Physicians value both profit and patient health.

Plan: We're going to write out a utility function mathematically. We're then going to go back and forth between mathematical examples and graphical depictions of the supply curve.

Defining terms:

π = profit
b(q) = total patient benefit as function of quantity
MB(q) = marginal benefit of unit q (this is the derivative of b(q))
θ = weight on profit; $(1 - \theta)$ is weight on patient benefit

So we can write:

Utility = $\theta\pi + (1 - \theta)\, b(q)$

What's profit? Profit depends on how the physician is paid. To capture the major ways in which physicians are paid, we'll allow for both a salary component and a fee-for-service payment.

α = salary payment
r = reimbursement rate. This is the standard physician payment in our diagrams
c(q) = total cost as a function of quantity
MC(q) = marginal cost of unit q (this is the derivative of c(q))

So $\pi = \alpha + rq - c(q)$

Utility = $\theta[\alpha + rq - c(q)] + (1 - \theta)\, b(q)$

Starting from any given point, what happens to the physicians' utility when he/she chooses to provide an additional unit of care?

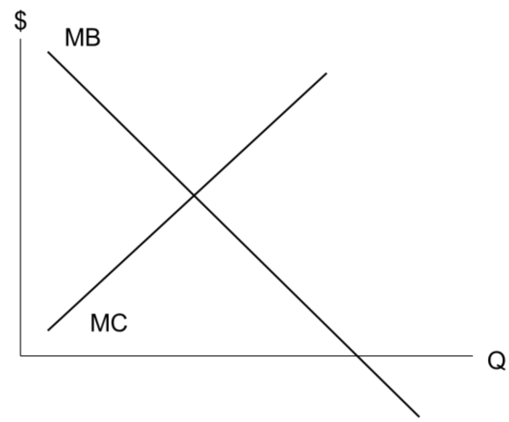
Change in profit: gain r and lose MC(q)
Net value of $\theta[r - MC(q)]$

Change in patient benefit MB(q)
Net value of $(1 - \theta)MB(q)$

Illustrative examples:

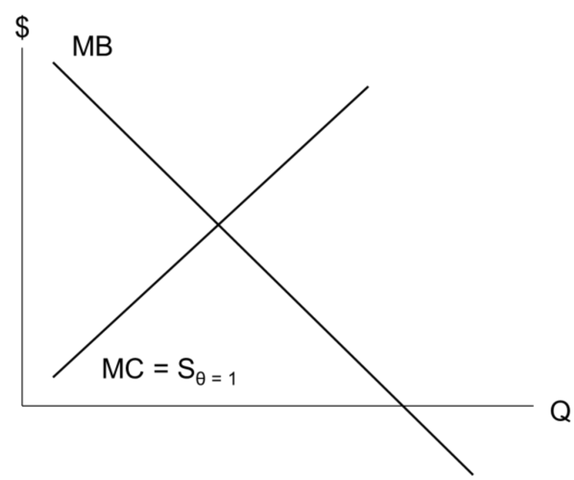
1) How does the decision look when the physician only values profit ($\theta = 1$)?

What is the Supply Curve if $\theta = 1$ (We'll call this $S_{\theta = 1}$)



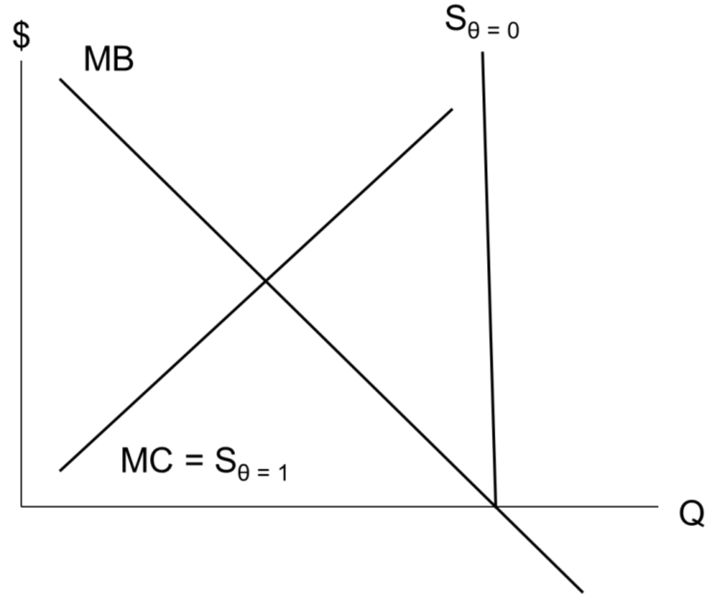
a. Provide until MC = r. This is the usual assumption we make about firms' short run supply curves when they are profit maximizers

$\theta = 1$ is the case of standard profit maximization, so ($S_{\theta = 1}$ = MC)



2) How does the decision look when the physician only values patient benefits ($\theta = 0$)?
   a. Provide until MB = 0. Health maximization.

What if θ = 0, implying no concern for money and all concern being for patient health (this not a realistic extreme, but is an analytically useful example).



Let's dive a little deeper.

Physicians' Marginal Utility brings together the financial benefit and the "altruism" benefit

$$MU(Q) = \theta[r - MC(Q)] + (1 - \theta)MB(Q)$$

The physician optimizes by choosing the quantity at which MU = 0. That's exactly what we were discussing previously (e.g., the reason why the profit maximizing physician supplies care until MC(Q) = r.)

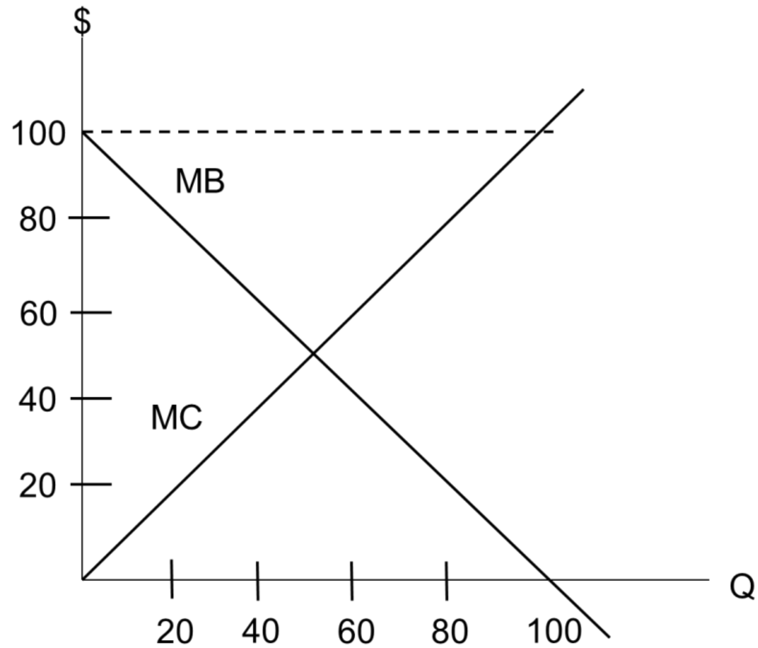
So optimizing means choosing the Q* such that

$$0 = \theta[r - MC(Q^*)] + (1 - \theta)MB(Q^*)$$

(This is the First Order Condition for the physicians' utility maximization problem)

We'll now work through a numeric example:

Assumptions:
$MB(Q) = 100 – Q$
$MC(Q) = Q$



So the physicians' first order condition is…

$$0 = \theta[r – MC(Q)] + (1 – \theta)MB(Q)$$

$$0 = \theta[r – Q] + (1 – \theta)[100 - Q]$$

This will give us the supply curve if we solve for Q:

$0 = \theta[r – Q] + (1 – \theta)[100 - Q]$ (repeat of previous expression)

⇨ $0 = \theta r – \theta Q + 100 – Q - \theta 100 + \theta Q$ (distribute the theta and 1 minus theta terms)

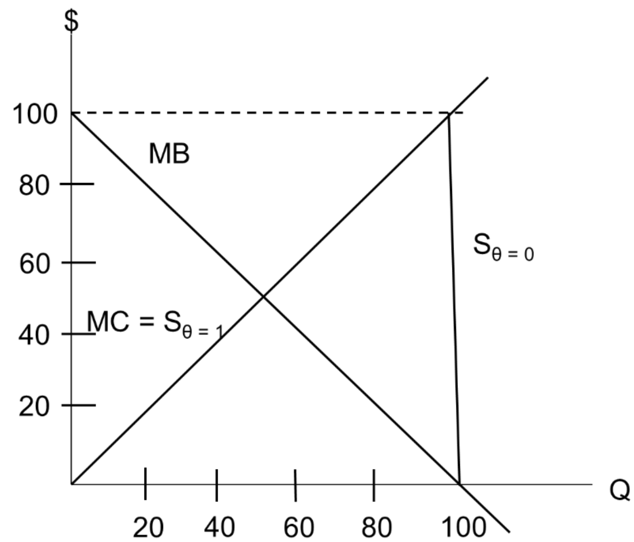
⇨ $0 = \theta r + 100 – Q - \theta 100$ (cancel out the offsetting -theta x Q and theta x Q)

⇨ $Q = \theta r + 100 - \theta 100$ (add Q to both sides so that we have solved for Q)

Let's look at two special cases:

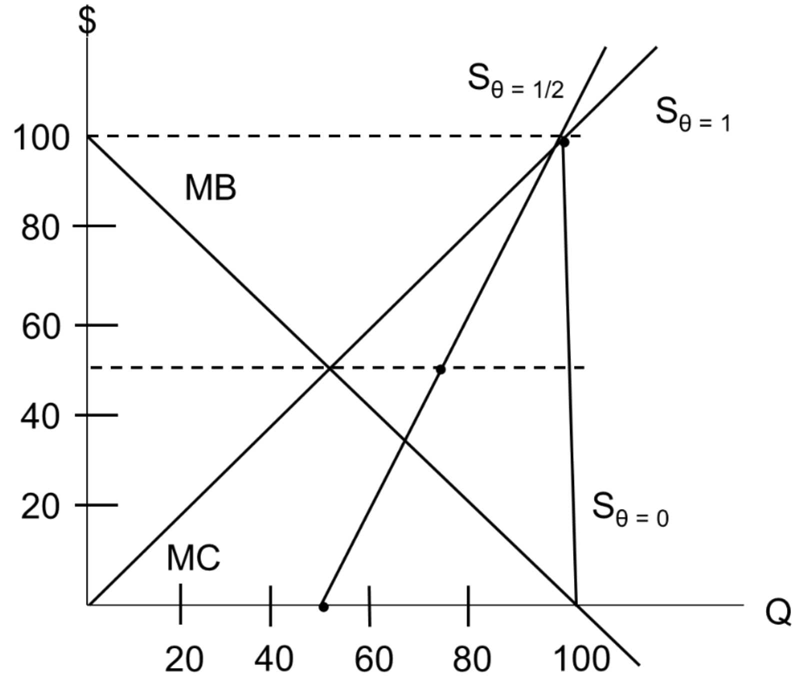
1) If the physician only cares about profit, then $\theta = 1$. This gives us
    a. $Q = \theta r + 100 - \theta 100$
    b. $Q = 1r + 100 - 100$
    c. => $Q = r$ (in this case, this is the same as saying the physician sets $MC(Q) = r$ because $MC(Q) = Q$)

2) If the physician only cares about patient benefits, then $\theta = 0$. This gives us
    a. $Q = \theta r + 100 - \theta 100$
    b. $Q = 0r + 100 - 0 \times 100$
    c. => $Q = 100$ (the physician provides all 100 unites of care for which MB > 0)



3) What if the physician places equal weight on profit and patient benefits?
    a. $Q = \theta r + 100 - \theta 100$
    b. $Q = .5r + 100 - .5 \times 100$
    c. => $Q = .5r + 50$

    d. Let's plot some points on the supply curve
        i. With $r = 0$, $Q = 50$
        ii. With $r = 50$, $Q = 75$
        iii. With $r = 100$, $Q = 100$



Observations:

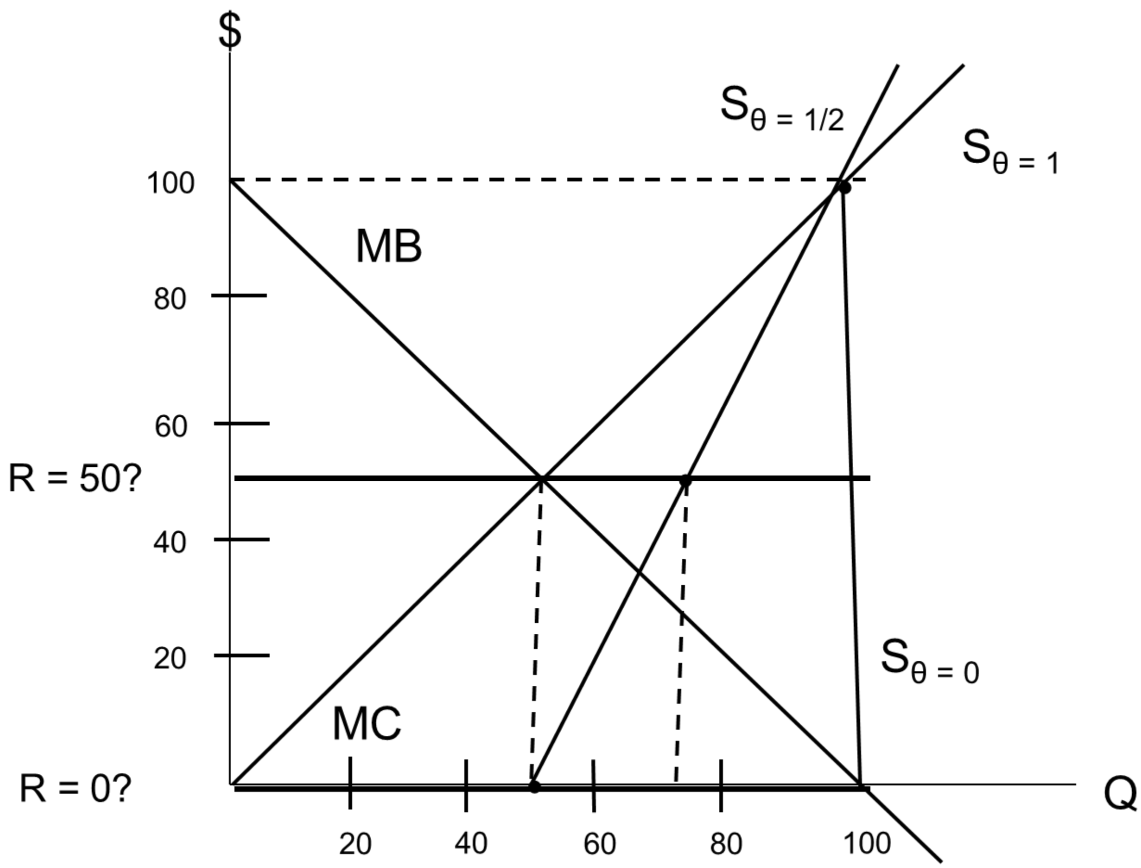
1) It shouldn't be surprising that the physician with $\theta = 0.5$ has a supply curve that falls between supply curves for the physicians at the extremes of $\theta = 0$ and $\theta = 1$.

2) Valuing patient benefits tends to make supply steeper (less elastic) than a supply curve based on the marginal cost curve alone.

    a. True so long as the marginal benefit curve slopes down rather than being constant.

3) The supply curves for all types intersect at Q = 100 in this example because that's the point at which the health benefit term equals 0: supply 100^{th} unit if r = MC = 100.

What does this mean for optimal reimbursement rate setting?



Things to note:

1) R = 50 gets the profit maximizer to provide the socially desired 50 units
    a. But the physician who equally values patient benefits provides 75

2) R = 0 gets the physician who equally values profit and patient health to provide 50 units
    a. This means that such physicians should be paid on salary rather than through fee for service
    b. But the physician that just maximizes profits provides no care with R = 0

Key Point: Different payment systems are appropriate when physicians are trained in different ways.

Also, pure health maximizers pose a problem for reimbursement policy:

a. Care provision will tend to be excessive.
b. It is not possible to steer their behavior with financial incentives

What are additional real-world issues that the model does not directly capture? Other factors that could affect the supply curve:

a. **Malpractice lawsuits** might lead physicians to weight more towards health maximization

b. The utility function might be weighted towards some notion of **best practice** rather than valuing patient benefits in the way we've described

c. The payment model could be richer
   a. Fee for Service with **utilization reviews** (you don't get the payment if the service was clearly inappropriate (i.e., low value)
   b. Salary with **quality bonuses**
   c. Salary with **threat of removal** from an insurers' network if quality is low

"General Solution" to the Model:
Rather than use a specific example for the MC and MB curves, let's now take a somewhat more abstract look at the problem and see what it implies for "optimal" physician payment:

We're going to step back and look at the "general" determinants of the supply curve without plugging in a particular structure for MC and MB.

We'll derive the reimbursement rate that leads physicians to supply until MB = MC.

Recall from the top…

Utility = $\theta[\alpha + rq - c(q)] + (1 - \theta)\, b(q)$

$MU(Q) = \theta[r - MC(Q)] + (1 - \theta)MB(Q)$

The physician optimizes by setting Q such that $MU(Q) = 0$

$$0 = \theta[r - MC(Q)] + (1 - \theta)MB(Q)$$

Knowing that physicians behave this way, the insurer wants to pick the r that leads physicians to provide Q* such that MB(Q*) = MC(Q*). We can find this by substituting MC = MB and solving for r.

> We're moving away from thinking about the shapes of the curves and focusing exclusively on where they intersect (MC(Q) = MB(Q)). This will tell us more about the optimal reimbursement rate, but not about the costs of missing it.

Substituting MC(Q*) = MB(Q*) gives us:

$$0 = \theta r^* - \theta MB(Q^*) + (1 - \theta)MB(Q^*)$$

Now solve for r*:

⇨ $\theta r^* = \theta MB(Q^*) - MB(Q^*) + \theta MB(Q^*)$ [Add θr* to both sides to move r* to the left.]

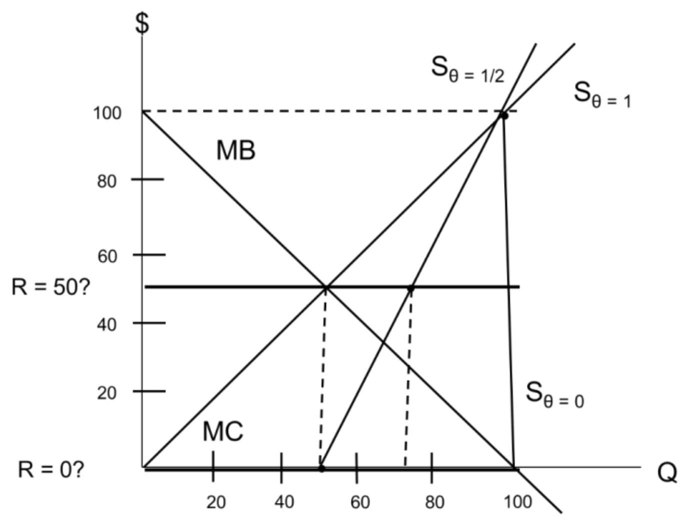
⇨ $\theta r^* = 2\theta MB(Q^*) - MB(Q^*)$ [Combine the two θMB(Q*) to get 2θMB(Q*)]

⇨ $\theta r^* = MB(Q^*)[2\theta - 1]$ [Factor out the MB(Q*) to get that times 2θ -1]

⇨ $r^* = MB(Q^*)[2 - 1/\theta]$ [Divide through by θ]

Thinking back to our initial diagram, we see two key pieces of intuition:

1) Optimal reimbursement is high when MB is high
2) Optimal reimbursement increases with θ, meaning the physician cares relatively more about profit and thus needs more financial inducement to provide care. (Note that θ is in the denominator of a term that enters negatively on the right-hand side.)



An additional implication is that for any given "agency" term (this means θ), there's at most one optimal reimbursement rate:

1) If physicians vary, you can't get it right for all of them

Next time: we'll see that this framework has some interesting implications for services that have particular marginal benefit and marginal cost profiles, and that insights from the model can help us understand key patterns in U.S. health expenditures.