



3 Stages of Production

By [Dr. Mason Gaffney]

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3 stages of production

NB ---> THIS IS A LECTURE OUTLINE, WITHOUT FULL TREATMENT OF POINTS LISTED

1. Values of ϵ in the 3 stages, and at the critical points between them.
2. Reasons why Stage II is most common.
3. Stages I and III do occur, however, and need to be treated. Ordinary neo-classically trained economists tend to neglect them.

a. Open access to land leads to Stage III proportions. Examples: open range; common pools of petroleum, gas, water; wild fish and game; parks; highways; property rights based on use or capture;

A trickier case is damage functions from pollution. Here, damage is treated as the product, everything is backwards, and it is desirable to concentrate pollutants where they may do the least damage and may actually become useful by-products.

"Tragedy of the Commons" vs. "The Magic of Property turns Sand into Gold." Crowding and the dissipation of rent. Maldistribution of population caused by rent as a magnet. Unregulated airlines and the rush-hour crush. Radio interference. In such cases, congestion brings equilibrium, but not an optimal one.

Subtle cases of rent dissipation, a step removed. Exploration for minerals before leasing on the OCS and state lands. Mining Law of 1872 on uplands of Federal domain. Free mining rights in British Columbia. Heavy local taxation to serve immigrants (Marshall's "onerous" taxation). Social dividends in Alaska and Alberta. Machine politics in big cities. Cross-subsidies.

b. Stage I proportions occur where lack of demand limits scale. Examples of public works, mass transit, and distributive networks of public utilities, especially where they are oversized today in expectation of future higher demand. Case for

"marginal-cost pricing" (the seller is a price-maker, and sets $P = MC$).

4. Property rights: a partial solution, creating new problems
Man has invented property to substitute for Nature's tooth and claw. But man has overdone it.

Distributive injustice.

Institutional obstacles to full economic use of superior or "rentable" land.

The kind of market failure called "land speculation."

Cartel prorates putting rentable land on ice. Market entry prorated by landholdings, overmotivating land acquisition.
"Rent-seeking" in various forms, e.g. appropriating water.

Tax rewards for land speculation vs. tax penalties for land use.

"Land Banking" by governments and large private holders.

Property taxes based on the market price of land used to abate those problems. Since 1978 in California, however, such taxes are held down to very low rates.

5. Magnetism of open-access rents vs. repulsion of cartelized rents results in extreme overuse of former relative to extreme underuse of latter. T.N. Carver and "the congested frontier" problem.

A. Stages of Production, Matrix

Stage	MP/AP (ϵ)	MP/MC	λ of AP	AP	Rent	λ of TP	TP
I	>1	$\sim$	+			+	
Cusp 1	$=1$	>1	0	Max		+	
II A	<1	>1	-			+	
Cusp 2	<1	$=1$	-		Max	+	
II B	<1	<1	-			+	
Cusp 3	<1	<1	-			0	Max
III A	<1	<1	-			-	
Cusp 4	<1	<1	-	$= MC$	0	-	
III B	<1	<1	-	$< MC$	-	-	

B. Inferences from the table above.

MP/AP, shown in Col. 2, is also called epsilon (ϵ). Epsilon stands for "Elasticity of production," which is the fractional rise of output divided by the fractional rise of the variable input. Delta (Δ) means a small but finite increment of the variable it precedes.

MP of $x = \Delta p / \Delta x$, where p = a product and x = a variable input

AP of $x = p/x$

$MP/AP = \{\Delta p / \Delta x\} / \{p/x\}$

Switching Δx and p does not change the value of the right side, so we have

$MP/AP = \{\Delta p / p\} / \{\Delta x / x\}$, that is, the fractional rise of output divided by the fractional rise of the variable input.

The "optimal" combination of inputs is where rent maxes out. Note that is not where MP maxes out, nor where AP maxes out, nor where TP maxes out.

Note also that where TP maxes out is also where the AP of the fixed input, land, maxes out, since land is fixed.

C. Draw a graph showing the relationships indicated in the matrix table in "A" above. MC is to be a horizontal line, indicating constancy, and $MC = AP$. This will be required, to answer a question on the Final.

D. Some important inferences for economists

1. To economize solely on x , waste land (Cusp 1).

2. To economize solely on land, waste x (Cusp 3 and below).
3. To optimize, max rent (Cusp 2).
4. Note that maxing out rent (Cusp 2) is not the same as maximizing the product, p , per acre or per square foot or per \$ of land value (Cusp 3). Be able to explain why that is.
5. After Cusp 3 the TP falls, obviously indicating extreme overuse of the land. And yet there is still some rent ($AP - AC$) to be taken by a marginal interloper, if there is no tenure restriction on entry onto the land.
6. At Cusp 4, there is complete "dissipation of rent": i.e., there is no rent at all, for anyone. The total product (TP) = the total cost (TC). At this point, voluntary entry will cease, even if entry is open to all comers.

Cusp 4 is an "equilibrium," but not an optimal one. Everyone has spoiled the resource for everyone else. In our original example of pumping water up from a common pool (the aquifer) it is the point where everyone's cost of lifting water has risen to equal the value of the water being pumped.

Commuting by car today in our region is approaching Cusp 4. Crowding makes driving so slow and unpleasant that some marginal drivers choose to drive less, until further crowding ceases. The equilibrium is not "optimal," but the opposite, which is called "pessimal."

7. Is there any circumstance that might cause even higher intensity of use? Yes, if all users expect that a court will adjudicate the resource in the future, and base permanent future rights on histories of use. As we have seen, this is how the legal doctrine of "Mutual Prescription" works for groundwater, and "Prior Appropriation" works for surface water.

It is also how the law creates rights to many resources, like the "right" to pollute air, or to fish a certain area.

D. Numerical example of relationships

Inputs	MP	TP	AP	MC	TC	TP-TC	Rent
x	(\$)	(\$)	(\$)	@\$1/unit	(\$)	(\$)	(\$)
1	2	2	2	1	1	2-1	1
2	5	7	3.5	1	2	7-2	5
3	5	12	4	1	3	12-3	9
4	4	16	4	1	4	16-4	12
5	3	19	3.8	1	5	19-5	14
6	2	21	3.5	1	6	21-6	15
7	1	22	3.1	1	7	22-7	15
8	.5	22.5	2.8	1	8	22.5-8	14.5
9	.2	You fill	in the	rest			

	.15						
	.1						
	0						
	-.5						

E. Likely exam questions

1. Given a schedule of AP, find MP.
(From AP, find TP; MP is the change in TP)
2. Given a schedule of MP, find AP (etc.)
3. Given a schedule of TP, find max of AP (etc.)
4. Where AP of land is max, what is MP of x (the variable input)
5. More will follow tonight and tomorrow.