



Production Economics: Variable Proportions of Inputs

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PRODUCTION ECONOMICS: VARIABLE PROPORTIONS OF INPUTS

M. Gaffney, Econ 162, F88, pp. 1-13

This is a simple list of main topics and points for you to learn in production economics for this course. This list does not cover economies of scale, which is treated separately; and it does not do as much as the text with marginal trade-offs.

The points listed here are treated at much greater length in notes on reserve, "Production Economics: variable proportions". The numbering there is the same, |1-14. Beginning with |15, the present notes insert a few new points.

INTRODUCTION. Importance of recognizing and rewarding functional effort and other contributions to production. Art of "imputation" (distinguish from "allocation"). Imputation and distribution. Functional vs. personal imputation. Imputation vs. accounting conventions. Basic functional classes: land, labor, capital. All production uses at least some of each; they have distinctive origins and supply determinants; they are not convertible into one another; they are highly interchangeable within each class; their returns are subject to common economic forces, and rise and fall together; etc.

An "enterprise" is a specific use of fixed and variable inputs to produce a specific product or product mix. Mgrl ecs focuses more on the enterprise than on the "firm", which is an ownership unit. Enterprises are managerial units. Avoid fallacy of "reifying" the firm, as text does. Stick with real things you can see and touch.

1. Diminishing returns, variable proportions. Fixed and variable factors (FF & VF). The "parameter" concept: a constant switches to a variable, and v.v., so you aren't locked into fixing one factor constant always and forever.

- a. Usually make land and durable capital the FFs, but not necessarily, always or forever. Hang loose.
- b. Symmetry of principles: let parameter become variable.
- c. Residual imputation to fixed factor: the easy way.
- d. Assume const returns to scale, in these notes, to simplify and focus on variable factor proportions.
- e. Analysis of "marginal net productivity", (last item on this list), will synthesize variable proportions and economies of scale.
- f. Universal nature of diminishing returns: "theory transcends technology".
- g. "The Product" means value-added, net of raw materials.

2. Logistic (s-shaped) production function. Relations of TP, AP, MP. Critical points on curves.

3. Given schedule of TP, AP, or MP, find the other two.

4. Geometrical interpretation: slopes and products. Relation to differential

calculus.

5. Areas representing TP; slopes representing AP and MP. Relation to integral calculus.

Areas representing gain to fixed factor. Concept of residual rent, or net product, and its history. Foretaste: later show residual rent = MP of fixed factor.

6. Elasticity of production, $\epsilon_p = P'X/X'P$ where P =Product and X =Variable Input. $E_p = MP/AP$.

E_p is the exponent of an exponential prodn fn. (but see below on why I avoid exponential prodn fns. because they lock us into assuming constant ϵ_p , and into assuming away substitution of the drastic kind that causes displacement of some factors).

7. Stages of prodn. Values of ϵ_p in 3 stages.

Divide Stage II into II,A and II,B, where II,B is subeconomic even though TP is rising.

Reasons why most prodn occurs in Stage II. Reasons why some prodn still occurs in Stages I & III (and why one input's Stage I is another input's Stage III). Cases of open access to land; property rights based on use or capture; "tragedy of the commons". Gresham's Law of Public Places and deterioration of public behavior. Dissipation of rent, maldistribution of people and capital. Cases of limited demand.

8. MP as a systems concept. MP same as MNP, and why. Assumption of interchangeability of homogeneous inputs, flexible response and optimal adjustment by manager to changes in factor inputs.

MP geometrically as a column less a stratum, as AP falls.

9. Inverse relationship of productivities of inputs A and B being combined in production. Economy of A is waste of B, and v.v. Four ways of seeing this point (see p.8 of unabridged notes).

Sum of ϵ_p s of different factor inputs in equilibrium equals one (1): otherwise firm is wrong size and can raise overall AP by adding or shedding some of all inputs. E.g. when 10% more of all inputs adds 20% to output, firm should add more of all inputs, there are increasing returns to scale.

Therefore optimize, instead of maximizing AP of just one input.

Fallacy of maximizing AP of just one input, (usually labor), ignoring cost of others. "Productivity" a buzzword leading to error and ruin (cf. #19, infra). AP of VF is max where MP of FF is zero, and v.v. You max partial productivity (that is, our AP) of one input only by wasting all others, not smart.

Beware of something called "benefit/cost ratio". It is the AP of everything included in "cost", but often owned inputs are omitted, leading to

wasting them when you max this ratio.

AP is a dull tool for dimwits. Don't be one. It's main use is for blurring issues and supporting fallacies.

10. Optimal intensity where $MP=MC$, both measured in \$ (or other common unit).

- a. Why MC is flat line due to choice of abscissa scale.
- b. Why MP must be falling at optimal point.
- c. Optimum not max MP, AP or TP except in odd cases. Explain one or more odd cases (e.g. FF has no value, is marginal).
- d. What to max: Net gain to FF (NGFF). Optimizing is maximizing NGFF. Show NGFF as area, using i) MP curve; ii) AP curve. Show mgnl gain/worker, and ave gain/worker. Show max gain/worker is not optimal.

What to equalize: MC and MP. Show this is same as max NGFF. Every maximizing procedure is also a procedure of equalizing marginal gains and marginal costs from some change.

Using AP curve, show optml intensity is where you max product of gain/worker and no. of workers. It's even easier to show it is not where AP max, because where AP curve is flat, any dW has to dP by full AP. But max NGFF is where $\%dW = -\%d(AP)$. Salt away gnrl principle of maximizing products of two variables where % changes are equal and opposite (cf calculus rule for max the product of two variables, where derivative of product = 0). [Extra brain-teasing: relate that to ep.]

Every optimizing solution involves maximizing some function, and the calculus rules usually involve equalizing some marginal % changes. Examples from geometry: Max area of rectangle of fixed perimeter; volume of cylinder of fixed surface, or torus of fixed surface. (We won't take time for this, but interested parties may get a handout on subject from me, or review your calculus.)

e. Penalties for lax mgmt that fails to max net gain to fixed inputs, (generically called "rent"). Ownership of fixed input allows slack for failure to max. rent. Non-owners make fixed cash pmts for rent, interest and property tax which remove slack, force "lean and mean" optimizing. Such pmts add a stick without removing the carrot. "Opportunity cost" of owned fixed inputs is a weaker economizing incentive than explicit cash costs, in history and practise. "Ahistorical" micro theory deludes you when it equates opportunity cost and cash cost as economizing incentives. Error is especially misleading w.r.t. land, whose hoped-for price increments offset opportunity cost of holding.

Corporate raiding as penalty for lax mgmt: pros and cons.

NOTE: ITEMS #1-10 WERE MOSTLY COVERED DURING "BASIC
WEEK OF OCTOBER 17 BEGINS HERE

TRAINING", SO

11. Optimal adjustments to scarcity and surplus, as expressed in higher and lower prices of outputs and inputs. Marginal adjustments when facts (parameters) change

a. "Intensive" margin of production. When prices rise and/or variable costs fall, intensify use of fixed input. Effect of dX (added variable input) on production depends on ep . High ep means output is sensitive to X , percentagewise.

"Intensity quotient" ($i.q.$) means ratio of variable factors (VF) to output. High ep usually means high $i.q.$ Show graphically: AP is a long, low hill in this case. High $i.q.$ means high volume, and low rent/worker.

High-volume, low margin enterprises compete with low-volume, hi-margin enterprises for the same fixed factors. The high $i.q.$ enterprises are marginal w.r.t. the lands they use (which are usually supra-marginal for some other, lower use).

An "enterprise" is a specific use of fixed and variable inputs to produce a specific product. One firm may have several enterprises, and switch from one to another. Intensification takes two forms: putting more X into each enterprise; and switching to enterprises that use more X . Uncle Ed can grow more ptoes/acre; or switch to tomatoes. Either change raises volume and $i.q.$ Purpose of change is to "realize" max potential rent.

Intensification not same as substitution, which implies a 3d input, Y , which displaces X on the fixed input. Cf. |28.

Enterprises of high $i.q.$ are always marginal on the fixed inputs, even though they may yield high rents, because a small fall of price or rise of variable cost wipes them out. Enterprises of low $i.q.$ can absorb increased variable charges; those of high $i.q.$ cannot.

Beware Fallacy of The Representative Firm, which masks vital differences among them, and among enterprises within firms.

b. "Extensive" margin of production: bring in more of fixed input, often land. Changes here at extensive margin may be small, if land is marginal because of low yields. But there is another kind of land that is marginal because of high costs. Supply response here is not incremental but quantum. Large supply impact from resources yielding little or no rent, having little market value. Examples from citrus, avocados, oil and gas. Depopulation of eastern hill lands from small price changes: example of Vermont.

c. Weight of institutional bias (with exceptions) is to subsidize extensive margin; to tax or otherwise penalize intensive margin.

d. Two kinds of effects of parameter changes: incidence and allocation.

e. Fallacy of Transplanting Technology to regions with different cost

patterns. The "Ugly American" syndrome in foreign aid programs. The "Edifice Complex" of distant lenders. "Appropriate Technology" and "Intermediate Technology" and "Soft Path" technology as solutions.

f. Fallacy of AP as a performance standard. Don't judge the salesman without looking at his territory; don't judge the professor without looking at his labs, experimental plots, and budgets; don't judge the farmer without valuing his land; don't judge the nation without looking at its territory.

g. Fallacy that "productivity determines wages". From employer's viewpoint, with wage rates given, wage rates determine productivity -- marginal productivity, that is. And AP of labor is MP/ep. Cf. |28.

12. Bias of lenders against marginal production.

Lenders shun marginal production, both intensive ("increments of low quality") and extensive. They like a cushion of equity (read slack, fat, rent, surplus, etc.) as collateral security. Borrowers can use their good collateral to cover loans to intensify marginally, but past some point are under pressure to use them instead to acquire more equity assets -- typically land -- to be improved suboptimally again.

A firm with cheaper labor will use given assets more labor-intensively; but a firm with cheaper loans will buy more fixed assets in preference to using its given assets more intensively. Here the "fixed" asset becomes a variable ("parameter" is the word for inputs that can change from fixed to variable).

"Fallacy of Partial Constraint" is exemplified in the frequent assertion that cheap credit lets one improve land more intensively with capital, ignoring that it also lets one buy more land. Or to stress that it lets one conserve energy by insulating a 5-rm house, ignoring that it also lets one move to a 7-rm house and use more energy.

Cf. |9, supra: max AP of input X implies low MP of fixed input. So avoiding low-quality increments of X means your increments of the fixed input are low quality. This is overlooked only because certain fixed inputs, notably land, are usually bought with equity, while capital is financed with mortgage credit, and labor with production credit.

Net result: an institutional bias against intensive land use, especially at the intensive margin. Moral for enterprising individuals: find ways to overcome the bias, find untapped opportunities to make money.

13. Wage rates are independent of the AP of labor; interest rates are independent of the AP per dollar of capital. These factors are highly mobile, and interchangeable within each class: "arbitrage" equates their returns everywhere. Factors that cannot move around or change form or use receive "rents" which start at zero and rise without limit.

Common interest rate means that money is pretty much alike, whatever the lender. Common wage rate does not mean that workers are alike; but those who are alike make same wage rate. There is a "structure" of wage and salary rates that rises and falls as a structure, with relative positions maintained. There

is also a structure of interest rates charged, but it is based on differences in borrower collateral, not in the money loaned.

Rising population and increased capital formation, with fixed land resources, pushes up land rents and values. The pressure so created causes invasion of extensive frontiers, highly capital-using, soaking up limited capital supplies, raising interest rates, and halting the process. It has often been a boom-and-bust cycle, which managers should observe and beware, avoiding traps for the unwary.

14. Distributive "exhaustion" of the total product.

a. Residual imputation of rent to fixed factor.

b. Euler's Theorem, residual return is same as MP of fixed input, provided we have const returns to scale.

$$P'/W' \times W + P'/L' \times L = P$$

Divide both sides by P. Eqn now says the sum of the eps = 1. That in turn says we have const returns to scale. That's Euler.

So residual imputation of rent to fixed factor, and direct imputation of its MP to fixed factor, are the same. No conflict. It's like discovering that God created Evolution: dispute resolved.

Euler also means P is "exhausted" when you cut the pie by paying each factor its MP. All can be paid; nothing is left over. "Distribution follows Imputation", and it all works out.

c. Net product approach: make the fixed factor a continuously varying parameter, pencil out associated costs and products for various sizes of the enterprise. Optimal size is where net product per unit of the parameter input is max. In land markets, when moving to optimal scale from the left, increase in value/acre is called "plottage"; moving from right, increase is called "negative plottage".

Net product approach is both simple and complete and is the best way to analyze variable proportions and economies of scale jointly, showing their relationships.

This approach seems elusive to some students, but it is only the lingo that throws you. Instead of "net product", try saying "cash flow", or "net income", both of which are net product concepts. (Income is cash flow less depreciation.) Now let cash flow rise, and you have marginal net product? Simple? They are verbal tools for grasping, comprehending and handling all variables in one grand conspectus. You need that as a navigator needs a globe and compass.

15. The equimarginal principle for economical allocation.

Take from surpluses to meet shortages. Equate MPs, not APs.
Reward: a free lunch. TITSTAAFL for TANSTAAFL.

16. Fallacy of Prorating. Mgrs on economy drives may cut back every enterprise, division or dept by x% of some input, or total budget. Cartels that restrict output routinely cut back all members by x% of some basis; or to operate their fixed input just y days/mo.

Results are not "equimarginal"; and usually have strong bias toward substituting land and capital for labor. Cartels force all sellers to carry excess capacity, which screens out lean firms w/o regard to their true efficiency.

17. Fallacy of routine pass-through of higher costs and taxes.

a. Prices are determined by supply and demand. costs are only passed through if they cut supply, and demand is inelastic. Look at effect on marginal production, (intensive and extensive). Low ep means there is little marginal production.

Higher fixed costs may spare mgnl prodn completely, but force better use of fixed inputs, raise prodn and lower price.

Higher variable costs abort only mgnl prodn, and where ep is low there is little of that. Ep is low where rent/worker is high, and here "royalties" based on units of production, and "share-cropping" contracts are common, their convenience and risk-sharing advantages outweighing their incentive-twisting effects.

Here is where unions can raise wage rates. Low ep means a steep MP curve; MP is demand curve for workers; steep curve means inelastic demand. Employers with low ep may actually favor unions, which hurt their marginal competitors much more than themselves.

Here also is where consumers can capture some rent, by getting legislatures to impose max price controls. Examples: oil and gas; rents in Sta. Monica and N.Y. City.

b. Fallacy of routine pass-through due to inelastic demand. Where prices are determined in world or national markets, large local supply changes hardly affect prices at all.

c. Fallacy of routine supply cuts after personal failure. When prices fall, recent investors on thin equity may suffer personal bankruptcy, but the creditors keep the resources producing to minimize their losses.

d. Fallacy of representing all sellers as marginal. No one wants tax-hungry legislators to perceive slack or fat in their part of the private sector, so it is their interest to present a public image of marginality -- the opposite of their image for bankers and stock buyers. Their rhetoric is thus understandable, but don't make bad judgments and lose your own money by believing it.

e. The "cushion of rent" concept. Rent is what absorbs losses and enjoys gains without changing supply of an input. Examples: effects of Prop 13; incidence of fees on builders; Alaska severance tax; N.D. severance tax; etc.

18. Bias of share contracts on factor proportions.

"Share-cropping" and analogous share contracts in many businesses have landlord share in the product, but not the costs. Two wastes result. a) Tenant applies variable inputs to higher (less intensive) margin; b) Tenant rents more land, until its marginal product equals zero to him, because he pays nothing for land as such.

Taxes and royalties based on gross sales have similar effects, usually at lower rates

19. Is efficiency uneconomical? Is economizing inefficient?

We have stressed the folly and fallacy of maximizing AP of VF. Optimizing is maximizing AP of the sum of VF and FF, for total efficiency.

AP of labor is often loosely called "productivity" and equated with "efficiency". Interfirm comparisons by these measures are common, and fallacious, and harmfully misleading. AP is partial efficiency of one input alone, and is maximized only by wasting other inputs. Physical efficiency (e.g. energy-efficiency) is not an economic performance standard.

Every input has its zealous champion who would economize only on it, or produce only it, and measure performance accordingly. Some value only labor, others energy, foreign exchange, food, fine arts, fishing, the environment, speed, highways, you name it: there's a freak for everything. A good mgr recognizes their fallacy of single-factor efficiency, and holds these fundamentalists in check and reconciles their demands not with simple-minded personal compromises, but with good economic analysis.

Goal is total efficiency. This is same as max net product of fixed input, aka rent. To see this as a ratio, like efficiency, add full cost of fixed input (G) to cost of variable input (W), max $P/(G+W)$. Show graphically and algebraically.

Fallacy of maximizing "return on sales", or taking same as a performance standard. Is same as max AP of variable inputs, ignoring value of fixed inputs.

20. Fallacy of understating true capacity of fixed input to yield rent.

As G approaches zero in $P/(G+W)$, ratio approaches P/W . Then max P/W looks like max efficiency. Managers do that routinely, to make themselves look better -- a Fallacy of Arrogation, meaning they are arrogating to their credit the output properly imputable to the fixed input. Carrying land at historical cost. Ignoring associated costs, complementary costs, allocated overhead, etc.

21. Fallacy and folly of setting naive records

... like max sales, gross output, budgets, height of building, speed of travel, size of office, area of spread, cost of facing, full use of damsites, perfection of flood control, output of forests and mines (low-grading), assets of firm or bureau, etc. All those involve ignoring MC in Stage II, B.

Costs most often overlooked are imputed interest and rent on owned assets. Overacquisition of land caused by Malthusian apprehensions, guarding against anticipated monopoly, storing up for future needs, holding for the rise, securing boundaries, avoiding sales to hide market values from tax assessor, sharecropping, inflating rate base of utilities, etc.

Fallacy of internalizing company profits, claiming they are not profits but current expenses when reinvested in the firm. Capital thus captured by firm's management often gets beyond its capacity to manage productively.

22. Marginal productivity and social justice in distribution

Imputing returns to an input is different from determining who owns it and gets that slice of the pie. Defenders of private property have pushed the marginal productivity theory of imputation, and radicals have opposed it, both under the illusion that it justified private property in land and capital. But the theory only says that these are productive -- not who should own them, which is a separate issue. "Unearned income" remains unearned when the owner acquired resources wrongly or unjustly.

How to share rent surpluses is a constant preoccupation of politics. Politics is found within firms as well as within and among governments. Good policy finds ways to share or distribute rent without dissipating it and without distorting allocation of rentable resources.

23. Factoral imputation as a management tool

Factoral or functional imputation differs from personal distribution, it is objective and independent of ownership. Functional analysis is to enhance personal welfare. It tells mgrs how much you can pay, for how much of an input. It guides managers in adapting resource uses to changing costs, prices, taxes, interest rates and rents. Put each resource where its MNP is highest; MNP and residual rent are equal. Add inputs in just the amt that equates MNP with MC. Use MC as a performance standard, holding and acquiring no inputs that do not repay their MC.

24. Functional analysis and accounting

Traditional accounting looks to the past, and to ownership. It is for lawyers and coupon-clippers. Functional analysis looks to the future and to aiding decisions about resource use. It is for managers.

25. Who opposes marginal productivity theory, and why?

Theory may be understood better by understanding sources of opposition. Whom does it threaten? Marginal analysis threatens all who gain by the Fallacy of Arrogation, i.e. imputing to one's-self the product of someone else's effort or saving.

a) The extreme left, who believe that "labor produces all value". This now includes workers in fat industries, where ep is low, who would like to claim their AP. The moderate left, who believe that production is cooperative and it is impossible, destructive of cooperative spirit, and hyperindividualistic to impute specific amounts of production to specific

inputs.

b) Recipients of rents, who seek to blend in with productive management and/or savers who create capital, and take credit as managers for high AP of labor. Their position is mixed, because they supported MP theory originally to make themselves seem productive rather than "residual".

c) Anti-rationalists who find it hard to follow analysis.

These groups jointly form The Omelette School, so-called because the slogan is "you can't unscramble an omelette".

26. Marginal changes vs. quantum leaps

We have seen that high-volume land uses (intensive, high i.q. and high ep) compete for land with low-volume land uses (extensive, low i.q. and low ep) where the low-volume uses yield high rents/worker. The high-volume uses are marginal in those areas, so a small drop in prices relative to variable costs wipes out their rents. Here, adjustments to price changes are not minor marginal changes, but quantum changes in use. Avoid Fallacy of Petty Incrementalism which considers only minor nibbling at fringes of existing uses, overlooks major changes in uses. Fallacy of Petty Incrementalism vastly understates supply responses to price and cost changes.

27. Fallacy of fixed proportions

The Fallacy: Inputs are always combined in fixed proportions, like chemical valences, for technological or natural reasons. This belief arises from the same mindset that makes demand and supply curves inelastic, and the price mechanism generally irrelevant and delusive. People who adapt to current prices and costs are accused of abandoning proper "standards", "requirements", "duties", etc. Professional associations (doctors, engineers, labor unions, etc.) are notorious for insisting on rigid standards regardless of cost or demonstrated need.

The Charls Walker Fallacy: national income bears a fixed relation to energy consumption. (Walker is a lobbyist for the energy industry.) Time has disproven the assertion.

Measuring capital in value terms, a new auto provides capital-intensive transportation; as it ages and requires more maintenance and upkeep and operating care it provides labor-intensive transportation. Ditto for houses and shelter, and if the location rises in value it becomes land-intensive shelter. All this from the same sticks and stones, over time.

Water in California yields high returns or low, depending on the crop to which applied: high for tomatoes, low for rice. There is no fixed output per unit.

"Scarcity breeds substitution" is universal. A good manager works with the cheapest suitable inputs suitable to meet demands. History and practise show economic man is flexible and imaginative in adapting over wide ranges. Dimwits say things like "It takes \$60,000 of capital to make one job", but assets/worker range from \$5,000 (Singer, Mattel) up to \$700,000 (Chevron).

28. Substitution as an eternal triangle

Substituting A for B implies the presence of C: A occupies C and displaces B. It's the eternal triangle of economics. This is not a case where "Three's Company".

Our text (like most others) is faulty and misleading (pp. 189-90) to say its example shows "substitutability" between K and L. K would truly substitute for L only if it lowered the MP of L, but in the example, adding K raises the MP of L. That would in fact cause more L to be hired, and the firm to expand.

Here are examples of true substitution. Farm machinery displaces labor by bumping it off the land; so does capital in other forms like sheep, cattle, timber. So may other natural resources used in fuel, fertilizer, pesticides and water supplies.

Many of these substitutes, in practise, actually lower yields/acre. Such an input is "preemptive". It is nice for lazy landholders who want to cut down their management input: labor is hard to manage. But they are Hell on displaced workers.

The productivity of a substituting input is measured in the cost of what it displaces/replaces, less any decline of P, and plus any rise.

Cobb-Douglas production function is faulty because it contains built-in, unspoken presumption of complementarity between capital and labor; more K always raises MP of labor, as in text's pp. 189-90.

Capital is "Protean", it takes many forms, and changes form each time it turns over and readapts. Some capital substitutes for land and uses labor: e.g. tall buildings, fork-lifts, tomato vines, land-fills, fertilizer, narrow-band broadcasting equipment, theatres, etc. Land generally complements (makes opportunities for) labor, and substitutes for (obviates) capital. Developing marginal land is capital-using.

Fallacy that "productivity determines wages", reprise. Subbing K for workers raises their AP but lowers their MP (lowers ep). Cf. |11,e. If subbing is widespread this drives down wage rate.

29. Capital as the manager's independent variable

Managers often see their range of control in terms of capital to invest. Here it is customary to express both the product and the cost in percentage terms: the cost is the interest rate; the product is the rate of return. This is a superior and more comprehensive and sophisticated procedure than treating labor as X, as we have done so far. But it becomes superior only by forcing us to learn to calculate and understand rates of return, which is why we return to learn more about "time value" calculations in Week #7.

Diminishing returns to capital investment implies that the manager does not control all inputs: some input is still fixed, otherwise managers could add capital and land and labor indefinitely. The ultimate limit is diseconomies of scale, our last topic.

30. Net product, complementation and economies of scale

To analyze economies of scale, let the fixed factor vary. Land being the most fixed factor, make it X. For every size of holding, model the best use for that size. Expanding from 10 acres to 11 there will be added revenues (dR) and added complementary costs (dCC). The excess of dR over dCC is the Marginal Net Product (MNP) of land.

Economies of scale are generally found in capital inputs: a large building costs less/sq.ft. than a smaller one. So as your land expansion permits larger capital units you get lower CC/acre: you "spread the overhead" of large units over more land, and more output.

Diseconomies of scale (itemized in next set of notes) set in when this advantage peters out, and added land stops yielding much added revenue. Optimal scale is where Average Net Product (ANP) is max.

Show this graphically and in numerical examples. Why is max ANP optimal, when max AP is not? Because ANP is comprehensive; AP is partial.