

## Margins, Quantum Leaps, and Ecotones

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### 1. Intensive margin of production

When prices rise, or costs fall, it opens a wider gap between MP (which we measure in \$, remember) and MC; and moves their intersection to the right. The manager adjusts by intensifying the use of the fixed factor. He puts on higher buildings; more trees/acre; more workers/shift, and more shifts; more oil wells per section; more fertilizer and pesticide per acre; and so on.

Intensification is the general word for what happens. Some economists call that "substitution" of labor (or whatever variable input) for land, but that is confusing, since the land remains in use. In fact, even more is brought in at the extensive margin (see below). "Substitution" is better reserved for cases where a third input displaces one of the first two, as for example when farm machines displace farm labor, or cattle or trees do the same, actually taking the land away from them. See paper on "Substitution."

The percentage effect of intensification on output depends on MP/AP, or epsilon ( $\epsilon$ ) (elasticity of production). For marginal firms (including firms on good land who are using it in a higher use than their neighbors)  $\epsilon$  approaches one, and the percentage increase in output approaches the percentage increase in variable input. For their opposite numbers it is just the other way.  $\epsilon$  may be low, say 20%, and the curve of MP dropping steeply. In such cases there is little change in output (as a fraction of total output).

However, every camel's back may break with some last straw, and some pressures are enough to induce some land managers to break radically with the past and shift from being supramarginal or low-cost producers in industry A to being marginal or high-cost producers in industry B, representing a higher use of the land.

Beware the *Fallacy of the Representative Firm*. All firms are different, and all resources are different. Beware and eschew equally the fallacy of treating "the firm" as owner of a mass of undifferentiated or interchangeable assets. Firms hold all kinds of resources, and they will or should treat each one appropriately to its circumstances; they will if the managers are smart, honest, and motivated. We focus here on the traditional model of land management to keep the focus on the resources, rather than the firms as such. (A weakness of ordinary neo-classical theory, centered on "the firm" as the basic unit, is to overlook resources as specific, differentiated objects for economizing.)

### 2. Extensive margin of production

There has always been an extensive margin of production, and probably always will be. It is the margin at which land yields no net product above the costs of using it. Land outside or "below" the margin is not incapable of use: rather, the costs of use exceed the gross products. The margins are progressively extended with pressures from increased population, demands, and technological advances, but with important exceptions. There are abandoned lands in Vermont today which supported a heavy population of Green Mountain Boys in 1770, for example - so many that they won the Battles of Bennington and Saratoga in the Revolutionary War. They

could support people again today if required (except now they are locked up by absentee owners with vague plans). I have walked through the remains of their homes. The eastern states are full of such abandoned lands, farms and towns. Some of your ancestors probably came from one of them, as mine did. You also see them in parts of the west: ghost towns, dead groves and vineyards, etc.

Changes at the extensive margin are more radical and less incremental. Extensive margins go in and out of production in quantum leaps as demands for land rise and fall. Only land has an extensive margin because only land is provided to man without cost, unlike labor and capital, which can move around and must be paid.<sup>1</sup> Not only can they move: labor must eat and reproduce; capital must be maintained and reproduced.

When marginal land comes in, the MP/AP of the variable inputs equals one. Thus there may be a large supply increment from a resource base which is just barely economical to develop and use, and yesterday was worthless. Could this be why avocados were a drug on the market in 1980? Could this be why so few investors saw the bust coming? It could be, and it was. To that you may add most of California's capital-using specialty fruits and nuts.

The weight of institutional bias is, uneconomically, to penalize and suppress the full use of better lands, while subsidizing the development of marginal lands. California farm marketing orders force production cutbacks or crop diversions on the low-cost producers, while we subsidize water supply to new producers. This is not an aberration but a long-standing and ongoing set of policies: crazy, but all-American and, to a growing extent, all-world. The same pattern obtains in most cartelized industries, and most governments which regulate them.

### 3. Marginal changes vs. quantum leaps

An increase in the cost of the variable input -- in our model that is the wage rate -- reduces, as we have seen, the optimal input of work. Thus it nibbles at the fringes of intensity of land use. Such nibbling is the "marginal adjustment", and it is often viewed as small and gradualistic. But it can also cause radical changes of land use.

Many lands are in close competition among uses whose intensities are very different even though the net gains to land are much the same. Berries may compete with barley for certain lands. The berries use high volumes of labor and there is a small net gain made on each worker. Barley uses low volumes of labor with a high net gain on each one. Labor might be 90% of cost growing berries, and 40% growing barley.

Let wage rates rise by 11% and the rent from berries is reduced by 100%, wiped out. But the rent from barley is barely touched. The result is a quantum change: barley replaces berries.

Some economists get locked into narrowing their vision to the nibbling kinds of adjustments and never see the big ones. They are in thrall to the *Fallacy of Petty Incrementalism* (q.v.). This Fallacy bids us consider only minor nibbling at fringes of existing uses. It has us overlook major changes in uses, quantum leaps of all kinds.

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<sup>1</sup>except in circumstances so exceptional they are not worth discussing.

Such myopic thinking can easily lead us to a low local max on the shoulder of a peak: a "molehill on a mountainside." It is an error promulgated by the generally estimable Alfred Marshall, whose motto was *Natura non facit saltum* (nature makes no leap). In fact, nature does leap (mutations, eruptions, extinctions, ice ages), and so do mankind, society, and the economy. It was, rather, Marshall who made no leaps - he was a cautious fellow. (Marshall also takes the blame for the "Representative Firm" fallacy" mentioned above.)

We have seen that high-volume land uses (intensive, with high elasticity of production) compete for land with low-volume land uses (extensive, with low elasticity of production) where the low-volume uses yield high rents/worker. The high-volume uses are marginal in those areas (called "ecotones") where sharply different land uses compete for the same land. A small drop in prices, or rise in variable costs, wipes out their rents. Conversely, a small rise in price or drop in variable costs multiplies their net rents and causes them to expand fast. Here, adjustments to price changes are not minor marginal changes, but quantum changes in use.

Again, in urban growth there often comes a need to replace a collection of individual systems with one large system, e.g. a mass of septic tanks with a sewer system, or a gaggle of private cars by mass transit. Just prior to the last, improving traffic control is rearranging deck chairs on the Titanic.

The *Fallacy of Petty Incrementalism* vastly understates supply responses to price and cost changes. A current petty incrementalist in California is a certain Prof. at UC Davis, who studies the economy of water use and declares that farmers cannot lower their water use by more than 2% without basic changes (which he presumes to be unthinkable). He will consider only incremental changes in operating current systems with current crops, overlooking possibilities of shifting from alfalfa, rice, and irrigated pasture (high water use, low value) to berries, vines, and orchards (low water use, high value); from primitive flood and furrow irrigation to drip irrigation; from bad lands to good lands; etc.

He overlooks the remarkable fact that you can often produce more value per acre, and employ more workers, with less water per acre. This is because water applied to land often substitutes for labor. The landowner, in such cases, measures the productiveness of water in lower costs per acre, rather than higher yields. The same is often true of energy.

Actually a modest price charged for water would wipe out half the use of water for irrigated pasture, alfalfa, and rice, and release the water and the land for higher uses. These are quantum leaps. Remarkably, it might well raise farm production in the state, since the competing crops use less water per acre with more capital and labor per acre to produce higher dollar yields ("yield" means not just output, but output/acre). See paper on "Substitution."