Prof. Tybout

Economics 404W
Lecture 10
February 7, 2006

Note: Writing assignment posted; see writing hints linked to course site
Background reading: Ross-Larsen, pp. 1-39

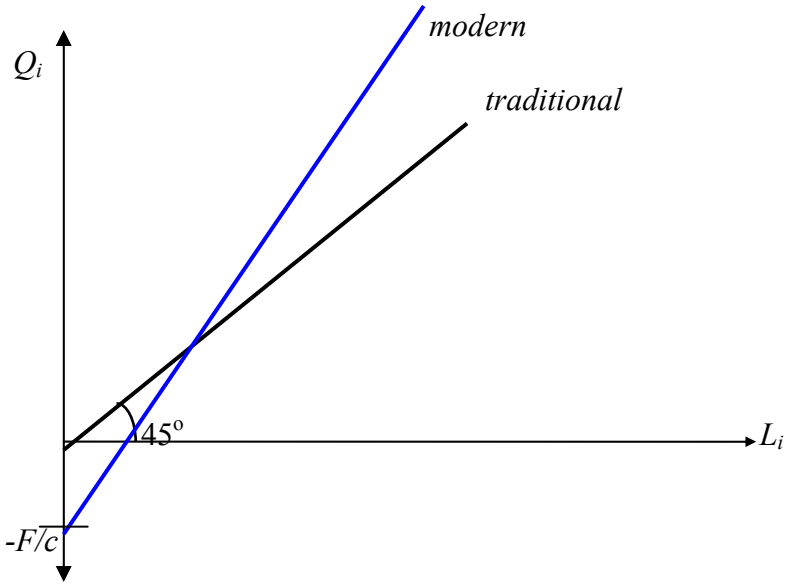
2. Market Size Externalities: Rosenstein-Rodan and Murphy et al

Rosenstein-Rodan emphasized a special kind of (pecuniary) externality. Efficient modern sector production involves significant, lumpy capital investments. A modern factory can only be built so small and still be efficient. The fixed capital costs associated with building a factory must be spread over a large volume of production if factories are to be more profitable than traditional cottage techniques. So, unless there is large demand for output—that is, unless *other* efficient producers are generating lots of income—it doesn't pay to go modern.

Murphy, Schleifer and Vishny (1989) restated Rosenstein-Rodan's arguments in terms of a simple mathematical model, and Krugman (1992) made the exposition even simpler with a graph.

Technology

Let the total labor requirement of a modern factory that produces Q_i units of good i be given by: $L_i = F + cQ_i$, where F represents the fixed costs of setting up the factory (measured in terms of units of labor) and $c<1$ is the marginal labor requirement of producing each unit the good. In contrast, let the labor requirements of a traditional producer be simply one unit of labor per unit of output. These assumptions guarantee that the cottage producer will be more efficient for small output levels, and the modern factory producer will be more efficient for large output levels:



Consumer behavior

Also, assume that demand for each good is isoelastic, so that the amount consumers spend on each good is independent of price, and when income goes up, spending on all goods goes up proportionately.

aside: Those who know calculus should be able to prove that these assumptions follow from the Cobb-Douglas utility function $U = \prod_{i=1}^{N} q_i^{\gamma}$, given the budget constraint $Y = \sum_{i=1}^{N} p_i q_i$, where there are N goods produced and p_i is the price of the i^{th} good.

Pricing behavior

Each good is produced either by competitive cottage shops, or by a single modern sector monopolist, depending upon which type of production is cheaper. (Economies of scale ensure that only one modern sector producer will survive in each industry.)

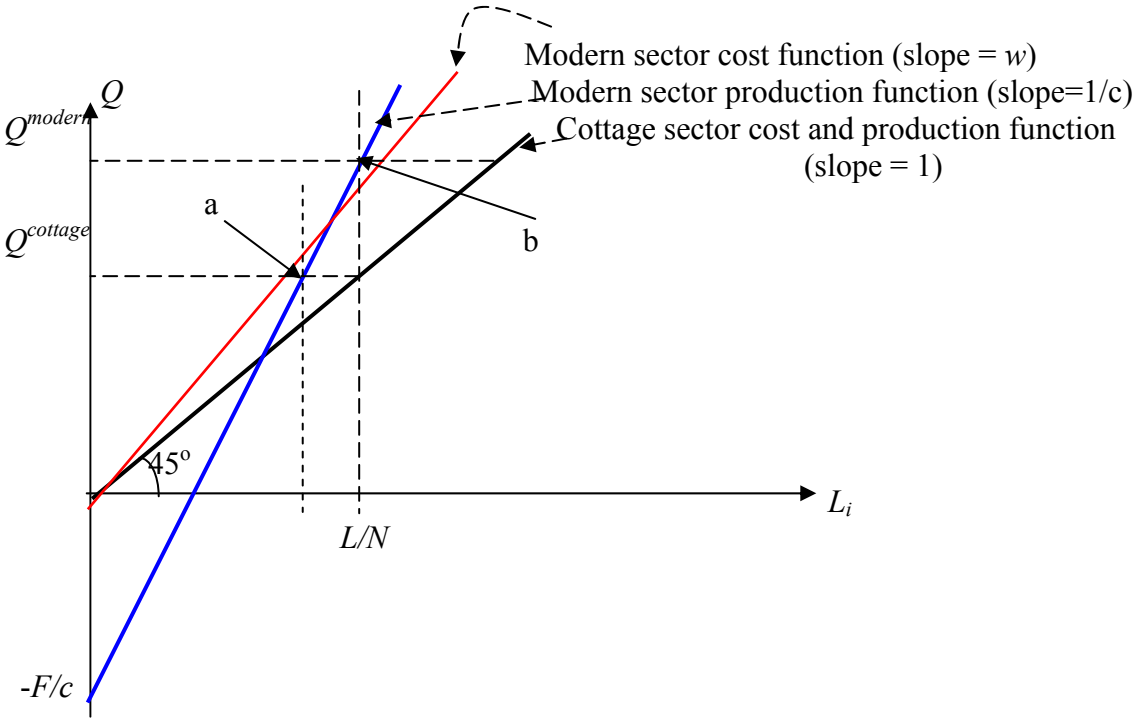
The cottage shops price competitively at average (and marginal) cost, so if the unit price of cottage labor is $1, the price of all goods produced using traditional techniques is 1.

Modern factories cannot price above 1 because they would be undercut by cottage producers if they did. Also being monopolists, they have no incentive to price below 1. (Reducing price below 1 and increasing quantity leaves revenue unaffected, but increases cost.) So the price of *all* goods will be 1 and we can ignore prices hereafter.

Equilibrium

Will production take place in the traditional or the modern sector? This depends upon the level of demand, which in turn depends upon income, which in turn depends upon output per worker, which in turn depends upon whether production is modern or traditional. It turns out that multiple equilibria are possible.

The figure below (from Krugman 1992) shows output from each type of producer at each level of labor input for a representative industry. Tastes are symmetric and all goods have the same price, so the same amount of each good will be demanded. If the total labor force is L, and all sectors use the same technology, each industry will use L/N.



Modern Sector production point

When all other producers use cottage technology	*When all other producers use modern technology*
point a (hence losses)	point b (hence profits)

When all producers are traditional, each produces $Q^{cottage}$, and total income is $NQ^{cottage}$. Similarly when all producers are modern, each produces Q^{modern} and total income is NQ^{modern}. So when the labor force is sufficiently large, markets are big enough that modern production yields more.

But modern production may not always prevail when it yields higher income. Suppose workers require that they be paid at least $w >$ \$1 if they are to tolerate working in a factory rather than in the more pleasant cottage environment. (Total production costs for a modern sector producer are then given by the ray from the origin with slope w .) Then it may be that when all producers are traditional no modern producer wishes to enter. That is, at income level $NQ^{cottage}$, a modern producer would expect to only sell $Q^{cottage}$, and would be unable to cover the costs (point a). Only traditional producers could profitably operate.

On the other hand, if all sectors modernize at once, total income is NQ^{modern} and each modern producer can sell Q^{modern}. At this output level, modern production is cheaper. Further, workers are more than compensated for the loss of the pleasant cottage environment (i.e., $wL/N < Q^{modern}$), so welfare is higher.

The moral of the story is that low-level subsistence can be a non-cooperative equilibria. To break out and begin intensive growth, a "big push" is required. What form might it take? How might free trade alter the model's implications?

Things to note

- Whether a big push will work or not depends upon country size (L), the fixed costs of creating factories (F), and the factory wage (w).

- This model *doesn't* say that history condemns a country to subsistence. If there are no frictions (i.e., the pay-off to switching over is immediate, and rapid adjustment isn't costly), it's simply a matter of expectations.

- Savings isn't the issue here, nor is factor quality. It's all about efficiency—what we've called A in the aggregate production functions.

- This isn't really a growth model because there are no dynamics to it. Its an explanation for why some countries remained stuck in the "extensive growth" stage where output per worker is not expanding and most production takes place in the household with traditional techniques.