

EXTERNAL ECONOMIES AND UNEVEN DEVELOPMENT

A. A RICARDIAN MODEL.

Consider two sectors, food and manufacturing, and two regions, Catalonia and Andalusia. Variables corresponding to Andalusia will be denoted by an asterisk (“*”). The sizes of the labor force are identical in both regions: $L=L^*$. The unit labor requirements in food and manufacturing are:

Food	l	l
Manufacturing	l/A	l/A^*
	Catalonia	Andalusia

Remember that the unit labor requirements are the inverse of the labor productivities. The manufacturing productivities in Catalonia and Andalusia are therefore A y A^* . We assume that initially manufacturing productivity in Catalonia is slightly higher than in Andalusia: $A > A^*$.

The supply of food relative to the supply of manufactures is given in **Figure 1**. Although we do not give an exact functional form for relative demand, we suppose that consumers have a stronger preference for manufactured goods than for food.¹ This implies that the relative demand curve is located toward the left in **Figure 1**, implying that relative demand crosses relative supply in the horizontal portion where Andalusia produces both goods and Catalonia produces only manufactured goods.² In that case the price of food relative to the price of manufactured goods is $P_F/P_M=A^*$.

We now determine the wage levels in both regions. Given that the price of manufactured goods has to be equal to its marginal cost ($P_M=w/A$), the wage level in Catalonia is $w=P_MA$. Since workers are mobile across sectors, wages in Andalusia are equal in both sectors, so that $w^*=P_MA^*=P_F$. Wages in Catalonia relative to wages in Andalusia are therefore $w/w^*=A/A^*$. Since productivity in Catalonia is only slightly higher than in Andalusia, the regional wage difference is very small, so that both regions are at similar levels of development. In the next section we will see how this slight advantage of Catalonia gets reinforced over time, leading to a process of uneven development between both regions.

¹ This makes sense in developed countries, where consumers spend most of their income on consumer goods, and not on food.

² Earlier in this class we mentioned that the case of partial specialization (one of the countries or regions continues to produce both goods) occurs when countries or regions are very different in size. However, incomplete specialization can also be due to a particularly strong preference for one of the two goods.

B. DYNAMIC EXTERNAL ECONOMIES.

We assume that as a region gains experience in the production of manufactured goods, its productivity increases. In other words, the manufacturing sector is subject to a region-specific learning curve (**Figure 2**). Manufacturing productivity depends on the cumulative production in a given region, and productivity gains affect all workers of that region. We therefore talk about *external economies*, rather than *internal economies*. We assume that these external economies only exist in the manufacturing sector; productivity in the food sector is constant.

Since all of the Catalan labor force is employed in manufacturing, whereas only a small part of the Andalusian labor force, learning is faster in Catalonia than in Andalusia. Over time the difference between A and A^* becomes increasingly larger,³ and Catalan wages relative to Andalusian wages keep increasing: $w/w^* = A/A^*$. Our economy has entered into a spiral of uneven development, where the difference between both regions becomes increasingly larger (**Figure 3**). If the technological difference between both regions becomes sufficiently big, at some point Catalonia will be able to produce *all* of the manufacturing demand. (*This can easily be seen by redrawing the relative supply – relative demand diagram.*) In that case both regions become fully specialized: Andalusia in food and Catalonia in manufactured goods.

C. TECHNOLOGICAL CHANGE.

We now introduce technological change in our economy: a new process for producing manufactured goods is invented. This new technology is superior to the old one: for any level of experience, the productivity of the new technology is larger than the productivity of the old technology (**Figure 4**). Neither of the two regions has any experience with this innovation, so that the new technology has the same productivity A_0' in both regions. The unit labor requirements in food and manufacturing are now:

Food	1	1
Manufacturing	$Min(1/A, 1/A_0')$	$Min(1/A^*, 1/A_0')$
	Catalonia	Andalusia

In manufacturing each region chooses the technology with the highest productivity. Assume the experience Catalonia has accumulated in the old technology is such that it does not benefit from adopting the new technology ($A > A_0'$), whereas in Andalusia the new technology is superior to the old one ($A_0' > A^*$). Although Catalonia continues to have a comparative advantage in manufacturing, it is possible that Andalusia will start producing some manufactured goods. This happens if the difference between A y A_0' is not too big. (*Again, this can easily be seen by re-drawing the relative supply – relative demand diagram.*) In that case Andalusia produces both food and manufactured goods (using the new technology), whereas Catalonia produces only manufactures (using the old technology).

³To obtain this result, we need to assume that the learning curve is not too concave.

Andalusia now starts to gain experience in the new technology, leading it to move up the new technology's learning curve. In Catalonia, on the contrary, productivity hardly increases, because most learning in the old technology has already been exhausted. (Catalonia is in the flat part of the old technology's learning curve in **Figure 4**). At some point productivity in Andalusia overtakes productivity in Catalonia. This leads to dramatic changes: (a) the pattern of specializes – and comparative advantage – reverses: Andalusia becomes completely specialized in manufactured goods, and Catalonia starts producing food; and (b) Andalusian wages rise above Catalan wages. The poor region has become rich, and the rich region has become poor.

We can therefore conclude the following:

- Technological change can affect the patterns of specialization and have an important impact on regional growth and development. For instance, since the first industrial revolution until the 1950s the so-called heavy industries made many regions in Europe and the U.S. very wealthy: this was the case of the Basque Country in Spain, the North of France, the South of Belgium, the U.S. Midwest. However, technological change in the last 40 years have led to the decline of many of these industries, turning these “manufacturing belts” into “rust belts”.
- Being less developed, and having lower salaries, may be an advantage to attract new technologies.

It is of course not always the case that regions with low salaries gain from technological change. There are many examples of new technologies locating in high wage regions. Silicon Valley – the area between San Francisco and San Jose in Northern California – is a case in point. Traditionally specialized in the production of semiconductors, Silicon Valley has been able to attract many new internet businesses in spite of its high wages. The key reason has been the presence of a well-trained labor force with the right skills. In other words, Silicon Valley was more productive than other regions with lower wages because of the experience and the training of its engineers. This example suggests that the productivity of a new technology (in this case, the internet) need not be the same in all regions.

Let's now see how this possibility could change the results of our model. Suppose the experience Catalonia has accumulated in the old technology makes Catalonia more productive than Andalusia in the new technology: $A_0' > A_0'^*$. This would tend to happen if both technologies are relatively similar (i.e., having experience in the old technology helps you in the new technology). Assume, moreover, that in Catalonia the new technology is more productive than the old technology: $A_0' > A$. In that case the unit labor requirements are:

Food	I	I
Manufacturing	I/A_0'	$I/A_0'^*$
	Catalonia	Andalusia

We are now in the same situation as in *Section A*. Wages in Catalonia continue to be higher than in Andalusia, so that technological change has reconfirmed the dominant position of Catalonia.

This leads to the following conclusions:

- If the old and the new technologies are similar, it is possible that the advanced region adopts the new technology in spite of its higher wages. In that case the advanced region remains in the lead.
- If not, it is likely that the new technology locates where wages are lower, thus giving the backward region a chance to take off and develop.

Referencias

Brezis, E.S., Krugman, P.R. and Tsiddon, D. (1993), "Leapfrogging in International Competition: A Theory of Cycles in National Technological Leadership", *American Economic Review*, 83, 1211-1219.

Desmet, K. (1999), "A Simple Dynamic Model of Uneven Development and Overtaking," *Economic Series 11*, Working Paper 99-21, Universidad Carlos III de Madrid.

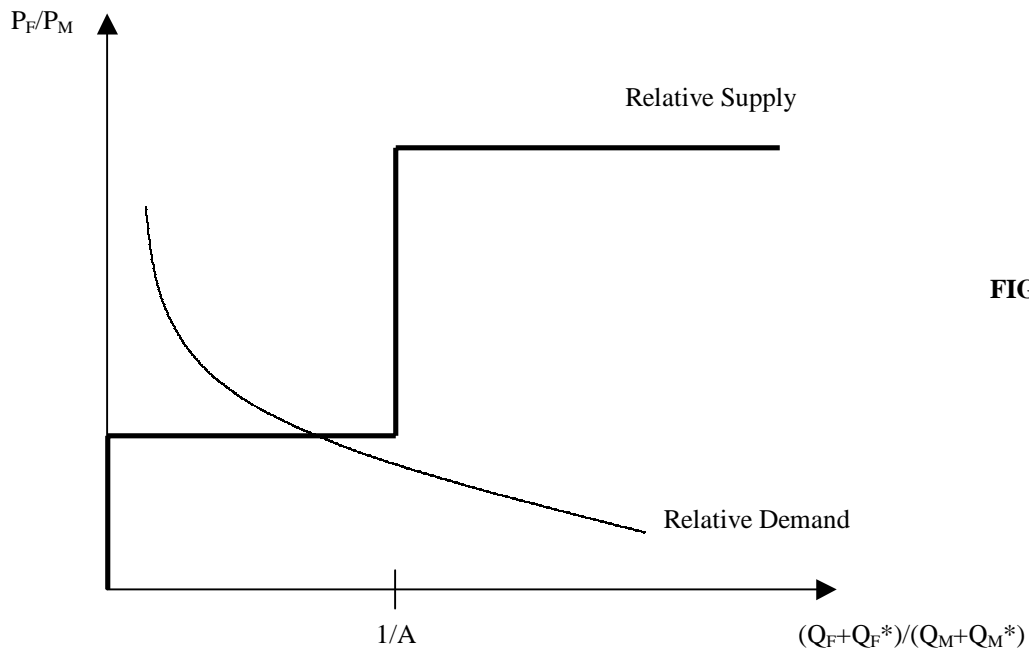


FIGURE 1

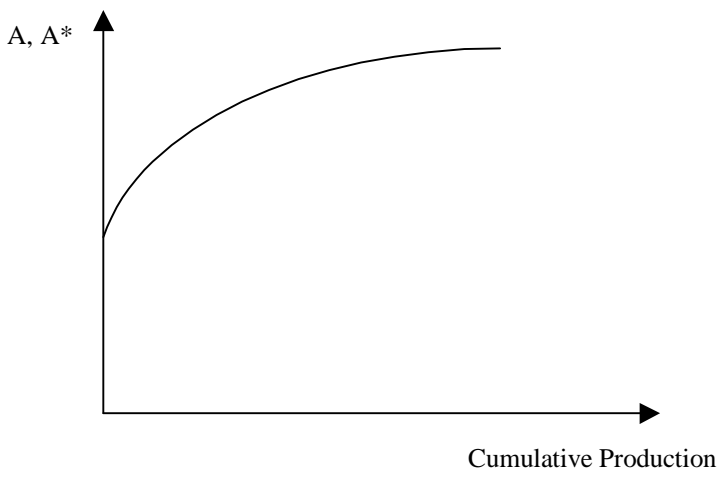


FIGURE 2

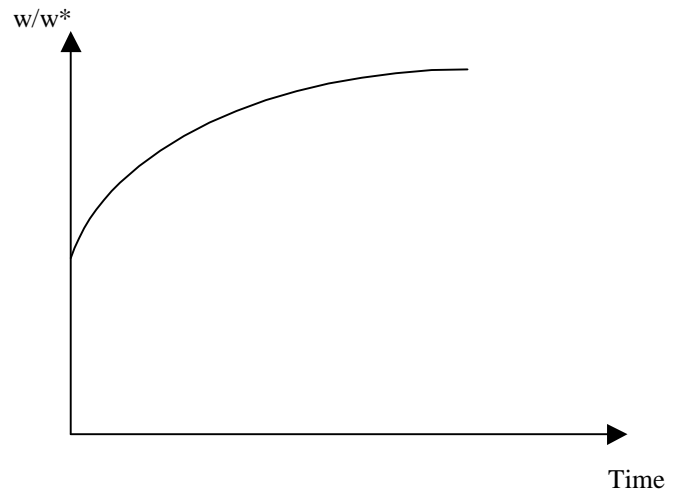


FIGURE 3

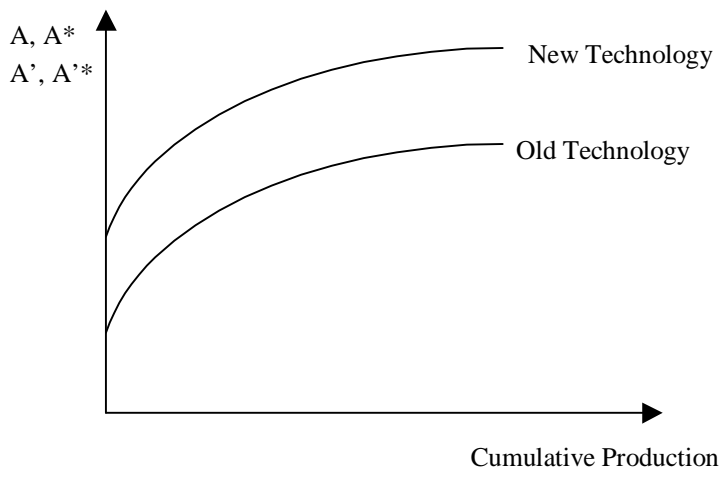


FIGURE 4