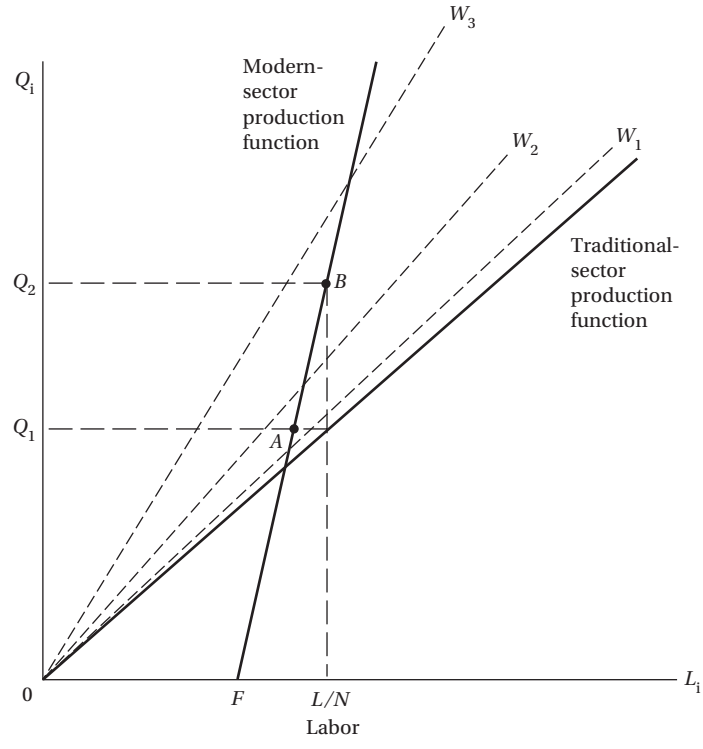
The Big Push: A Graphical Model

Assumptions In any model (indeed, in any careful thinking), we need to make some assumptions, sometimes seemingly large assumptions, to make any progress in our understanding. The analysis of the big push is no exception to this rule. The assumptions we use for the big push analysis here can be relaxed somewhat, though at the expense of requiring more mathematical technique, but it should be noted that we cannot relax our assumptions as much as we are accustomed to doing in simpler microeconomic problems, such as those that assume perfect competition. Here we cannot meaningfully assume perfect competition in the modern sector, where increasing returns to scale and hence natural monopoly, or at least monopolistic competition, prevail. To paraphrase Paul Krugman, if we think development has something significant to do with increasing returns to scale, then we will have to sacrifice some generality to address it. We will make six types of assumptions.

1. *Factors.* We assume that there is only one factor of production—labor. It has a fixed total supply, L.
2. *Factor payments.* The labor market has two sectors. We assume that workers in the traditional sector receive a wage of 1 (or normalized to 1, treating the wage as the numeraire; that is, if the wage is 19 pesos per day, we simply call this amount of money "1" to facilitate analysis using the geometry in Figure 4.2). Workers in the modern sector receive a wage $W > 1$ (that is, some wage that is greater than 1).

   As a stylized fact, this wage differential is found in every developing country, even if it needs some explanation (see Chapter 7). The underlying reason for this differential *may be* a compensation for disutility of modern factory types of work. If so, in equilibrium, workers would receive no net utility benefits from switching sectors during industrialization; but if economic profits are generated, this will represent a Pareto improvement (in this case because investors are better off and no one is worse off), and average income would rise (there can also be income redistribution so that everyone may be made better off, not just no one worse off). Moreover, if there is surplus labor in the economy or if modern wages are higher than opportunity costs of labor for some other reason,[14] the social benefits of industrialization are all the greater.[15] Finally, note that we are examining one example of a model in which a driving force for an underdevelopment trap is the relatively high wages that have to be paid in the modern sector. We do this because it is an approach that is easy to characterize graphically and that has received a lot of attention. As will be described later, however, high modern wages is only one circumstance in which a coordination problem may exist. In fact, we will see that there may be coordination failure problems even if modern-sector wages are no higher than those in the traditional sector.
3. *Technology.* We assume that there are N types of products, where N is a large number.[16] For each product in the traditional sector, one worker produces one unit of output (this is a less stringent assumption than it

FIGURE 4.2 The Big Push



appears because again we have a certain freedom in choosing our unit of measurement; if a worker produces three pairs of shoes per day, we call this quantity one unit). This is a very simple example of constant-returns-to-scale production. In the modern sector, there are increasing returns to scale. We want to introduce increasing returns in a very simple way. Assume that no product can be produced unless a minimum of, say, F workers are employed. This is a fixed cost. Because we are keeping things simple to facilitate analysis of the core issues, we have not put capital explicitly in the model; thus the only way to introduce a fixed cost is to require a minimum number of workers. After that, there is a linear production function in which workers are more productive than those in the traditional sector. Thus labor requirements for producing any product in the modern sector take the form $L = F + cQ$, where $c < 1$ is the marginal labor required for an extra unit of output. The trade-off is that modern workers are more productive, but only if a significant cost is paid up front. As this fixed cost is amortized over more units of output, average cost declines, which is the effect of increasing returns to scale. We assume symmetry: The same production function holds for producing any product in the modern sector.

4. *Domestic demand.* We assume that each good receives a constant and equal share of consumption out of national income. The model has only one

period and no assets; thus there is no saving in the conventional sense. As a result, if national income is Y, then consumers spend an equal amount, Y/N, on each good.[17]

5. *International supply and demand.* We assume that the economy is closed. This makes the model easy to develop. The most important conclusions will remain when trade is allowed, provided that there are advantages to having a domestic market. These advantages likely include initial economies of scale and learning to achieve sufficient quality, favorable product characteristics, and better customer support before having to produce for distant and unknown consumers. These are very realistic considerations: Evidence suggests that export-led economies such as South Korea have benefited enormously from the presence of a substantial domestic market to which early sales are directed.[18] Moreover, export-led economies have benefited from an active industrial policy aimed at overcoming coordination failures (see Chapter 12). The points will also hold if there are necessary inputs that are not tradable, such as certain types of services. Alternative models focusing on infrastructure investments can also imply the need for a big push even with a fully open world economy.[19]

6. *Market structure.* We assume perfect competition in the traditional (cottage industry) sector, with free entry and no economic profits. Therefore, the price of each good will be 1, the marginal cost of labor (which is the only input). We assume that at most, one modern-sector firm can enter each market. This limitation is a consequence of increasing returns to scale. Given the assumptions about preferences, the monopolist faces unit-elastic demand, so if this monopolist *could* raise its price above 1, it would be profitable to do so.[20] However, if price is raised above 1, competition from the traditional-sector producers will cause the modern-sector firm to lose all of its business. Therefore, the monopolist will also charge a price of 1 if it decides to enter the market.[21] Because the monopolist charges the same price, it will monopolize this particular market if it enters but will also produce the same quantity that was produced by the traditional producers. Because this firm is the only one using modern techniques and, in producing all other products, workers receive a wage of 1, national income will be essentially the same, so more units of output cannot be sold.[22] We also assume that at the point the monopolist would choose to produce, it is able to produce at least as much output as the traditional producers for that same level of labor; otherwise, it would make no sense to switch out of the traditional techniques.

Conditions for Multiple Equilibria With these six assumptions, we can characterize cases that will require a big push. To begin, suppose that we have a traditional economy with no modern production in any market. A potential producer with modern technology (i.e., a technology like the one described previously, with fixed costs and increasing returns) considers whether it is profitable to enter the market. Given the size of the fixed cost, the answer depends on two considerations: (1) how much more efficient the modern

sector is than the traditional sector and (2) how much higher wages are in the modern sector than in the traditional sector.

In Figure 4.2, production functions are represented for the two types of firms for any industry.[23] The traditional producers use a linear technique with slope 1, with each worker producing one unit of output. The modern firm requires F workers before it can produce anything, but after that, it has a linear technique with slope $1/c > 1$. Price is 1, so revenues PQ can be read off the Q axis. For the traditional firm, the wage bill line lies coincident with the production line (both start at the origin and have a slope of 1). For the modern firm, the wage bill line has slope $W > 1$. At point A, we see the output that the modern firm will produce if it enters, provided there are traditional firms operating in the rest of the economy. Whether the modern firm enters depends, of course, on whether it is profitable to do so.

Using Figure 4.2, first consider a wage bill line like W_1 passing below point A. With this relatively low modern wage, revenues exceed costs, and the modern firm will pay the fixed cost F and enter the market. In general, this outcome is more likely if the firm has lower fixed costs or lower marginal labor requirements as well as if it pays a lower wage. By assumption, production functions are the same for each good, so if a modern firm finds it profitable to produce one good, the same incentives will be present for producing all goods, and the whole economy will industrialize through market forces alone; demand is now high enough that we end up at point B for each product. This shows that a coordination failure need not always happen: It depends on the technology and prices (including wages) prevailing in the economy.

If a wage bill line like W_2 holds, passing between points A and B, the firm would not enter if it were the only modern firm to do so in the economy because it would incur losses. But if modern firms enter in each of the markets, then wages are increased to the modern wage in all markets, and income expands. We may assume that price remains 1 after industrialization. Note that the traditional technique still exists and would be profitable with a price higher than 1. So to prevent traditional firms from entering, modern firms cannot raise prices above 1.[24] The modern firm can now sell all of its expanded output (at point B), produced by using all of its available labor allocation (L/N), because it has sufficient demand from workers and entrepreneurs in the other industrializing product sectors. As can be seen in Figure 4.2, with prevailing wage W_2, point B is profitable after industrialization because it lies above the W_2 line. Workers are also at least as well off as when they worked in the traditional sector because they can afford to purchase an additional quantity of goods in proportion to their increased wage,[25] and they have changed sectors (from traditional to modern) voluntarily. All of the output is purchased because all of national income is spent on output; national income is equal to wages plus profits, the value of which is output of each product times the number of products N.[26]

Thus, with a prevailing wage like W_2, there are two equilibria: one in which producers with modern techniques enter in all markets, and profits, wages, and output are higher than before; and one in which no modern producer enters, and wages and output remain lower. The equilibrium with higher output is unambiguously better, but in general, the market will not get there by itself.

A final possibility is found in a wage bill line like W_3, passing above point *B*. In this case, even if a modern producer entered in all product sectors, all of these firms would still lose money, so again the traditional technique would continue to be used. In general, whenever the wage bill line passes below point *A*, the market will lead the economy to modernize, and whenever it passes above *A*, it will not. The steeper (i.e., more efficient) the modern-sector production technique or the lower the fixed costs, the more likely it is that the wage bill will pass below the corresponding point *A*. If the line passes above *B*, it makes no sense to industrialize. But if the wage line passes between points *A* and *B*, it is efficient to industrialize, but the market will not achieve this on its own. Be sure to note that these are three different wages that might exist, depending on conditions in a particular economy at one point in time, not three wages that occur successively.

Again, the problematic cases occur when the wage bill line passes between *A* and *B*, thus creating two equilibria: one in which there is industrialization and the society is better off (point *B*) and one without industrialization (point *A*). However, the market will not get us from *A* to *B* because of a coordination failure.[27] In this case, there is a role for policy in starting economic development. There is no easy test to determine where a traditional economy, such as Mozambique, is located on this continuum. But at least we can begin to understand why development often has not gotten under way, even when technology is available.

Note that in general, it is not necessary for all product sectors to industrialize to get a sufficient push for some to do so. It is only necessary that a sufficient number industrialize in order to generate enough national income (through the higher industrial wage and positive profits from the industrialized product sectors) to make industrialization minimally profitable. Also note that each firm's failure to take into account the impact of its investments on demand for other firms' goods represents a very small distortion by itself. But when added up across all of the product sectors, the resulting distortion—namely, the failure to industrialize at all—is very large indeed.

We could also have cases of semi-industrialization, in which benefits or costs accrue in different amounts to different product sectors or in which there are different types of spillovers from firm to firm. For example, this is plausible when the level of required fixed costs declines the more product sectors industrialize, because there are more local examples from which to learn.[28] With this alternative type of externality, no wage premium is necessary for multiple equilibria to be present. In this case, if there are clusters of two or more firms that have large effects on each other's fixed costs, *F*, but not on firms outside of the cluster, the result can be an equilibrium in which only the industries in this cluster change to modern techniques. Thus, in this circumstance, we could have three or more equilibria; we could also have enclave economies, in which a modern sector exists side by side with traditional cottage industries in other product sectors.[29]

Technological externality A positive or negative spillover effect on a firm's production function through some means other than market exchange.

Notice that this model has not assumed the existence of any type of **technological externality**, in which the presence of one advanced firm can, through "learning by watching" other firms' production methods or some similar effect, generate spillovers to other firms that can raise their productivity as well as lower their costs. This is another type of market failure that can

also lead to inefficiently low investment; we considered one such possibility when we examined the Romer endogenous growth model in Appendix 3.3.

Other Cases in Which a Big Push May Be Necessary

The need for a big push can result from four conditions beyond those described previously.

1. *Intertemporal effects.* Even if the industrial wage rate is 1 (i.e., the same as the traditional-sector wage), multiple equilibria can occur if investment must be undertaken in the current period to get a more efficient production process in the next period.[30] Investment in the first period depresses aggregate demand in the first period but increases it in the second (or later) period. But investment will be undertaken only if it is profitable, that is, if demand is expected to be high enough in the second period, and this may require that many product sectors invest simultaneously. Once again, however, the market does not ensure that industrialization will occur, even when it is (Pareto-)preferred, because of pecuniary externalities. Again the source of the multiple equilibria is that one firm's profits do not capture its external contribution to overall demand for modern-sector products because it also raises wage income in the future periods when other entering modern firms will be seeking to sell their own products. When there is a case for a big push, industrialization makes the society better off (is Pareto-preferred) because first-period income is decreased only by the fixed cost, but second-period income is sufficiently increased by both the wage and profits in other product sectors to more than offset this.[31] Note once again that a part of the profits can, in principle, also be subject to income redistribution so that everyone may be made better off rather than just some people made better off and no one made worse off.

2. *Urbanization effects.* If some of the traditional cottage industry is rural and the increasing-returns-to-scale manufacturing is urban, urban dwellers' demand may be more concentrated in manufactured goods (e.g., foods must be processed to prevent spoilage due to the time needed for transportation and distribution). If this is the case, one needs a big push to urbanization to achieve industrialization.[32]

3. *Infrastructure effects.* By using infrastructure, such as a railroad or a port, an investing modern firm helps defray the large fixed costs of that infrastructure. The existence of the infrastructure helps investing firms lower their own costs. But investing firms thereby contribute indirectly to lowering the costs of other firms (by lowering the average cost of infrastructure use). Infrastructure, such as roads, railroads, and ports, is not tradable; by definition, it is located in a particular region. And openness to foreign investment cannot always solve the problem because investors do not know whether firms will develop to make use of the infrastructure.[33] The critical point is that when one product sector industrializes, it increases the size of the market for the use of infrastructure services that would be used by other product sectors and so makes the provision of these services more profitable. But it is also possible that efficient industrialization

may not take place, even if the infrastructure is built, if other coordination problems are present.

4. *Training effects.* There is underinvestment in training facilities because entrepreneurs know that the workers they train may be enticed away with higher wages offered by rival firms that do not have to pay these training costs. There is also too little demand by workers for training because they do not know what skills to acquire. (In addition to not knowing whether firms will make investments requiring these skills, people are not born with perfect information about their comparative advantage; basic education helps workers discover it.) This is part of the economic case for mandatory public education. Note that in this case, openness to trade cannot resolve the coordination failure unless there is free mobility of labor across borders, which has yet to develop perfectly even within the European Union, where there are few formal barriers to such mobility, and is far from emerging for any developing country. In any case, relying on expatriate skilled workers is hardly an adequate solution to a country's own underdevelopment. Actually, infrastructure and trained workers are subsets of a general case of jointly used intermediate goods. Another example is joint research facilities for small firms in an "industrial district" (see Chapter 7).

Why the Problem Cannot Be Solved by a Super-Entrepreneur

Some readers may wonder, why can't one agent solve the coordination failure problems by capturing all the rent? In other words, why not have a super-entrepreneur who enters into all of the markets that need to be coordinated and receives the profits from all of them? For some types of coordination failures, this solution is ruled out in advance. For example, regarding education and skill development, there is a legal constraint on bonded labor. But in terms of our industrialization problem, why can't one agent become a super-entrepreneur in each of the N markets simultaneously? There are at least four significant theoretical answers and one decisive empirical answer.

First, there may be capital market failures. How could one agent assemble all the capital needed to play the super-entrepreneur role? Even if this were logistically imaginable, how would lenders have confidence in their investments? In particular, how could a penalty for default be imposed?

Agency costs Costs of monitoring managers and other employees and of designing and implementing schemes to ensure compliance or provide incentives to follow the wishes of the employer.

Second, there may be costs of monitoring managers and other agents and designing and implementing schemes to ensure compliance or provide incentives to follow the wishes of the employer; these are often referred to as **agency costs**. Monitoring is too expensive once the scale of a firm gets too large. Even if the plan is to sell off the industries, these industries must be developed simultaneously. The super-entrepreneur is likely to know more about the firms than the potential buyers do. In other words, if the firm is so profitable, why would its owners be selling? Thus, potential purchasers of the industries face a problem of **asymmetric information**, often known as the "lemons problem."[34]

Asymmetric information A situation in which one party to a potential transaction (often a buyer, seller, lender, or borrower) has more information than another party.

Third, there may be communication failures. Suppose someone says to you, "I am coordinating investments, so work with me." Should you do so?