

2

Significance of the Multiple Outcomes That Result from Economies of Scale

If the operation of free markets in the global economy always produced a unique and relatively predictable outcome for the interrelated economic affairs of nations, then there would be little that anyone could do to change it. That predestined balance of economic forces would represent our unavoidable destiny. Directed by the market's Invisible Hand, we would be fated to produce, trade, and prosper, all in a strictly choreographed international pattern. We could study, describe, and write about the details of that fate, but in the end we would either have to accept it or fundamentally reject the guidance of the free market. If, in addition, there were grounds for believing this destiny to be dependably beneficial—always serving not only the economic interests of the world as a whole but also each of the countries that compose it—then the uniqueness and inevitability of that outcome would be reassuring rather than inhibiting or threatening. This fortunate state of affairs, in which we are only deprived of the ability to tinker with something that is already for the best, is just what classical trade theory may lead us to expect.¹

But in this chapter our review of the traditional thinking will show that these characteristic features strongly depend on one crucial assumption: the absence of widespread and substantial economies of scale (situations in which production is only possible on a large scale or is carried out most cheaply and efficiently by large-scale enterprises) or high startup costs (situations in which successful operation in an industry requires the entrant to incur a very large investment that is recoverable only after a substantial period of time). We will see that once such scale economies or startup costs become a significant feature of the goods exchanged in world trade, which is clearly true today, then instead of the single, predictable, and favorable end result, the opposite becomes possible: There are a very large

number of possible production and trade relationships all of which, once established, can be maintained for significant lengths of time by market forces. Indeed, under today's conditions market forces can perpetuate whatever global balance is established in many industries rather than choosing the one uniquely beneficial outcome. And these different outcomes can have very different effects on the welfare of the trading nations.

2.1 Ancient History: The World of Preponderantly Diminishing Returns

The classical trade model used by economists reflects the world of some 200 years ago in which it was conceived. The model reflects that world especially in its assumption of what economists refer to as *diminishing returns to scale*. Diminishing returns means that as an industry increases in size, it becomes less productive rather than more.² Additional units of output cost more, not less, to produce.

This was in fact a very reasonable assumption when the world was dominated by agriculture,³ for in agriculture the best or the most accessible land tends to be used first, and then, as production continues to increase and to require more land, the less productive and less accessible land is brought into use. Or, alternatively, as demand for food grows, agricultural land is sometimes used more intensively, with farmers trying to squeeze larger crop yields out of a given number of acres, something that generally entails an increase in the cost of each added unit of output. Even today we observe diminishing returns in agriculture. For example, in China farmers have used greater and greater amounts of fertilizer to raise grain. Use of fertilizer is four times what it was 15 years ago, but grain output has increased only 50 percent—a clear case of diminishing returns.

The cost of setting up a business in those bygone days was also extraordinarily low by modern standards. Historian David Landes writes, "The early machines, complicated though they were to contemporaries, were nevertheless modest, rudimentary, wooden contrivances which could be built for surprisingly small sums. A forty-spindle [spinning] jenny cost perhaps £6 in 1772; [wool] scrubbing and carding machines cost £1 for each inch of roller width . . ." (Landes 1969, pp. 64–65). The purchasing power of an English pound was much greater then, but even giving it the generous valuation of 100 times its value today, it is evident that machinery at the onset of the Industrial Revolution was

surprisingly cheap, meaning that no huge investment needed to be incurred in launching a new firm.

And the firms themselves were very small. Outside of the Army, Navy, and the Church there were almost no large organizations. Most of the population was rural, and most of industry was small. As Alfred Chandler described it, "As long as the processes of production remained powered by humans, animals, wind, and water the volume of output was rarely enough to require the creation of subunits within the enterprise or to call for the services of a salaried manager to coordinate and monitor the work of those subunits" (Chandler 1977, p. 51).

It was, then, a world of diminishing returns, and in such a world, as Adam Smith, David Ricardo, and the classical economists who followed them showed in their illuminating analyses, there is normally only one possible outcome that is stable. This unique state of *equilibrium*, as economists call it, is the one arrangement of goods and services toward which free-market forces (i.e., better or cheaper producers replacing those who are less effective) always drive the economy. It is the outcome automatically selected by the Invisible Hand.

And, as the classical economists also showed, that unique equilibrium is always in some sense the best one possible. In this most advantageous situation those who can produce most cheaply in a given industry are the only ones in the industry. The less efficient producers have been driven out of that industry and are engaged in doing something else at which they can be competitive. This same unique equilibrium also does the best job of satisfying the preferences of consumers, given the current state of technical knowledge and the availability of resources. Reaching this outcome automatically is the superb achievement of the market mechanism that has rightly endeared it to economists and made them wary of interfering with its functioning.

2.2 International Trade and Diminishing Returns

Market forces yield these results because, in a world of universal diminishing returns, market forces will undo any outcome that does not assign production in a particular industry to the country that is one of the most efficient producers of that industry's goods.

Suppose that there is a country, currently not producing a particular good, that is capable of producing the good more cheaply than the

current producers and therefore can make a profit by entering that industry. Profit provides the motive to enter the industry, and because of diseconomies of scale, the new producer can start off producing only a small amount of the industry's products and yet do so very efficiently—as efficiently or more efficiently than it can do it on a large scale. Diseconomies of scale mean that small is competitive. If a country is entering a new branch of agriculture, the land it devotes to it at the outset is as good or better than the land it will bring on later if its initial efforts are successful. In a diseconomies world it is not necessary to make a huge and risky leap and emerge full-grown with a large-scale industry in order to have a chance of entering the world market successfully. The new entrant can, in effect, creep in and achieve competitiveness as well (or better) on a small initial volume as on a large one.

This entry of the new competitor will drive the global economy toward a new outcome. Along the way some less efficient producers will decrease output, while the growth of the new entrant, and entry by other efficient producers will continue until the world economy settles down into a position in which only the most producing nations operate in each industry. And each of these produces efficiently enough, and has costs sufficiently low, to enable it to meet prevailing world prices.

That, in simplified form, is how the Invisible Hand of the market operates in a world of scale diseconomies (diminishing returns), always pushing the economy toward one equilibrium outcome, an outcome in which only the lowest-cost producers produce. It is an outcome therefore that always possesses a high degree of efficiency.

2.3 High Entry Cost and “Retainability” of an Industry

But whatever may have been true two centuries ago, we know that in today's world a good part of international trade consists of products that are definitely not characterized by ease of entry on a small scale. On the contrary, in many cases small-scale entry is almost impossible. Automobiles, computers, and television sets are examples. You cannot hand-make a car from scratch in your garage and compete with the large-scale production of General Motors.

And, quite aside from the necessary scale of production, it may require a long period of operation before the personnel of a new industry entrant acquire the skill and experience to make the product as effi-

ciently as the current leading competitors. There may be new technology to be mastered, technology that is based on experience and not easily learned. Or success in the product in question may require the availability of nearby ancillary industries that themselves are difficult to establish and that the prospective entrant country may lack. A distribution network may have to be set up from scratch, knowledge of the marketplace acquired, and so on. It is not easy to compete when the competition has learned much by years of effort and experience in all these areas. And the advantage of the established industry does not need to be static. Often, considerable learning continues in an established industry. The methods and technology of production are continually evolving through large-scale learning-by-doing, as well as by continuing investment, and there is much feedback from an established customer base leading to steady improvement in product and support. This adds to the difficulties of entry by providing a moving target.

We use the term *retainable industry* to refer to any industry that is characterized by such start-up costs and the resulting difficulties for small-scale entry. A retainable industry, because of its high real start-up costs, offers the current established producers a substantial degree of protection from competitive entry, making it easier for them to retain their positions. While in industries with diminishing returns market forces favor the small-scale competitive entrant, in retainable industries those same market forces have the opposite effect. Small-scale entrants are uneconomical and tend to be eliminated by market forces while large-scale entry is hard to come by. Market forces in retainable industries tend to perpetuate the status quo.

The protection is never absolute, and no industry is perfectly retainable. The modern world has its examples in which, over time, new entrants have appeared in industries with high start-up costs. The emergence of the Japanese auto industry and its impact on the U.S. automobile market comes immediately to mind. But this is an illuminating case. The Japanese auto industry was able to start on a small scale in the protected Japanese home market. It had grown into a formidable and large-scale industry by the time its products started to appear in the United States.

This retainability attribute of modern industry is therefore important. In our analysis in this chapter, in contrast to the earlier diminishing returns or diseconomies assumption, we will assume that there is a high cost of starting up an industry that is new to a country. That is, we will discuss retainable industries and their consequences in a world

of free international trade and free international competition. In chapter 4 we will extend our analysis and conclusions to industries that are characterized by rapid learning rather than by economies of scale.

2.4 When Industries Are Retainable, There Are Many Stable Outcomes

In contrast with the classical case, in an economy characterized by widespread and substantial start-up costs—that is, by retainable industries—a vast variety of possible outcomes become possible, any one of which can become and remain a stable arrangement of world production. And while some of the available equilibria score very high in terms of their economic benefits to the world public, and provide large gains from trade, others may be very poor outcomes indeed. The nature of these alternative equilibria can now be described, and we can even calculate how many of them there are.

To bring out these ideas and their differences from the classical economies case most strongly, we first discuss the most extreme possibility: that all industries of the world are retainable. Then in that world, populated only by industries with high start-up costs, we will look first at outcomes in which each good is produced in only a single country. We will call such outcomes *perfectly specialized equilibria*. Of course, in real life there are many examples of retainable industries that are not specialized, where more than one country has attained the scale and expertise needed to be competitive, so that there is more than one country with a substantial market share. The analysis we are about to describe and the conclusions we will reach apply to these situations of more than one producer country as well, and we will discuss them in a later chapter. For now, for simplicity, we will emphasize the specialized equilibrium case, the case in which no good is produced in more than one country. The conclusions we reach will apply even more strongly to the case in which more than one country supplies some of the world's products, and it will also apply to the case where not all industries are retainable.

Let us first consider these specialized equilibria and see how many of these there can be, bearing in mind that any of these outcomes can be sustained by market forces. To represent the world of global trade, we will scale the world down to just two countries, the United Kingdom (“U.K.”) and “France” (we choose these names only because they are familiar). Our U.K. and France are, of course, very simplified versions

Table 2.1

Number of equilibria and number of traded goods

Number of goods	2	3	4	5	6	7	8	9	10
Number of equilibria	2	6	14	30	62	126	254	510	1,022

of real countries. In contrast with the diseconomies case with its one stable outcome or equilibrium, our hypothetical, two-country world populated exclusively by retainable industries will generate many equilibria. In fact, in a world of retainable industries each and every possible specialized assignment of the task of production among different countries will be an equilibrium. It does not matter whether the United Kingdom happens to specialize in the production of semiconductors and France in the production of steel, or the reverse. Whichever of these possibilities happens to occur, the country that has specialized in one of the products will benefit from some degree of automatic protection against invasion of that field by the other country. Its large-scale production of that commodity will give its producers a cost advantage. The other country will be unable to succeed if it tries to venture into the field on a small scale because of the high costs of production, and the learning and organizing difficulties, that this entails.

Thus, in this world of retainable industries, where each product is produced by just one nation, *any* specialized assignment of products among countries will tend to persist because of the high cost of entry, and it will therefore be a stable outcome or equilibrium. And since there are an enormous number of ways in which a given set of products can be divided up among producer countries, there are an enormous number of possible different equilibria.⁴ To illustrate the numbers involved (which can be determined by a straightforward arithmetic calculation; see table 2.1), if two countries trade in only 10 commodities, there will be more than 1,000 potential equilibria. And if 20 items are traded, the number of possible equilibria exceeds one million. Trade in 25 goods yields more than 33 million different stable possible outcomes. Since in the real world the number of goods traded goes into the hundreds of thousands, it should be clear that the number of potential equilibria—all stable outcomes supported by market forces—is vast indeed.

2.5 Many Equilibria: The Good, the Bad, and the Mediocre

Why should we care about the existence of this very large number of stable candidate equilibria? After all, under free trade it is still the market mechanism that eliminates high-cost producers and leads us to an outcome in which only the lowest cost producers remain. But any equilibrium with which we happen to end up is just one of many. It has a large component of history going into its selection, and very little of inevitability. Worse yet, the uniformly beneficial attributes that characterized the unique equilibrium in the classical scenario no longer obtain. Among these many equilibria there are those that are good, some that are bad and some indifferent. And they may have different effects on the welfare of the different trading countries.

The equilibrium that market forces will perpetuate is the equilibrium with which the international community will, at least for the moment, have to live. This outcome may well depend on historical accident. If Belgium happens to have gone early into the production of specialized machine tools for fax machine parts, it may have acquired a preponderant and, for the near future, unbeatable position in the field (unless there is a radical change in attendant circumstances). This can be so even in cases where other nations—if they were ever to attain the required sales volume, distribution, and reputation—could supply just as good a product at lower cost.

Influences that are fortuitous in their relation to current circumstances, ancient investment decisions, patterns of migration produced by wars or famines, or the happenstance of political orientations of yesterday's governments—all these can play an important part in determining which market equilibrium is selected by the market forces today. But though the choice may be the product of chance or history, which equilibrium ends up being selected matters today, and it matters for two quite different reasons.

First, there is the question of global efficiency. Among the many specialized equilibria that have just been discussed, each with its different assignments of products to countries, there will be many assignments that apportion these tasks haphazardly in relation to relative costs and other current economic circumstances. Japan is, for instance, a significant producer of steel and automobiles even though it has no domestic energy sources to contribute to steelmaking, and it has high wages. China, were it ever to attain volume production of high-quality automobiles, would seem to have many advantages as a producer.

It has low labor costs and lots of coal. But today, and probably for some time to come, China is not a threat to Japan's strong position in automobiles because there is so much China would have to go through to attain the strengths of volume, skill, and reputation that Japan already has.

Thus, among the many equilibria available to the market in a world of high start-up costs, there are those that are good, those that are bad, and those that are mediocre from an overall world output point of view. Yet there may conceivably be little in the market mechanism that leads it to favor the good or even to avoid the bad. Its choice among them is, so to speak, fraught with happenstance. And, once the wheel of fortune has picked one equilibrium, society only extracts itself slowly from that state of affairs. Whatever its degree of vice or virtue, the stability of the equilibrium makes it difficult to escape to a better or a worse alternative. For the move to another stable outcome can never be carried out easily. The development of a new industry is slow, involves a long time and large-scale effort, and is beset with risk.

There is a second reason why we should care about the particular equilibrium being sustained by the market, and this reason is much closer to home. Retainability means that a country with many industries can hold on to them even though the wage in this many-industry country may be very high. As we will see in more detail in the next chapter, if a country is producing more than its population's share of the world's commodities, it will have a high income and, usually, a high standard of living. If it produces a large share of the world's goods, it has much to consume and much to trade. It becomes a high-wage, high-consumption country. This beneficial effect of being the producer of a large proportion of the world's tradable industries can be very substantial, and will often far outweigh for that country the world efficiency effects mentioned in the preceding paragraph. And, equally clearly, a country that finds itself frozen out of most industries and is unable to enter will find itself with little to consume that is produced at home and little to trade to obtain goods from abroad.

So the choice of equilibrium matters both on a global scale and also very directly on a national scale. To find out which are good and which are bad, one must find a way to compare the many candidate equilibria systematically, to derive some insights into their general properties, and their relative virtues and vices. Though their sheer number may appear to make such an analysis unmanageable, we will see in the next chapter that it can be done.

We will see that these numerous possible outcomes distribute themselves into a surprisingly simple and orderly pattern that makes visible their advantages and disadvantages to the countries involved. There is nothing random about their arrangement. We will describe that pattern and show why it is universal rather than being an artifact of the particular examples we have chosen to illustrate our analysis.

Because of this simple pattern we will be able to go beyond talking about the great variety of equilibria. In the next chapter we will characterize the outcomes that offer substantial benefits to the world economy, the outcomes that provide substantial benefits to the economy of a particular country, and the outcomes that perform poorly on either count.

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