Chapter Two
A Literature Survey on Economy of Scale

This chapter must begin with a caveat. Most of the empirical data cited below on the ideal size for economy of scale reflect the comparative performance of plants and firms in the existing economy, with the given structure of costs and returns. They ignore the extent to which the existing economic environment is itself the product of state subsidies and other interventions. The ideal size for efficiency in the existing economy refers to the size needed for maximizing profit *given* subsidized inputs, and *given* protected monopoly prices for outputs. The optimally sized firm, in other words, is optimally sized for maximizing profits in the existing economic environment.

This is indicated, in most cases, by the very methods used to determine the ideal size for economy of scale. According to F.M. Scherer,[1] the methods used to determine minimum efficient scale (MES) are the following:

1) Analyzing profitability as a function of size. This is problematic because it is hard to distinguish profitability resulting from internal efficiency from profitability resulting from monopoly or monopsony power. For example, a Johnson administration study found the average rate of profit to be 50% higher in concentrated industries.[2] Even in recessions, losses from the late fifties through the early seventies were relatively rare among the largest corporations. Only one of the top 200 industrials operated at a loss in the recession of 1957; and only seven and 34 of the Fortune 500 lost money, respectively, in the recessions of 1964 and 1970.[3] One of the forms taken by oligopoly market power is administered pricing: in the 1960s, for example, General Motors targeted its prices to provide a 15-20% return after taxes, with costs estimated on the assumption that plants operated at only 60-70% capacity. And U.S. Steel, likewise, set prices to allow for a profit even when operating only two days a week. Bethlehem Steel's Chairman complained in 1971 that the company had to operate at 70% capacity to make a profit, compared to only 50% in 1966. By the way, this complicates the engineering approach described below, since that approach estimates peak efficiency on the assumption that the different size plants being compared operate at 100% of capacity. The comparative "efficiency" estimates would differ somewhat if it were taken into account that the smaller plant can operate at full capacity, while the larger one cannot.[4] An FTC study cited by the Nader Group estimated that oligopoly markup amounted to 25% of existing prices, where the four largest firms controlled 40% or more of an industry's sales.[5] So it's

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[1] F.M. Scherer and David Ross, *Industrial Market Structure and Economic Performance*. 3rd ed (Boston: Houghton Mifflin Company, 1990) pp. 111-15.
[2] Barry Stein, *Size, Efficiency, and Community Enterprise*, p. 54
[3] Ibid., p. 55.
[4] Ibid., p. 56.
[5] Mark J. Green, with Beverly C. Moore, Jr., and Bruce Wasserstein, *The Closed Enterprise System: Ralph Nader's Study Group Report on Antitrust Enforcement* (New York: Grossman Publishers, 1972), p. 14.

hard to control for the extent to which internal inefficiency costs of large scale are offset by the increased market power also resulting from large size.

2) Statistical cost analysis, relating costs to volume of output. This method takes into account such complex variables as capacity utilization, age of capital stock, etc. The sheer amount of numbers crunching involved makes this approach quite intensive. The results are also potentially misleading, because detailed cost data are available disproportionately from regulated monopolies, whose rates are determined by a cost-plus markup.

3) The "survivor test," associated in particular with George Stigler. "...[F]irm or plant sizes that survive and contribute increasing fractions of an industry's output over time are assumed to be efficient; those that supply a declining share of output are deemed too large or too small." This approach measures "efficiency" in terms of the ability to thrive under a given set of conditions; it does not distinguish environmental conditions resulting from monopoly power or discriminatory legislation from others.

4) The engineering approach, based on engineers' technical knowledge of "alternative equipment and plant designs and the associated investment and operating costs," relies heavily on a complicated and labor-intensive series of interviews and questionnaires.

So when empirical studies of economy of scale find that the dominant plant or firm is far larger than the ideal for maximum efficiency, it is something of an *a fortiori* argument: the dominant plant or firm size is above the maximum size for ideal efficiency *even* in an economy where subsidies make large size artificially profitable, and *even* where cartelization enables large firms to escape many of the competitive penalties for their large size. So even the "ideal" size for plant or firm, as determined by the empirical studies cited below, is itself artificially large; in an economy without government subsidies and protections, the most efficient firm or plant would be considerably smaller even than what is described below by Walter Adams or Joe S. Bain.

A. Economies of Firm Size.

Assessments of economy of scale must also distinguish between economies of plant size and economies of firm size. Economies of plant size result from purely technical considerations; as Barry Stein put it,

> some of the factors required for production are "lumpier" (that is, less divisible) than others. In principle, capital can be subdivided as finely as desired, but the same cannot be said for tools or people. In consequence, these resources can only be used efficiently when the scale of activity is large enough to employ them fully.[6]

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[6] *Size, Efficiency, and Community Enterprise*, p. 1.

If the smallest available widget producing machine costs $100,000 and turns out a thousand widgets a day at full capacity, a small firm cannot spend $10,000 for a machine to produce a hundred widgets a day. And if the widget machine must be used along with other machines of different capacities, in order to minimize unit costs it is necessary to purchase the proper ratios of different kinds of machinery, and to maintain sufficient output that no individual machine has idle capacity.

Plant economies also reflect, to a lesser extent, the geometries of building construction. The larger the building, within reasonable limits, the less the cost of materials compared to the usable volume.

> ...the volume or capacity of physical objects (containers, buildings, vehicles) increases with the third power of length or radius, and thus faster than the surface area, which only increases as the second power. Since the costs associated with material needs and construction tend to be related to the surface area, large units have greater capacity or volume per unit cost.[7]

The "within reasonable limits" qualifier is added because, eventually, when a building gets large enough, the space required for support infrastructure will grow faster than the space available for productive use; Leopold Kohr gave the example of a skyscraper, in which the taller the building the larger the percentage of floorspace on each story devoted to unproductive space (elevator shafts, heating ducts, load-bearing structures, etc.).[8]

Economies of plant size are real, at least, however much controversy there may be as to the precise point at which they level off. On the alleged economy of firm size, there is less agreement.

> It rests upon alleged efficiencies of management rather than technology. Efficiency, it is said, is enhanced by spreading administrative expertise and expenses over multiplant operations; by eliminating duplication of officials, services, and records systems; by providing sophisticated statistical, research, and other staff services that smaller firms cannot afford; by circumventing "transaction costs" by performing support activities in house rather than purchasing them from outsiders; by obtaining credit on more advantageous terms; by attracting more competent executives and mounting more effective marketing campaigns; and so forth.[9]
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> The savings from spreading administrative costs over more than one plant are

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[7] Ibid., p. 2.
[8] *The Overdeveloped Nations*, pp. 106-07.
[9] Walter Adams and James W. Brock. *The Bigness Complex: Industry, Labor and Government in the American Economy*. 2nd ed. (Stanford, Cal.: Stanford University Press, 2004)., pp. 30-31.

doubtless true, *ceteris paribus*. But as usual, *ceteris* in this case is not *paribus*. Whatever savings result from administrative rationalization are probably offset, or more than offset, by the bureaucratic inefficiencies resulting from added layers of administration, and from increased Hayekian problems of aggregating distributed information.

The advantages resulting from superior bargaining power in the credit market, from the power of a large-scale buyer to negotiate lower prices, and so forth, are also real. But as Adams and Brock point out, such advantages of superior bargaining power are not real operating efficiencies: unlike internal efficiencies, which result in real cost savings overall, they are zero-sum transactions that merely shift a portion of costs to those with less bargaining power.[10] Barry Stein made same distinction in *Size, Efficiency, and Community Enterprise*:

> It is necessary... to distinguish between true social efficiency and simple power. Efficiency has been defined... as a measure of the extent to which social and individual needs are met for a given set of available resources. But large and well-established firms also have power, the ability to control the environment toward their own ends. To a considerable degree, organizations with power can be less efficient; at least, they can change the nature of the contest so that others, even if more truly efficient, are less able to compete. Thus, many of the gross measures of the relative efficiency of firms of different scale (such as overall profit, sales growth, or survival), may be indicative of the power of size, rather than the economic effect of scale....
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> It is a well established fact that large firms have a degree of power, simply as a result of size, which is ordinarily used to acquire more or surer profits on operations over time, to raise barriers against the entry of new competition, to gain access to funds, or to control a share of the market greater than may be accounted for by conventional models of a fully competitive economy....
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> And, in fact, there is evidence that, in concentrated industries, profits are higher than they would be otherwise.[11]

It is quite plausible that most of the "efficiencies" of the large firm fall into this category: the ability to excercise power outside the firm, especially insofar as large size creates a power center for the control of state-granted privileges like "intellectual property," or creates a financial base to lobby the state for special privileges.

Joseph Schumpeter suggested, as we saw in the previous chapter, that large firm size, by insulating the corporation from risk, put it in a superior position to undertake expensive and long-term innovations. But as we shall see below, in the real world the large firm is far less innovative.

William G. Roy. *Socializing Capital: The Rise of the Large Industrial Corporation*

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[10] Adams and Brock, 2nd ed., p. 31.
[11] Barry Stein, *Size, Efficiency, and Community Enterprise*, pp. 52-54.

in America (Princeton, N.J.: Princeton University Press, 1997). Oliver Zunz. *Making America Corporate, 1870-1920* (Chicago: University of Chicago Press, 1990).

Economies of firm size are relatively insignificant compared to economies of plant size. Honda's main operating plants in Japan are about three times the average plant size for the American Big Three. But Honda as a firm, with only two major plants in Japan, is far smaller than either GM (28 plants) or Ford (23 plants). Not only does GM's larger size fail to provide any cost efficiencies compared to Honda; it is riddled with inefficiency. GM is significantly less efficient than either Ford or Chrysler, while all three American producers are far (24-38%) less efficient than Honda's North American operations.[12]

A 1956 study by Joe S. Bain found that the efficiencies of multiplant firms were "either negligible or totally absent" in six of twenty industries. In another six, unit cost economies accruing to multiplant firms were small but measurable, ranging from "slight" in cigarettes to 2-5% in steel. In the remaining eight, no estimates of multiplant firms' advantages were available.[13]

The alleged efficiencies of large firm size are even more dubious in the case of the conglomerate, a steroidal parody of the M-form corporation. In the heyday of the conglomerate, its advocates saw it as a sort of private planned economy:

> Defenders of conglomerate bigness argued that the capital markets are an inferior instrument for optimizing society's investment decisions and for planning its output patterns of goods and services. Decentralized decision making by myriads of borrowers, lenders, and investors, they claimed, sufferes from inadequate information and unnecessary and wasteful "transactions costs." Allocation of investment, they said, would be more effectively achieved through centralized generation, control, and allocation of capital *within* the giant conglomerate firm.
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> Thus, conglomerate giants were portrayed as superior to decentralized capital markets in allocating financial funds among alternative uses and in ensuring that these funds would flow to their most socially desirable uses.[14]

As we shall see in Part III of this book, those at the top of the pyramid even within the large unitary firm fall victim to "MBA disease," operating on the basis of finance and marketing considerations while viewing the production process largely as a black box. They strip departments of productive assets, defer maintenance, and the like, all in order to inflate apparent short-term profits. Imagine these very same types attempting to make rational decisions on the shuffling of finance between divisions of a conglomerate:

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[12] Adams and Brock, 2nd ed., pp. 31-32.
[13] Joe S. Bain. *Barriers to New Competition: Their Character and Consequences in Manufacturing Industries*. Third printing (Cambridge, MA: Harvard University Press, 1965), pp. 86-87.
[14] Adams and Brock, 2nd. ed., p. 71.

holding the ultimate power not only of the purse, but of hiring and firing, over those in charge of the production process, even though they themselves understand the conglomerate firm only as a glorified investment portfolio. If the MBAs in charge of traditional large firms are prone to milk them for short-term profit, imagine the opportunities for those in charge of a conglomerate to treat entire divisions as cash cows for asset stripping! And as Duggar pointed out, the management of the old conglomerates engaged in just that kind of cross-subsidization.[15]

In the end, the conglomerate movement was largely a failure--even *within* a state capitalist economy where the rules are stacked in favor of bigness. The conglomerates were even *less* efficient than the general run of subsidized and protected giant corporations. The conglomerate fad of the '60s and '70s had passed by the '80s, and existing conglomerates subsequently were largely divested of their non-core holdings.[16] In an economy where the average large firm survived entirely through government welfare, for the conglomerate corporate welfare was not enough; it was in need of a heart-lung machine.

B. Economies of Plant Size.

Cross-industry studies have found little evidence to back up the alleged efficiencies of large plant size. For example, a study by T.R. Saving covering the 1947-54 period found that in 64 of 91 manufacturing industries, the minimum efficient plant created 1% or less of industry value added.[17]

A 1956 study by Joe S. Bain found that in eleven of twenty industries, the plants with the lowest unit production costs operated on average with an output of 2.5% or less of total national sales (with the individual outputs ranging from 0.02% to 2.5%); in fifteen industries, less than 7.5%; and in seventeen out of twenty, less than 10%.[18]

A 1975 study of 12 industries in seven industrialized nations, based on the engineering survey method, found that--with the exception of the refrigerator-freezer industry--the least-cost plant sizes were "quite small relative to the national market." The same study found a remarkably shallow cost curve for plants below optimal size: in half of the industries surveyed, a plant operating at one-third the optimal output suffered an increase in unit costs of under 5%.[19]

According to F. M. Scherer, the statistical cost analysis method of investigation

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[15] William M. Dugger, *Corporate Hegemony*, pp. 34-35.
[16] Adams and Brock, 2nd ed., p. 72.
[17] Scherer and Ross, p. 114.
[18] Joe S. Bain. *Barriers to New Competition: Their Character and Consequences in Manufacturing Industries*. Third printing (Cambridge, MA: Harvard University Press, 1965), pp. 72-73.
[19] Scherer and Ross, pp. 114-15.

typically shows that, "[w]ith few exceptions, the minimum efficient scale revealed in studies of U.S. manufacturing industries has been small relative to industry size." The most common finding has been "distinct economies of scale at relatively small plant sizes, a range of intermediate sizes over which unit costs did not differ appreciably, and (in a minority of cases) diseconomies of scale for very large plants."[20]

In the steel industry, for example, minimills have been cleaning the clocks of the old steel giants. According to Adams and Brock, minimills operating at infinitesimal fractions of the output of U.S. Steel and Bethlehem Steel had by 1998 achieved a 45% share of the U.S. market. They used electric furnaces to process scrap metal, and oriented their output toward local markets. Minimills produced wire rod and cold-rolled steel sheets 28% and 29% cheaper, respectively, than U.S. Steel. A minimill could produce steel bars with only thirty employees on average, compared to 130 even in a single plant of U.S. Steel.[21]

C. The Comparative Significance of Scale Economies and Organizational Efficiency.

Barry Stein suggested that whatever the increased costs resulting from below-optimum-size production facilities, they pale in comparison to the variations in cost resulting from greater or lesser efficiencies within facilities of *any* given size.

The normal neoclassical approach, according to Stein, is to treat the firm's internal functioning as a "black box":

> One of the characteristics of classical economists' view of business organization is a tendency to view firms as entities operating at near-optimal efficiency within whatever constraints size, industry, and the environment impose. The treatment of economies of scale and of other questions related to efficiency thus have generally focused on the allocative aspects; that is, the extent to which resources or factors of production have been optimally distributed to firms and establishments within the economic system. Within that framework, firms are assumed to operate on the frontier of their specific production functions.[22]

As an example, he quoted Robert Dorfman:

> businessmen determine the cost of attaining any [desired] output by choosing the combination of factors [labor, materials, or capital] with which to produce that output.... The production function incorporates all the technical data about

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[20] Ibid., pp. 112-13.
[21] Adams and Brock, pp. 36-37; see also Murray Bookchin, *Post-Scarcity Anarchism* (Berleley, Ca.: The Ramparts Press, 1971), pp. 108-110.
[22] Stein, p. 27.

production; it shows the greatest amount of output that can be obtained by the use of every possible combination of input quantities.[23]

Stein continued:

> If this describes the actual situation, then questions of allocation become critical. However, there is very good reason to believe that industrial firms operate not on or near their production frontier, but well inside it, and, correspondingly, measures assuming the ideal case are likely to be misleading.
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> There are two points to be made. The lesser is related to utilization of capacity. It is clear that what might be theoretically true with regard to the efficiency of a plant that is operating at design capacity, with all fixed assets properly contributing their share to output, will hardly be true when some fraction of the assets are, in effect, idle....
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> But excess capacity is the minor point. More important is the fact that while economists focus on problems of allocation, businessmen have always spent more time on problems of internal efficiency, in the obvious belief that it can be increased....[24]

By way of contrast to the neoclassical assumption that the production elves were magically running things in an optimal manner inside the black box, Stein brought in Harvey Leibenstein's key concept of "x-efficiency" (about which more in Chapter Seven). This was anticipated in the 1950s by the so-called "Solow residual," which showed that some 80% of economic growth could not be explained by the accumulation of labor or capital stocks.[25]

Leibenstein suggested "an approach to the theory of the firm that does not depend on the assumption of cost-minimization by all firms."

> The level of unit cost depends in some measure on the degree of x-efficiency, which in turn depends on the degree of competitive pressure, as well as on other motivational factors. The responses to such pressures, whether in the nature of effort, search, or the utilization of new information, is a significant part of the residual [unexplained increase] in economic growth.[26]

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[23] Robert Dorfman, *Prices and Markets* (Englewood Cliffs, N.J.: Prentice-Hall, 1967), pp. 67-68, in Stein pp. 27-28; Stein commented, in fn1 p. 98: "Of course, no one assumes that the production function is either known with precision or ideally followed, but the assumption is that businesses, by and large, operate sufficiently close to their production frontier so that attention can shift to the exogenous variables influencing the firm."

[24] Stein, p. 28.

[25] Robert U. Eyres, "Lecture 5: Economic Growth (and Cheap Oil)," p. 4.

[26] Harvey Leibenstein, "Allocative Efficiency vs. X-Efficiency," *American Economic Review* (June 1966), pp. 412-13.

> ...[F]irms and economies do not operate on an outer-bound production possibility surface consistent with their resources. Rather they actually work on a production surface that is well within that outer bound. This means that for a variety of reasons people and organizations normally work neither as hard nor as effectively as they could.[27]

As Stein commented,

> In other words, the usual assumptions about the efficient use of resources within a firm are simply not true. What is more, the extent of those inefficiencies is not small. There is significant opportunity for firms to increase their output for any given array of resources or, alternatively, to reduce their use of resources for any given level of output....
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> It is at least arguable, and perhaps should be apparent, that there can be no perfect utilization of available resources. Theories concerning the firm that assume that *any* single specific parameter is responsible for observed behavior are positing an overly simplistic assumption. Corporations, despite the legal fiction of personhood, do not act uniquely as entities, but as a composite of human subsystems, each of which is attempting to satisfy conflicting and comlex needs, some personal (keeping one's job, doing more satisfying work, earning more money) and some organizational (exceeding profit goals, developing new products, maintaining the corporate share of market).... What is clear... is that the larger the firm and the more complex the subsystem of interactions, the more the possibility that alternative solutions exist and the likelihood that efficiency, however measured, can be improved.
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> Support for these views of potential loss of efficiency can also be gained from simple observation of the extent to which companies "discover" during lean times that they are perfectly capable of operating at the same level with substantially fewer employees or, in some cases, facilities....
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> The significance of all this is simply that computations and estimates of economies of scale, from whatever source, can be misleading or downright inaccurate, since they typically assume that firms and plants operate efficiently within their constraints. This is generally not the case; what actually is being measured, if anything, is the relative productivity of various entities, all of which are capable of increasing their efficiency by amounts and in ways that are uniquely related to that entity. In addition, such savings as might in fact be available because of the real economies of scale (ranging up to perhaps 20 or 25 percent for a substantial change in size) are capable of being overhwelmed by the continuing increases due to improvement in "x-efficiency."

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[27] Ibid., p. 413.

It may be that these inefficiencies help explain the great lack of consistency in the many studies of economies of scale....[28]

D. Increased Distribution Costs

It's also important to remember that whatever reduction in unit production cost results from internal economies of large-scale production is to some extent offset by the diseconomies of large-scale distribution.

> ...[U]nit costs of production, which up to some point decrease with scale, must be compared to unit costs of distribution, which tend to increase (other things being equal) with the size of the area served.[29]

As Ralph Borsodi observed years ago, the larger the plant needed to achieve economies of scale in production, the larger the market area it serves; hence, the longer the distances over which the product must be distributed. His observation, stated simply as Borsodi's Law: as production costs fall, distribution costs rise.

In most cases, the increased cost of distribution exceeds the reduced cost of production at a level of output far lower than would be ideal for maximizing purely internal economies of scale. The increase in unit production cost, even for significant reductions in size below the optimum for productive economy of scale, is quite modest: The 1975 study referenced earlier by Bain, surveying twelve industries in seven industrialized nations, found a remarkably shallow cost curve for plants below optimal size: in half the industries surveyed, a plant with output at a third of the optimal level suffered unit cost increases of less than 5%.[30] Compare this to the reductions in distribution cost for a market area reduced by two-thirds.

Distribution costs are increased still further by the fact that larger-scale production and greater levels of capital intensiveness increase the unit costs resulting from idle capacity, and thereby greatly increase dependence on high-pressure, "push" forms of marketing. Borsodi wrote extensively on the phenomenon--the increased reliance on brand differentiation, packaging, and advertising--in *The Distribution Age*. That entire book was an elaboration of the fact that, as he stated in the Preface, production costs fell by perhaps a fifth between 1870 and 1920, while at the same time the cost of marketing and distribution had nearly tripled (we've already examined the marketing aspect of the phenomenon in Chapter One).[31] "[E]very part of our economic structure," he wrote, was "being strained by the strenuous effort *to market profitably what modern industry can*

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[28] Stein, pp. 28-30.
[29] Ibid., p. 65.
[30] Bain, pp. 114-15.
[31] Ralph Borsodi, *The Distribution Age* (New York and London: D. Appleton and Company, 1929), p. v.

produce."[32]

Kirkpatrick Sale described the even greater relative costs of marketing gimmickry, in addition to physical distribution costs, in the 1970s:

> ...the complications [in cost-differential between large- and small-scale production] rose not in the plants but far downstream from the lathes and belts and assembly lines. First, distribution. The more goods that are produced, the wider the market area must be, hence the more expensive the costs of distribution... throughout that area; it is now an accepted standard in the U.S. that, particularly for consumer goods, the unit costs of distribution will be higher than those of production, and they will increase as the price of gasoline goes up. Second, advertising. Mass production naturally necessitates sufficient advertising to create a mass market, and the more extensive it is the more expensive--which is why name-brand items are always more expensive than generics.

I can't help but interject here on another reason that name-brand items are more expensive. The sale of generic products by the manufacturers of name-brand goods is a form of dumping, directly analogous to the dumping of surplus product overseas by domestic manufacturers protected behind tariff walls. The overbuilt manufacturing corporation must minimize idle capacity to keep unit costs down, but cannot dispose of its full product at cartel prices when running at full capacity. The solution is to sell as much of the product as possible at oligopoly markup, and then dispose of the rest at whatever price it will bring--whether by foreign dumping or by repackaging as generics. It's otherwise known as price discrimination, the classic monopolist's strategy of setting different prices for the same product based on ability to pay. Anyway, Sale continues:

> (The high cost of advertising also tends to keep smaller and cheaper firms out of a market--creating an "entry barrier," in economic terms--thus reducing the competition that might lead to lower consumer prices.) Finally, promotion and packaging. In markets that are saturated, and where Brand A is not especially different from Brand B, it is necessary to find gimmicks that make a product stand out--bigger boxes, added partitions, toys, contests--and lead to added costs.[33]

As with "x-efficiency" in our discussion above, the costs of the "push" distribution made necessary by large scale probably outweigh any savings in unit cost resulting from economy of scale iself. As we already saw in Chapter One, the shift from bulk commodity sales to brand specification and pre-packaging resulted in a price increase of some 300% for essentially the same goods. Barry Stein compared the price of Consumer Value Stores' private brand to the price CVS charged for the nationally branded version of the same goods. Typical was the CVS store brand of multi-vitamin, which sold for $1.39

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[32] Ibid., p. 4.
[33] Kirkpatrick Sale, *Human Scale* (New York: Coward, McCann, & Geoghegan, 1980), pp. 315-16.

per 100 compared to $2.13 for 100 1-a-Day vitamins, and $0.63 per 100 buffered aspirin compared to $1.00 for 100 Bufferin. And as Stein points out, CVS being a discount store, the price it charged for national brands was itself considerably lower than the manufacturers' suggested list prices. The latter was $2.98 and $1.67 for 1-a-Day vitamins and Bufferin, respectively.

> .... the CVS products are all attractively packaged and in no obvious way inferior in appearance or presentation to the national brands (therefore, no great savings are being made by cheaper packaging).... [And] it is likely, from CVS' own description of its program, that these products, by and large, are being manufactured on order by relatively small firms (such as manufacturing chemists). If this is not the case and they are, in fact, being produced by the same type of large firm as the national products, one can still clearly conclude that, at least for products of this class, whatever economies of scale exist in production, they are being dwarfed by *diseconomies* in advertising, promotion, and physical distribution.[34]

In other words, the alleged economies of large-scale production result in such expensive, high-capacity facilities that large corporations are required to take heroic measures--often more expensive than the supposed unit cost savings from large scale--to move enough of their product to keep the plants running at full capacity.

Increased unit costs from idle capacity, given the high overhead of large-scale production, are the chief motive behind the push distribution model. Even so, the restrained competition of an oligopoly market limits the competitive disadvantage resulting from idle capacity--so long as the leading firms in an industry are running at roughly comparable percentages of capacity, and can pass their overhead costs onto the customer. The oligopoly mark-up included in consumer price reflects the high costs of excess capacity.

> It is difficult to estimate how large a part of the nation's production facilities are normally in use. One particularly able observer of economic tendencies, Colonel Leonard P. Ayres, uses the number of blast furnaces in operation as a barometer of business conditions. When blast furnaces are in 60 per cent. operation, conditions are normal. When this figure is exceeded, productive industry is experiencing a period of good times; and when it falls below that figure, it is in for a period of hard times.
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> It is obvious, if 60 per cent. represents normality, that consumers of such a basic commodity as pig iron must pay dividends upon an investment capable of producing two-thirds more pig iron than the country uses in normal times.

Borsodi also found that flour mills, steel plants, shoe factories, copper smelters, lumber mills, automobiles, and rayon manufacturers were running at similar or lower percentages

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[34] Stein, pp. 67-68.

of total capacity.[35] Either way, it is the consumer who pays for overaccumulation: both for the brand name markup and marketing cost of distributing overproduced goods when industry runs at full capacity, and for the high overhead when the firms in an oligopoly market all run at low capacity and pass their unit costs on through administered pricing.

Furthermore, Borsodi's law does not apply merely to the relative efficiencies of large versus small factories; it also applies to the relative efficiencies of factory versus home production. Borsodi argued that for most light goods like food, textiles, and furniture, the overall costs were actually lower to manufacture them in one's own home. The reasons were the same ones put forward by Kropotkin and Mumford, with which we will deal more closely under our discussion of neotechnic in Part Four: the electric motor put small-scale production machinery in the home on the same footing as large machinery in the factory. Although economies of scale in production are available, on an ever diminishing level, up to a considerable scale of production, the majority of economies of machine production are captured with the bare adoption of the machinery itself, even with household electrical machinery. After that, the production cost curve is very shallow, while the distribution cost curve is steep.

Borsodi's first study of the economics of home manufacture involved the home-grown tomatoes that his wife canned. Expressing some doubts in response to Mrs. Borsodi's confidence that it "paid" to do it, he systematically examined all the costs going into the tomatoes, including the market value of the labor they put into growing them and canning them, the cost of the household electricity used, and every other cost they could think of. Even with all these things factored in, Bordodi still found the home product cost 20-30% less than the canned tomatoes at the market. The reason? The home product was produced at the point of consumption, and had zero distribution cost. The admittedly (if modest) unit cost savings from large-scale machinery were not enough to offset the enormous cost of distribution and marketing.[36]

Borsodi went on to experiment with home production of clothing with loom and sewing machine, and with building furniture in the home workshop.

> I discovered that more than two-thirds of the things which the average family now buys could be produced more economically at home than they could be brought factory made;
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> --that the average man and woman could earn more by producing at home than by working for money in an office or factory and that, therefore, the less time they spent working away from home and the more time they spent working at home, the better off they would be;
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> --finally, that the home itself was still capable of being made into a productive and

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[35] *The Distribution Age*, pp. 42-43.
[36] Ralph Borsodi, *Flight From the City: An Experiment in Creative Living on the Land* (New York, Evanston, San Francisco, London: Harper & Row, 1933, 1972), pp. 10-15.

creative institution and that an investment in a homestead equipped with efficient domestic machinery would yield larger returns per dollar of investment than investments in insurance, in mortgages, in stocks and bonds....

These discoveries led to our experimenting year after year with domestic appliances and machines. We began to experiment with the problem of bringing back into the house, and thus under our own direct control, the various machines which the textile-mill, the cannery and packing house, the flour-mill, the clothing and garment factory, had taken over from the home during the past two hundred years....

In the main the economies of factory production, which are so obvious and which have led economists so far astray, consist of three things: (1) quantity buying of materials and supplies; (2) the division of labor with each worker in industry confined to the performance of a single operation; and (3) the use of power to eliminate labor and permit the operation of automatic machinery. Of these, the use of power is unquestionably the most important. today, however, power is something which the home can use to reduce costs of production just as well as can the factory. The situation which prevailed in the days when water power and steam-engines furnished the only forms of power is at an end. As long as the only available form of power was *centralized* power, the transfer of machinery and production from the home and the individual, to the factory and the group, was inevitable. But with the development of the gas-engine and the electric motor, power became available in decentralized forms. The home, so far as power was concerned, had been put in position to compete with the factory.

With this advantage of the factory nullified, its other advantages are in themselves insufficient to offset the burden of distribution costs on most products....

The average factory, no doubt, does produce food and clothing cheaper than we produce them even with our power-driven machinery on the Borsodi homestead. But factory costs, because of the problem of distribution, are only first costs. They cannot, therefore, be compared with home costs, which are final costs.[37]

Even the internal economies of the factory, it should be added, were balanced by other internal diseconomies: the overhead costs of superintendence and administration, and the dividends and interest on capital.[38] Since first reading Borsodi's account I have encountered arguments that his experience was misleading or atypical, given that he was a natural polymath and therefore perhaps a quicker study than most, and therefore failed to include learning time in his estimate of costs. Still, Borsodi's case studies are a useful counter to claims that economies of scale are inherent in the greater technical efficiency of large-scale machinery. And the savings in unit cost Borsodi demonstrated, if true, would be sufficient to compensate a fair amount of learning time.

The internal economies resulting from division of labor, specifically (which Borsodi acknowledged in the quote above), are also greatly exaggerated. Stephen Marglin argued

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[37] Ibid., pp. 17-19.
[38] Ralph Borsodi, *This Ugly Civilization* (Philadelphia: Porcupine Press, 1929, 1975), pp. 34, 37.

that the economies in question resulted, not from division of labor as such, but from the separation and sequencing of tasks. Nearly the same economies could be achieved by a single workman or group of workmen in a small shop, by such separation and sequencing. To illustrate, he took Adam Smith's famous example of the pin factory and stood it on its head. An individual cottage workman, instead of painstakingly making one pin at a time, might draw out and straighten the wire for an entire run of production, then cut all the wire, then sharpen it all, etc., dividing the total operation into the very same subtasks as in Smith's pin factory.[39]

One alleged reason for economies of large-scale production is that large scale permits ever more specialized production machinery. But as Adam Smith pointed out, the profitability of division of labor is determined by market size; and as we shall see in Chapter Thirteen, when transportation ceases to be subsidized, so that the savings from maximal automation with highly specialized machines are offset by the true cost of long-distance distribution, the spurious economies of excessive division of labor disappear. When all costs are taken into account, it is more efficient overall to produce most goods in short production runs, for local markets, on general purpose machinery. Without artificially large market areas resulting from artificially cheap distribution, the demand in the smaller market areas would be insufficient in most cases to operate expensive specialized machinery at full capacity. Unit costs would be lower with frequent changes of product line on the same general-purpose machinery.

And even in the case of the largest existing corporations under state capitalism, with artificially large market areas resulting from subsidized transportation, their attachment to the largest-scale machinery is often misguided. While individual machines may be "super-efficient" from the standpoint of minimizing unit costs *of that particular stage of production*, they are often quite disruptive and inefficient from the standpoint of the overall flow of production. Their adoption is typically associated with the "batch-and-queue" operation of American Sloanist industry (about which more in Chapter Eight), which (as the authors of *Natural Capitalism* put it) optimizes the efficiency of individual steps in the production process at the expense of pessimizing the overall flow of production. Their excessive "efficiency," from the perspective of the overall production process, means that they generate excess inventories and buffer stocks that raise costs and disrupt flow. On the other hand, a smaller and less "efficient" machine that is compatible with the other stages of production may result in improved flow and greatly reduced overall cost, despite the higher unit costs of that particular stage. Consider the case of Pratt & Whitney:

> Traditional substitutions of complex machines for people can backfire, as Pratt & Whitney discovered. The world's largest maker of jet engines for aircraft had paid $80 million for a "monument"--state-of-the-art German robotic grinders to make turbine blades. The grinders were wonderfully fast, but their complex computer controls required about as many technicians as the old manual production system had required machinists. Moreover,

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[39] Stephen Marglin, "What Do Bosses Do?"

> the fast grinders required supporting processes that were costly and polluting. Since the fast grinders were meant to produce big, uniform batches of product, but Pratt & Whitney needed agile production of small, diverse batches, the twelve fancy grinders were replaced with eight simple ones costing one-fourth as much. Grinding time increased from 3 to 75 minutes, but the throughput time for the entire process decreased from 10 days to 75 minutes because the nasty supporting processes were eliminated. Viewed from the whole-system perspective of the complete production process, not just the grinding step, the big machines had been so fast that they slowed down the process too much, and so automated that they required too many workers. The revised production system, using a high-wage traditional workforce and simple machines, produced $1 billion of annual value in a single room easily surveyable from a doorway. It cost half as much, worked 100 times faster, cut changeover time from 8 hours to 100 seconds, and would have repaid its conversion costs in a year even if the sophisticated grinders were simply scrapped.

When entire processes are taken into account, "excessive scale or speed at any stage of production turns the smooth flow of materials into turbulent eddies and undertows that suck down earnings and submerge entire industries."[40]

Another example comes from the cola industry, where the most "efficient" large-scale machine creates enormous batches that are out of scale with the distribution system, and result in higher unit costs overall than would modest-sized local machines that could immediately scale production to demand-pull. The reason is the excess inventories that glut the system, and the "pervasive costs and losses of handling, transport, and storage between all the elephantine parts of the production process."[41]

Of course the authors of *Natural Capitalism* exaggerate the market penalties of inefficiency in such cases. The pressure to remedy such over-specialization and over-automation is hardly overwhelming in most cases. Large industry often operates with forms of production that are capital-intensive and specialized far beyond the point of increasing costs, simply because all the firms in an industry share the same institutional culture and consequently need not be overly concerned with any competitive pressure to minimize costs. Without cartelized markets and subsidies, the issue of jet engine manufacturing technology would probably be moot; in an unregulated market, with unimpaired competition and fully internalized costs, there likely wouldn't be any jet engine manufacturers in the first place.

E. The Link Between Size and Innovation.

The superior innovativeness of the large corporation, such a sacred cow for Schumpeter and Galbraith, is also questionable at best.

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[40] Paul Hawken Amory Lovins, and L. Hunter Lovins. *Natural Capitalism: Creating the Next Industrial Revolution* (Boston, New York, London: Little, Brown, and Company, 1999), pp. 128-29.
[41] Ibid., p. 129.

T.K. Quinn, a former Vice President of GE (writing in the heyday of managerialist liberalism), viewed the oligopoly firm's role in the innovation process as largely parasitic:

> I know of no original product invention, not even electric shavers or heating pads, made by any of the giant laboratories or corporations, with the exception of the household garbage grinder.... The record of the giants is one of moving in, buying out, and absorbing the smaller creators.[42]

Paul Baran and Paul Sweezy, in *Monopoly Capital*, commented on Quinn's rhetorical bombshell:

> ...the corporation knows how to use for its own ends the very weaknesses of the small enterprise which it has outgrown. When a new industry or field of operation is being opened up, the big corporation tends to hold back deliberately and to allow individual entrepreneurs or small businesses to do the vital pioneering work. Many fail and drop out of the picture, but those which succeed trace out the most promising lines of development for the future.[43]

John Jewkes, surveying the period from 1900 to 1958, found that comparatively few of the major inventions of the 20th century came from large organizations. Out of 61 of the most important inventions, 33 were individual efforts, seven were of mixed or unclear origins, and only 21 the product of corporate research labs. In even the latter group, five of the inventions came from smaller corporations. And the inventions coming out of the large corporations often involved research teams that were quite small,[44] what today might be called "skunk works." To take one example:

> At a $5 billion survey comany, three of the last five new-product introductions have come from a classic skunk works. It consists at any one time of eight to ten people, and is located in a dingy second-floor loft six miles from the corporate headquarters. The technical genius is a fellow whose highest degree is a high-school equivalency diploma... (although the company has literally thousands of Ph.D. scientists and engineers on its payroll)....
>
> The group's first product, now a $300 million per year sales item, was fully developed (prototyped) in twenty-eight days. Last year a major corporate product bombed. A skunk works member asked for and got permission to take two samples home and set them up in his basement. He used one as a benchmark. He tinkered with the other for about three weeks and corrected virtually all of its flaws (with nickel and dime items), actually improving performance over original design specs by a factor of three. The president visited his basement and approved design changes on the spot. The latest of the group's successes was designed in (covert) competition with a corporate engineering "team" of almost 700 people.[45]

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[42] T.K. Quinn, *Giant Business: Threat to Democracy: The Autobiography of an Insider* (New York, 1953), p. 117, cited in Paul Baran and Paul Sweezy, *Monopoly Capital*, p. 49.
[43] Ibid., p. 49.
[44] John Jewkes, David Sawers, and Richard Stillerman, *The Sources of Invention* (London: MacMillan & Co Ltd, 1958), pp. 72-88.
[45] Tom Peters, *In Search of Excellence: Lessons from America's Best-Run Companies* (New York: Warner Books, 1982), pp. 211-212.

Arnold Cooper found, likewise, that the small firm made better use of its R&D dollars, and that its technical workers were on average more capable.[46] And Jacob Schmookler testified before Congress in 1965 that there is an inverse relationship between firm size and productivity per research dollar:

> Existing comprehensive indexes of outputs of new technical knowledge suggest that beyond a certain not very large size, the bigger the firm, the less efficient its knowledge-producing activities are likely to be. Evidently, as the size of the firm increases, there is a decrease per dollar of R&D in (a) the number of patented inventions, (b) the percentage of patented inventions used commercially, and (c) the number of significant inventions.[47]

A National Science Foundation study of technical innovation between 1953 and 1973 found that the smallest firms produced "about 4 times" as many major innovations per R&D dollar as did the mid-sized firms, and 24 times as many as the largest firms.[48]

Adams and Brock contrast the innovativeness of the pre-WWII auto industry, with its many modest-sized firms, with the stagnation under the Big Three during the first decades of the postwar era.

> ...[W]ith the demise of the independents and the concentration of industry control in the hands of three giant firms, the pace of product innovation slackened significantly. Innovations like front-wheel drive, disc brakes, fuel injection, fuel-efficient subcompacts, and utilitarian minivans languished in the hands of the Big Three.... "The major features of today's automobiles--V-8 engines, automatic transmissions, power steering, and power brakes--are all prewar innovations. These have been considerably improved and refined over the past twenty-five years," [economist Lawrence J. White] concluded in 1971, "but still the industry has been uninterested in pursuing alternatives. The suspension, ignition, carburetion, and exhaust systems are fundamentally the same."[49]

Paul Goodman also viewed the automobile industry as a typical example of this aspect of oligopoly behavior: "Three or four manufacturers control the automobile market, competing with fixed prices and slowly spooned-out improvements."[50] As just one example, consider the way the Big Four automakers colluded to suppress antipollution devices. They agreed that no company would announce or install any innovation in antipollution exhaust devices without an agreement of the other three. They exchanged patents and agreed on a formula for sharing the costs of patents acquired from third parties.[51]

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[46] "R&D is More Efficient in Small Companies," *Harvard Business Review* (May-June 1964), in Barry Stein, p. 35.
[47] Quoted in Stein, p. 34.
[48] Adams and Brock, *The Bigness Complex*. 1st edition, p. 52.
[49] *The Bigness Complex*, 2nd ed., pp. 48-49.
[50] Paul Goodman, *People or Personnel*, p. 58, in *People or Personnel* and *Like a Conquered Province* (New York: Vintage Books, 1963, 1965), p. 58.
[51] Mark J. Green, et al., *The Closed Enterprise System*, pp. 254-256.

In the computer field, Intel saw the main market for its micro-processors as giant institutional clients, and IBM dismissed the idea of small computers for the home. The desktop computer was created by members of the Homebrew Computer Club, who, "playing with electronic junk..., combined Intel's microprocessor with spare parts," and built the first cheap computers able to "run on the kitchen table."[52] Apple produced its first desktop computers for the commercial market in Steve Jobs' garage.[53]

Harvey Leibenstein noted that the adoption of even known technologies and best practices--even when they are known to result in astronomical increases in productivity--occurs at a glacial pace in concentrated industries with little competitive pressure.

> ...there is a great deal of evidence that the delay time between invention and innovation is often exceedingly long (sometimes more than 50 years), and the lag time between the use of new methods in the "best practice" firms in an industry and other firms is often a matter of years. Salter in his study on *Productivity and Technical Change*... points to the following striking example: "In the United States copper mines, electric locomotives allow a cost saving of 67 per cent yet although first used in the mid-twenties, by 1940 less than a third of locomotives in use were electric."[54]

The drug industry's massive R&D spending is almost entirely directed toward gaming the patent system, rather than genuine innovation. A majority of R&D spending goes toward tweaking existing drugs on the verge of going generic just enough to justify a new patent for the "me, too" version of the old cash cow, rather than to fundamentally new drugs ("new molecular entities").[55] Even when fundamentally new drugs are developed, a majority of the total cost of is not for developing the drug itself, but for testing all the possible variants of the drug in order to secure patent lockdown against competition. "Quasibill," a frequent commenter at my blog with a background in engineering, is eloquent on the subject:

> What generally gets included in the accounting for research costs are some amazing things, that I can't do justice to on a blog - I get surprised everytime I talk to my friends in the industry about how much waste is involved - but it's all invisible to them. It's just "how it needs to be for the FDA to keep track of everything." If you want, I can give you some examples, but I'd rather focus on another point for now.
>
> Namely that what big pharma is researching is cancer meds. It's not. In the rare instances that big pharma produces and markets such medicines, it has purchased them from small start-ups that themselves are the result normally of a university

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[52] Johan Soderberg, *Hacking Capitalism: The Free and Open Source Software Movement* (New York and London: Routledge, 2008), p. 17.
[53] Adams and Brock, 2nd edition, pp. 52-56.
[54] Leibenstein, "Allocative Efficiency vs. 'X-Efficeincy,'" p. 403.
[55] Ibid., pp. 57-58.

> laboratory's work. When big pharma cites to billions of research costs, what it is talking about is the process whereby they literally test millions of very closely related compounds to find out if they have a solid therapeutic window. This type of research is directly related to the patent system, as changing one functional group can get you around most patents, eventually. So you like to bulk up your catalogue and patent all closely related compounds, while choosing only the best among them, or, if you're second to market, one that hasn't yet been patented.
>
> This work is incredibly data intensive, and requires many Ph.D's, assistants, and high powered computers and testing equipment to achieve. But it is hardly necessary in the absence of a patent regime. In the absence of patents, (and of course the FDA), you could just focus on finding a sufficient therapeutic window, and cut out the remaining tests. It would be an issue of marginal costs to determine whether someone would go to the effort to find a "better" therapeutic window, or related parameter.[56]

Quasibill also noted that Big Pharma displayed the general cultural atmosphere of waste that we normally identify with the Land of Cost-Plus Pricing, usually found in military contractors and the like.

> Have you ever been to a Merck campus (yes, they are campuses, not buildings or sites)? If you look at the structure of the business, the first thing that strikes you is that it looks like Detroit, circa 1980. And there's only one reason for that - government protection of their profit margin. A good friend of mine works there - makes over 100G a year in a union job, where he gets written up if he does too MUCH work. And yet while Detroit has suffered and is still paying for employing such a business model, Pharma's been posting huge profits. Why's that?[57]

And a great deal of Big Pharma's drug R&D is conducted at taxpayer expense, either through subsidies to the drug giants, or through research actually carried out in university and government agency labs.[58]

The one thing the massive organizational size and expenditure *aren't* very good at, according to Michael Perelman, is innovation. They attempt to compensate for their mediocre performance in developing new drugs "by more intensive marketing, taking over smaller, more innovative companies, and laying off workers."[59] He quotes a *Wall Street Journal* article:

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[56] Comment on Kevin Carson, "Intellectual Property Stifles Innovation," Mutualist Blog, May 21, 2006. http://mutualist.blogspot.com/2006/05/intellectual-property-stifles.html

[57] Comment on Ronald Bailey, "This Is One Reason People Hate Drug Companies," Reason Magazine Hit&Run blog, February 24, 2006, http://www.reason.com/blog/show/112756.html.

[58] Adams and Brock, 2nd edition, p. 58.

[59] Michael Perelman, "Pharmaceutical Crackup?" *EconoSpeak*, December 8, 2007. <http://econospeak.blogspot.com/2007/12/pharmaceutical-crackup.html>

> The rise of generics wouldn't matter so much if research labs were creating a stream of new hits. But that isn't happening. During the five years from 2002 through 2006, the industry brought to market 43% fewer new chemical-based drugs than in the last five years of the 1990s, despite more than doubling research-and-development spending...
>
> The dearth of new products has led the industry to invest heavily in marketing and legal tactics that squeeze as much revenue as possible out of existing products. Companies have raised prices; the average price per pill has risen 63% since 2002, according to Michael Krensavage, Raymond James analyst. Companies raised advertising spending to $5.3 billion in 2006 from $2.5 billion in 2001 and since 1995 have nearly tripled the number of industry sales representatives to 100,000....
>
> The industry spent $155 million on lobbying from January 2005 to June 2006, according to the Center for Public Integrity, on "a variety of issues ranging from protecting lucrative drug patents to keeping lower-priced Canadian drugs from being imported." The industry also successfully lobbied against allowing the federal government to negotiate Medicare drug prices, the center said. The lobbying has drawn fire from politicians, doctors and payers, and damaged the industry's public image.[60]

After a decade or so of relative fluidity caused by the disruptive onset of globalization, global capital has settled back (with joint ventures and strategic alliances) into the same oligopoly pattern as that of the old American economy. That's especially true of the auto industry. After a brief period of admittedly traumatic shock, when they first encountered vigorous Japanese and European competition,

> the Big Three began to spin a far-reaching web of joint ventures and alliances with their major foreign competitors. Thus, General Motors (still the world's biggest auto manufacturer) has joned with Toyota (then the largest importer of automobiles into the U.S. market) to jointly produce compact cars in California. G also has acquired sizable ownership in Japanese carmakers Isuzu and Suzuki, built a jointly owned production plant with Suzuki in Canada, and acquired half-ownership of Swedish manufacturer SAAB. Ford, for its part, acquired a 25 percent ownership stake in Mazda (later expanded); joined with Mazda to acquire an ownership stake in the Korean car firm Kia; joined with Mazda to build a production facility in Flat Rock, Michigan; combined its Latin American operations with Volkswagen (subsequently dissolved); and engaged in partnerships with Nissan to jointly produce vehicles (in addition to more recently acquiring outright control of Jaguar, Volvo, and rolls Royce). Chrysler joined with Mitsubishi to build the Diamond Star Motors assembly facility in Bloomington, Illinois, while spawning a variety of partnership pacts with other global car firms.

At the same time, the major American and European auto manufacturers participate in

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[60] Barbara Martinez and Jacob Goldstein, "Big Pharma Faces Grim Prognosis: Industry Fails to Find New Drugs to Replace Wonders Like Lipitor," *Wall Street Journal*, December 6, 2007, in Ibid.

the respective USCAR and EUCAR R&D consortia.[61] So thanks to joint ventures, foreign automakers have reason to view themselves more as partners than as competitors to the American firms in this country. Lawrence Wilkinson brilliantly described the way in which corporations regulate innovation, as oligopoly reasserts itself:

> We're headed to a world that's more oligopolylike, a transition from a period of robust change to a period of lock in.... All over, there's a settling down, a slowing of the pace of change. Companies aren't really killing innovation -- they're rationalizing it to manage its pace. The definition of oligopolistic economics is three or so players behaving in lockstep with the marketplace. They don't necessarily collude, but they develop ways of signaling pricing and containing innovation.[62]

F. Economy of Scale in Agriculture.

If there is one industry in which the triumphalist rhetoric of "superior efficiency" of large size is unjustified by reality, it is large-scale agribusiness. The reader has surely heard the rhetoric: claims that without "Green Revolution" techniques "the world would starve," ADM's boasts that "we feed the world," etc.

But the claimed "superior efficiency" of the large-scale agribusiness operation over the family farm is illusory. Likewise unfounded is the claimed superiority of mechanized, chemical agriculture, whether family or corporate, over more labor-and soil-intensive forms of production. The large agribusiness operation, with mechanized row-cropping and monocultures, is the most efficient "solution" to an artificial problem. The techniques of the so-called Green Revolution are only more efficient if one assumes from the outset the goals of the latifundistas and other state-privileged landed oligarchs in the Third World, and of the giant agribusiness interests in the West.

According to a 1973 USDA pamphlet (of all things), even mechanized farming reaches peak efficiency at a fairly small scale. Like all other internal economies of scale, economy of scale in mechanized farming relies mainly on making full use of equipment:

> The fully mechanized one-man farm, producing the maximum acreage of crops of which the man and his machines are capable, is generally a technically efficient farm. From the standpoint of costs per unit of production, this size farm captures most of the economies associated with size.... Beyond that range there may be diseconomies due to the increasing burden of supervision and communication between supervisor and workers.... The incentive for increasing farm size beyond the technically optimum one-man form is not to reduce costs per unit of production, but to increase

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[61] Adams and Brock, 2nd edition, pp. 160-61.
[62] Quoted in Harriet Rubin, "Power," Fast Company No. 65 (November 2002), p. 76.

the volume of business, output, and total income.[63]

More specifically, USDA studies have found that the optimal size farm for raising vegetables (using conventional mechanized techniques) is around 200 acres, while the optimal cereal farm in the Midwest tops out at 800 acres.[64]

The secret to the success of large-scale agribusiness is not greater internal efficiency, but its greater efficiency at manipulating the state for benefits. The real difference in profitability comes from the channeling of state-subsidized inputs to large-scale agribusiness. As California family farmer Berge Bulbulian testified to Congress,

> ...Probably the biggest obstacle we face in our struggle to save the family farm is the attitude of many Americans, including some farm people, that the family farm is obsolete, it is inefficient, and therefore unable to compete with the efficient and well-financed conglomerates. Well-financed they are, but efficient they are not. I challenge any giant agribusiness corporation to match my efficiency. There is no way a large concern with various levels of bureaucracy and managed by absentee owners can compete in terms of true efficiency with a small, owner-operated concern....
>
> ....No, I can't sell for a loss and make it up in taxes, nor can I lose on the farming end of the business and make it up at another level as a vertically integrated operation can....
>
> I have no political clout and lobbying to me means writing a letter to my Congressman or Senator. But that is not what efficiency is all about.
>
> Efficiency has to do with the relation between input and output. No, the big agribusiness firms are not efficient except in farming the government.[65]

The family farm is more efficient than the large agribusiness operation (what Mason Gaffney calls "latifundia") in terms of output per acre. Gaffney found that while big corporate farms have somewhat higher output per man-hour, their output per acre is actually less than that of small farms.

> One may at least firmly conclude that large farm units are less improved and less peopled than small and medium-sized farms. There are two possible interpretations. One is that big farms are more efficient, getting more from less, but that is refuted by

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[63] W.R. Bailey, *The One-Man Farm* (Washington, D.C.: USDA Agriculture Economic Research Service, 1973), pp. v, 3. Quoted in L.S. Stavrianos, *The Promise of the Coming Dark Age* (San Francisco: W.H. Freeman and Company, 1976), p. 38.

[64] Kirkpatrick Sale, *Human Scale*, p. 233.

[65] *Farmworkers in Rural America 1971-1972*. Hearings before the Subcommittee on Children and Youth of the Committee on Labor and Public Welfare, United States Senate, 92nd Congress, 11 January 1972, Part 3A, p. 1156. In L.S. Stavrianos, *The Promise of the Coming Dark Age*, pp. 38-39.

> their getting less output per $L. The other is that Veblen was right, many of them are oversized stores of value, held first to park slack money and only secondly to produce food and fiber, and complement the owner's workmanship. The Florida 9 may represent a home grown rural "third world" of large, underutilized landholdings that preempt the best land and force median farmers onto small farms on low-grade land.[66]

According to Frances Moore Lappé, large landowners--both in the U.S. and in the Third World--are not only least productive in terms of output per acre, but they hold huge tracts of arable land out of cultivation. In Colombia, for example, a 1960 study found that the largest landowners, who controlled 70% of the land, planted only 6% of it.[67] The best land, belonging to the large landholders, was often used for grazing cattle instead of growing staple crops.[68] In Guatemala, Del Monte planted only 9,000 of its 57,000 acres.[69] Small cultivators are consistently found to produce greater outputs per acre. In India, the smallest farms produce per-acre outputs a third higher than the larger ones. In Thailand, farms of 2-4 acres produce 60% more rice per acre than farms of over 140 acres. A World Bank study in Latin America found a three- to fourteen-fold difference in yield per acre between small and large farms.[70]

And bear in mind that these comparative figures on optimal economy of scale apply only when the large- and small-scale operations are both engaged in conventional mechanized row-cropping. The use of intensive raised-bed techniques for vegetables (the biointensive method of John Jeavons, for example) is far more productive than conventional commercial agriculture in terms of output per acre.

> [T]he small farmer working with his own labour on a family holding, has been shown in a wide variety of developing countries... to produce more per acre than big estates. Some of the highest yields are to be found in countries where acre limitations are strictly enforced. This productivity is secured not by heavy machines which drink gasoline and can easily damage fragile soils, but by hard work with light equipment which is by definition less prone to generate ecological risks. Fertilizers and pesticides are less lavishly used, human and animal wastes are more carefully husbanded. Greater personal care keeps terraces in trim, shade trees planted, gullies forested. And earnings are not spent, as is often the case in semi-feudal economies, on acquiring more land for extensive use, thus pushing up land prices and driving working farmers away from the soil. Nor are they withdrawn altogether from the rural economy, by the development of 'Western' standards of consumption or an over-

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[66] Mason Gaffney, from Chapter 10 of *Ownership, Tenure, and Taxation of Agricultural Land,* edited by Gene Wunderlich (Westview Press), excerpted in Dan Sullivan's seminar on "The Myth of Corporate Efficiency" at SavingCommunities.Org http://savingcommunities.org/seminars/corpefficiency.html.
[67] Frances Moore Lappé, *Food First: Beyond the Myth of Scarcity* (New York: Ballantine Books, 1977), p. 14.
[68] Ibid., p. 42.
[69] Ibid., p. 107.
[70] Ibid., pp. 183-84.

affection for numbered accounts in Swiss banks.[71]

John Jeavons, in developing successive versions of his biointensive farming techniques,[72] has managed to reduce to four or five thousand square feet the space needed to meet the bare subsistence requirements of the average person. Of course, it is a relatively spare and monotonous diet, with the vast majority of the space devoted to high carbohydrate cereal grains, legumes or tubers that concentrate a great deal of caloric value in a small area. Only a small fraction of the space, perhaps 20%, can be spared for fruits and vegetables to supplement the diet with vitamins. But 4000 square feet is about half the space available even on a standard suburban residential lot. Even for the cul-de-sac denizen, that leaves considerable space for additional vegetable beds, a few dwarf fruit or nut trees and berry bushes, and a patch of alfalfa or some extra corn to feed chickens and rabbits. The careful prevention of rainwater runoff, the saving of surplus rain in cisterns for dry season irrigation, the composting of kitchen scraps and human waste--all these things would make possible a nearly closed loop of food production.

In fact, some 15% of the world's total food production currently takes place in cities. In China, back garden, rooftop and small lot production together supply 85% of urban vegetable consumption, along with significant amounts tree crops and meat.[73]

All this is not to say that complete household sufficiency in food, or the elimination of division of labor between town and country, is either necessary or desirable. It only means that it is possible. A return to agriculture based on intensive work with the spade, u-bar and fork would not mean starvation. It would mean greater output per acre than is presently the case. And based on Borsodi's experience, even if the production process itself is more labor-intensive in such small-scale production than mechanized conventional farming, the overall labor required might still be less from the point of view of the subsistence farmer substituting labor in direct production for wage labor to earn the money to buy food; the wage laborer buying store food must, after all, work enough to pay the transportation and marketing costs, which comprise more of the typical food dollar than the actual production.

It's especially important to remember that there's no such thing as generic or immaculate "technology," independent of the purposes of those who design it. The decision to develop one techology, rather than another, is made from the perspective of someone's interest. The choice of a particular technology is an answer to a question--so we should always be aware of who's asking the question. The avenues of technological development taken by the Green Revolution reflect a conscious political decision to develop technologies of use primarily to large-scale agribusiness with access to

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[71] Barbara Ward and Rene Dubos, *Only One Earth*, in Godfrey Boyle and Peter Harper, eds. *Radical Technology* (New York: Pantheon Books, 1976), p. 249.
[72] John Jeavons, *How to Grow More Vegetables* (Berkeley and Toronto: Ten Speed Press, 1974).
[73] Hawken et al, *Natural Capitalism*, p. 200.

government-subsidized irrigation water and other inputs, rather than technologies that would increase the productivity of the peasant smallholder without subsidized water.

Large-scale plantation agribusiness, typically, flourishes only when supported by government-subsidized irrigation projects. For example, a large share of American produce comes from rain-poor areas of the West: vegetables are actually imported by rain-rich regions like New England, because subsidized irrigation water makes the Western operations artificially competitive. It is far more cost-effective in semi-arid regions, when irrigation is not subsidized, to use cisterns to save water from the limited rainy seasons for use through the dry period. For a subsistence farmer making intensive use of small spaces, runoff from the rainy season may well be sufficient to provide irrigation water during the dry spell. The main technical problem is providing enough storage tanks. The ITDG was quite successful in designing cheap water tanks made from local materials.[74] And biointensive horticulture, which minimizes plant spacings and maximizes soil cover, requires up to 88% less water than conventional large-scale farming.[75]

The so-called "Green Revolution" in the Third World, particularly, occurred in the context of a colonial history where peasant cultivators were pushed off of the best land and onto marginal land, and the most fertile, level land was used for plantation farming of cash crops. It is a myth that Third World hunger results mainly from primitive farming techniques, or that the solution is a technocratic fix. Hunger results from the fact that land once used to grow staple foods for the people working it is now used to grow cash crops for urban elites or for the export markets, while the former peasant proprietors are without a livelihood.

The techniques of subsistence production were often well-suited to the existing situation.

> Colonialism destroyed the cultural patterns of production and exchange by which traditional societies in "underdeveloped" countries had previously met the needs of the people. Many precolonial social structures, while dominated by exploitative elites, had evolved a system of mutual obligations among the classes that helped to ensure at least a minimal diet for all.... The misery of starvation in the streets of Calcutta can only be understood as the end-point of a long historical process--one that has destroyed a traditional social system.[76]

(It's also worth mentioning that colonial administrations, by ruling *through* the above-mentioned "exploitative elites," often removed all the traditional checks on their power.

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[74] George McRobie. *Small is Possible: A factual account of who is doing what, where, to put into practice the ideas expressed in E. F. Schumacher's SMALL IS BEAUTIFUL* (New York: Harper & Row, 1981)., p. 45.
[75] Hawken et al, *Natural Capitalism*, p. 210.
[76] Lappé, *Food First*, p. 100.

The British, e.g., turned the village headman in India into a tax farmer, and thus abrogated the cutomary peasant control of land in the village communes. The general phenomenon, turning local elites into landlords with absolute title in the modern European sense, was widespread throughout the colonial world.)

Native farming techniques, often derided by colonizers as primitive or backward, were in fact well-suited to local tradition as the result of generations of experience. Lappé cites A. J. Voelker, a British agricultural scientist in India during the 1890s:

> Nowhere would one find better instances of keeping land scrupulously clean from weeds, of ingenuity in device of water-raising appliances, of knowledge of soils and their capabilities, as well as of the exact time to sow and reap, as one would find in Indian agriculture. It is wonderful, too, how much is known of rotation, the system of "mixed crops" and of fallowing.... I, at least, have never seen a more perfect picture of cultivation.[77]

Colonial agricultural policy focused all subsidies to research and innovation on export crops, leaving subsistence techniques to stagnate. Slaves and hired farm laborers had no incentive for preserving traditional knowledge, let alone refining technique. To the contrary, farm laborers had every incentive to do the bare minimum, reduce output, and even sabotage production. (I believe Adam Smith had similar observations about the incentive effects of absentee land ownership in England.) The African peasant "went into colonialism with a hoe and came out with a hoe." The most important effect of plantation culture, perhaps, was a "narrowing of the experience of agriculture to plantation work... [which] over generations robbed entire populations of basic peasant farming skills."[78] Lappé cited the observations of Pascal de Pury, a WCC agronomist, that

> often [appropriate] technology turns out to be rediscoveries of a people's traditional practices that Western arrogance caused them to be ashamed of. Over and over again he finds peasant cultures that had refined and adopted techniques over centuries to be losing them in our time. What stands to be irretrievably lost is... successful, productive techniques uniquely suited to local conditions....[79]

It is impossible to understand the so-called Green Revolution as it occurred in the Third World, unless one first understands the political context in which it took place. The central facet of that context was the process by which the land of subsistence farmers was expropriated and turned over to cash crop cultivation, native populations were reduced to dependency, and formerly independent peasants were often forced to engage in cash crop production. The best land was often taken over by the colonial powers and handed over to settlers, and the former subsistence cultivators transformed into farm laborers.

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[77] Ibid., pp. 101-02.
[78] Ibid., p. 113.
[79] Ibid., p. 173.

> ...Throughout the colonies, it became standard practice to declare all "uncultivated" land to be the property of the colonial administration. At a stroke, local communities were denied legal title to lands they had traditionally set aside as fallow and to the forests, grazing lands and streams they relied upon for hunting, gathering, fishing and herding.
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> Where, as was frequently the case, the colonial authorities found that the lands they sought to exploit were already "cultivated", the problem was remedied by restricting the indigenous population to tracts of low quality land deemed unsuitable for European settlement. In Kenya, such "reserves" were "structured to allow the Europeans, who accounted for less than one per cent of the population, to have full access to the agriculturally rich uplands that constituted 20 per cent of the country. In Southern Rhodesia, white colonists, who constituted just five per cent of the population, became the new owners of two-thirds of the land.... Once secured, the commons appropriated by the colonial administration were typically leased out to commercial concerns for plantations, mining and logging, or sold to white settlers.[80]

Sometimes the labor of the dispossessed was secured by slavery and other forms of forced labor, although the colonial powers usually preferred to use direct taxation on people, land and houses to compel the native population to enter the wage labor market.

Lappé presents some instances of her own. For example, in 1815, following the British conquest of the Kandyan Kingdom (present day Sri Lanka), all central parts of the island were designated as crown land and sold for nominal prices to coffee planters, with government funding of surveying and road-building costs. In Java, the Dutch administration "authorized" village headmen (usually under the influence of bribes) to lease communal land to Dutch plantation companies. Often entire villages were thus "sold" to foreign planters, without the consent of the rightful owners of the land.[81] Colonial authorities worldwide similarly abrogated the traditional status of land, when it was the inalienable property of a village commune or clan, by making it--in violation of native law--usable as a pledge for debt. Likewise, such communally-owned land was often made seizable for non-payment of taxes by the individual cultivator.[82]

In addition, colonial authorities simultaneously granted protectionist privileges to settler plantations and imposed legal disabilities on independent native producers, through the mercantilist policies of shipping companies and produce marketing boards.[83]

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[80] "Development as Enclosure: The Establishment of the Global Economy," *The Ecologist* (July/August 1992) 133.
[81] Lappé, *Food First*, pp. 103-06.
[82] Ibid., pp. 114-15.
[83] Walter Rodney, "Chapter Five. Africa's Contribution to the Capitalist Development of Europe: The Colonial Period," in *How Europe Underdeveloped Africa* (Dar-Es-Salaam: Bogle-L'Overture Publications, London and Tanzanian Publishing House, 1973) Transcribed by Joaquin Arriola

Given this maldistribution of land through state-abetted land theft (either by colonial regimes or by landed oligarchies in collusion with Western agribusiness interests), the logical next step is for the state to divert inputs like subsidized irrigation systems, roads, and so forth, disproportionately to the large plantations while denying them to subsistence farmers. The state's direct subsidies and loan programs are set up so that only large holdings, with access to preferential benefits like state-subsidized irrigation, can qualify. Heavily state-subsidized agricultural R&D, likewise, is channelled in directions geared to increasing the profits of cash crop agriculture on the big plantations, rather than to increasing the productivity of small peasant holdings.

The "high-yielding variety" (HYV) seeds associated with the so-called Green Revolution are normally productive only under the most favorable conditions, like those prevailing on the big agribusiness plantations. The Green Revolution was a state-subsidized research project to develop plant varieties tailored to the prevailing conditions in the state-subsidized agribusiness sector. They are deliberately designed to be productive, in other words, under precisely the conditions provided by corporate agribusiness.

> ...[T]he term "high-yielding varities is a misnomer because it implies tha the new seeds are high-yielding *in and of themselves*. The distinguishing feature of the seeds, however, is that they are highly *responsive* to certain key inputs such as irrigation and fertilizer.... [W]e have chosen to use the term "high-response varieties" (HRV's) as much more revealing of the true character of the seeds.... Unless the poor farmers can afford to ensure the ideal conditions that will make these new seeds respond..., their new seeds are just not going to grow as well as the ones planted by better-off farmers....
>
> Just as significant for the majority of the world's farmers is that the new seeds show a greater yield variability than the seeds they replace. The HRV's are more sensitive to drought and flood than their traditional predecessors....
>
> HRV's are often less resistant to disease and pests. [They supplant] varieties that had evolved over centuries in response to natural threats in that environment.[84]

They are, in other words, "highly responsive" to plentiful water from subsidized irrigation projects, large-scale inputs of chemical fertilizer and pesticides, and monocultural growing conditions. And they are also most responsive on the kind of especially fertile, well-watered land that just happened to be stolen by landed elites under

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<http://www.marxists.org/subject/africa/rodney-walter/how-europe/index.htm>.
[84] Lappé, pp. 130-31.

the colonial regimes or post-colonial landed oligarchies.

Under the conditions of peasant subsistence farming, the traditional drought- and pest-resistant varieties are far more productive. Locally adapted varieties tend to be drought-resistant and hardy, and to produce steady yields under harsh conditions.[85]

Locally adapted varieties are also highly responsive to the kinds of inputs that are more likely to be within the means of the small subsistence farmer: for example, better plowing and harrowing techniques and weed elimination, crop rotation, green manuring, better soil conservation, and better moisture retention in the soil.[86]

"Green Revolution" seeds are like a genetically engineered superman who will die outside of his plastic bubble.

In Mexico, 97.7% of land devoted to corn and most land devoted to wheat lacked irrigation. The Institute for Agricultural Investigation, a Mexican research organization, set out to develop varieties of corn and wheat that would produce greater yields on small non-irrigated farms. But the Rockefeller Foundation concentrated on developing varieties that produced high yields in response to high levels of irrigation and synthetic fertilizer.

> ...The resulting new "miracle" strains enabled Mexico to become self-sufficient in wheat, but the beneficiaries were the wealthy landowners, who could afford the fertilizers and irrigation. The mass of the Mexican peasants have experienced increased unemployment or underemployment with the growing mechanization of the large estates.

The same pattern prevailed in India, Pakistan and the Philippines, where research went to developing seed varieties primarily of benefit to large landowners with access to subsidized irrigation water and fertilizer, rather than to the 70-90% farming non-irrigated land. At the same time, the resulting land hunger on the part of the great subsidized farmers has led to pressure to expropriate smallholders by abrogating traditional rights of land tenure, and to evict tenant farmers paying rent on land that is rightfully theirs. The landless and the underemployed rural proletariat, in turn, swell the urban slums with people who once fed themselves.[87] In addition, as Lappé observed (or perhaps, rather, recycled an observation at least as old as Henry George) that the increased productivity from Green Revolution seeds drives up rents, with crop share rents increasing from the traditional 50% to 70%.[88] Naturally, this further increases the tendency toward eviction of small holders and the consolidation of the large estates.

It is a widespread observation that the large plantations benefiting from Green

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[85] Ibid. p. 130.
[86] Ibid. pp. 150-51.
[87] Stavrianos, *The Promise of the Coming Dark Age*, pp. 42-44.
[88] Lappé, *Food First,* pp. 136.

Revolution techniques are likely to receive highly preferential access to subsidized inputs like irrigation water. According to Michael Perelman,

> ...It is true that the Green Revolution has increased the amount of wheat and rice produced in Asia. But it is also true that the adoption of this technology requires heavy government subsidies in the form of cheap credit, favorable foreign exchange rates, and high government support prices.... Much of the increase comes from the use of irrigation for prime agricultural lands. Extending irrigation is expensive and some observers even question whether it is possible to continue irrigating without depleting the ground water.[89]

As a good example of the big landed interests' privileged access to subsidized irrigation water, consider the case of Pakistan. The big landowners seek new dams to provide more subsidized water for their agribusiness plantations--and since they don't pay for it themselves, they're not very careful about how they use it:

> We, as a nation, tend to build, neglect and throw away, only to build again. There is no concept of maintenance. Pakistan has the largest contiguous irrigation system in the world. It is supposed to be a miracle of engineering that has helped increase our food production. But we don't maintain it. Operation, maintenance, and replacement costs a lot of money. Where is that money coming from?
>
> Some of the data in the recent World Bank report, "Pakistan's water economy running dry," is quite frightening. When comparing Pakistan with Australia, the report shows that in Australia, the entire cost of efficient operation, maintenance and replacement is paid by the actual users, whereas taxpayers pay the interest on any loans that may have been accrued in putting that water system into place.
>
> *In Pakistan, taxpayers - not users - are paying most of the operation and maintenance costs, no one is paying for replacement.... When we can't even look after our existing infrastructure, is there even a case for building new infrastructure?....*
>
> We have little additional water to mobilise. We've already used up everything that exists in our water cycle so when we say we're putting up another dam or reservoir, it doesn't necessarily mean there will be additional water coming in, we are just re-appropriating what's already in the system. *Who's going to pay for the additional investment? We've taken so many loans to be returned over a long term period, how much more can we sustain? Our water resource base is severely degraded because of pollution and atrophying and overuse, groundwater is being over-exploited.* Flooding and drainage problems are also going to get worse, partly because of climate change but also because of the way we manage our water system. The water infrastructure is

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[89] Michael Perelman, "Farming for Profit in a Hungry World: The Myth of Agricultural Efficiency," in Louis Junker, ed., *The Political Economy of Food and Energy* (Ann Arbor: University of Michigan, 1977), p. 34.

in terrible disrepair - everything is broken, there are leakages, powerful people create their own direct links. We have poor governance, low levels of trust, water productivity is extremely low, what we produce per acre, regardless of the crop, is still less than what others are producing....

Water rights in Pakistan is tied to ownership of land, so in spite of so many reforms, we still have very big farms owned by very powerful people, (rather than smaller farm owners) and landless peoples who actually work the land. The biggest farms are in southern Punjab and upper Sindh, while northern Punjab has smaller, more owner-worked farms. Where we have bigger landlords with their rent-seeking behaviour on the land, their payment for water is not a major consideration. Where sharecropping arrangements have been perpetuated, there isn't much impetus to change because the system suits the landowners.

So all we hear about is a demand for more water. The entire world is going on to use less water and grow more crops but here we are shouting for more water to maintain some of the lowest productivity not only in the world, but also in the subcontinent. There are so many cheap technologies available - drip and sprinkler irrigation and there are already people here producing this equipment. In our rural economy, the whole use of labour on farms suits those in power, while others have no voice.[90]

The same resources currently put into subsidizing the needs of agribusiness, if put into research efforts in the interest of small-scale farmers, would have meant a fundamentally different direction of technical development. L.S. Stavrianos wrote:

Large corporations are... virtually the sole beneficiaries of agriculture research financed by the federal, state, and county governments. Research oriented toward benefiting family farms would devise cooperative-ownership systems and credit schemes; develop low-cost simple machinery; provide information on the purchase, operation, and maintenance of machinery; and promote biological control of insect pests. Instead, scientists with research grants develop complicated and tremendously expensive machines. They breed new food varieties better adapted to mechanical cultivation.... Paramount has been the vision of rural America as a factory producing food, fiber, and profits for vertical monopolies extending from the fields to the supermarket checkout counter.[91]

The administration of Lazaro Cardenas in Mexico, during the 1930s, is a good example of the result when state policy is less one-sided. His agrarian reform, starting in a country where two percent of the population owned 97% of the land, resulted in 42% of the agricultural population owning 47% of the land and producing 52% of agricultural

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[90] "Interview--Simi Kamal" *Newsline* (Pakistan) February 2006. http://www.newsline.com.pk/NewsFeb2006/interviewfeb2006.htm.
[91] *The Promise of the Coming Dark Age*, p. 35.

output. Under Cardenas, state loans and technical support were aimed primarily at the needs of small-scale agriculture. The result was an explosive increase in the rural standard of living. As for state-funded agricultural R&D,

> ...The purpose... was not to "modernize" agriculture in imitation of United States agriculture but to improve on traditional farming methods. Researchers began to develop improved varieties of wheat and especially corn, the main staple of the rural population, always concentrating on what could be utilized by small farmers who had little money and less than ideal farm conditions.
>
> Social and economic progress was being achieved not through dependence on foreign expertise or costly imported agricultural inputs but rather with the abundant, underutilized resources of local peasants.... Freed from the fear of landlords, bosses, and moneylenders, peasants were motivated to produce, knowing that at last they would benefit from their own labor.[92]

The groups alienated by Cardenas--the great rural landowners, the urban commercial elites, and (as you might expect) the U.S. government--reasserted their political control under Cardenas' post-1940 successor, Avila Camacho. Rather than small farms and cooperatives, development spending was directed, on the American model, toward

> electric power, highways, dams, airports, telecommunications, and urban services that would serve privately owned, commercial agriculture and urban industrialization....[93]

The Camacho administration, naturally, was heavily involved in the postwar Green Revolution. The direction of the new big research program was diametrically opposite to that under Cardenas.

> ...Policy choices systematically discarded research alternatives oriented toward the nonirrigated, subsistence sector of Mexican agriculture. Instead, all effort went to the development of a capital-intensive technology applicable only to the relatively best-endowed areas or those that could be created by massive irrigation projects.[94]

Under Camacho, huge irrigation projects were developed for favorably situated land owned by big landed elites, and massive state subsidies were provided for the importation of mechanized equipment.

As Lappé writes, the Camacho approach could not coexist with that of Cardenas. The Cardenas agenda of increasing the productivity of peasant proprietors would have

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[92] Lappé, *Food First,* pp. 123-24.
[93] Ibid., p. 124.
[94] Ibid., pp. 125-26.

increased their standard of living; in so doing, it would have reduced the surplus going to urban and export markets rather than domestic consumption, and also reduced the flow of landless refugees to the cities. In other words, the Cardenas policies threatened the supply of cheap wage labor for industrialization, and the supply of cheap food to feed it.

The point to all this is not that Cardenas' version of state intervention was desirable, but 1) that the present system touted by neoliberals as the "free market" involves at least as much state intervention; and 2) that there is no such thing as neutral, politically immaculate technology that can be divorced from questions of power relationships. Criteria of technical "efficiency" depend on the nature of the organizational structures which will be adopting a technology. And the forms of state R&D subsidy and other development aid entailed in the Green Revolution artificially promoted capital-intensive plantation agriculture, despite

> overwhelming evidence from around the world that small, carefully farmed plots are more productive per acre than large estates and use fewer costly inputs...[95]

What's more, the high-response varieties developed by the Green Revolution crowded out equally viable alternatives that were more appropriate to traditional smallholder agriculture. Any just assessment of the Green Revolution must take into consideration the path not taken (or Bastiat's "unseen"). The Green Revolution, coming as it did on the heels of land expropriation, channelled innovation in the directions most favoring the land-grabbers. It was a subsidy to the richest growers, artificially increasing their competitiveness against the subsistence sector.

> ...Historically, the Green Revolution represented a choice to breed seed varieties that produce high yields under optimum conditions. It was a choice not to start by developing seeds better able to withstand drought or pests. It was a choice not to concentrate first on improving traditional methods of increasing yields, such as mixed cropping. It was a choice not to develop technology that was productive, labor-intensive, and independent of foreign input supply. It was a choice not to concentrate on reinforcing the balanced, traditional diets of grains plus legumes.[96]

HRVs are actually less hardy and durable under the conditions prevailing on subsistence farms--less drought-resistant, for example. Locally improved varieties are specifically adapted to be productive under conditions of low rainfall, and more resistant to insects and fungi without costly chemical inputs. Local seed varieties, combined with intensive techniques and the creative use of biological processes, result in levels of output comparable in many cases to that of Green Revolution seed

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[95] Ibid., p. 127.
[96] Ibid., p. 153.

varieties combined with heavy chemical inputs and subsidized irrigation. Even setting aside the long-term costs of soil depletion, good husbandry with local varieties of seed produce almost as much corn and sorghum output per acre. An experiment in Bangladesh--ceasing pesticide use in order to raise fish in rice paddies--resulted in a 25% increase in rice production, along with the high quality protein from the fish. The fish controlled insects more efficiently than chemical pesticides, and fertilized the rice.[97]

A rural development agenda geared toward the interests of peasant proprietors would have emphasized, not increasing the yield of seeds in response to expensive irrigation and chemical inputs, but improving the soil.

This brings us back to our earlier consideration of the concept of "efficiency." The discussion above gives the lie to vulgar Coasean arguments that justice in holdings doesn't matter, as long as they wind up in the "most efficient" hands. For one thing, it matters a great deal to the person who was robbed; it matters a great deal whether you're producing enough staple crops on your own land to feed your family, or instead holding a begging bowl in the streets of Calcutta or living in some tin-roofed shantytown on the outskirts of Mexico, while your stolen land is being used to grow export crops for those with the purchasing power to buy them. But more importantly, the Green Revolution and the alternatives it crowded out demonstrate--again--that *there's no such thing as generic "efficiency" in the use of resources.* The "most efficient" use of a piece of land depends mightily on who owns it, and what their needs are. An "efficient" technique for the land thief is entirely different from what would have been efficient for the land's rightful owner.

One can afford to be a lot less efficient in the use of inputs that he gets for free. Capital-intensive techniques that increase output per man-hour, but reduce output per acre, are suited to the interests of American-style agribusiness. They're perfect for large landowners who, as a historical legacy, have preferential access to large tracts of land (to the extent that they can even afford to hold significant parts of it out of use), but want to reduce their dependence on hired labor. In areas with underutilized land and unemployed population, on the other hand, it makes a lot more sense to increase output per acre by adding labor inputs. And this is exactly the pattern that prevails in small-scale agriculture. Lappé found, in a survey of studies from around the world, that small farms were universally more productive--far more productive--per acre than large plantations. Depending on the region and the crop, small farms were from one-third to fourteen times more productive. The efficiency of small proprietors working their own land, compared to plantation agribusiness using wage or tenant labor, is analogous to that of the small family plots in the old USSR compared to the state farms. Plantation agriculture is able to outcompete the peasant proprietor only through

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[97] Ibid., p. 127.

"preferential access to credit and government-subsidized technology...."[98]

Mechanized, large-scale production is more efficient, not in terms of food output per acre, but in terms of dollar output per laborer. That makes perfect sense if you're a capitalist farmer with more land than you can use (thanks to the state), and you want to minimize labor costs and agency problems through a strategy of capital substitution. But it doesn't make much sense where there's millions of unemployed people who would *rather* be working the land than squatting in the streets of Calcutta or the shantytowns of Mexico City.

Green Revolution techniques are very "efficient" indeed--but only given the artificial objectives of those who stole the land.

The same general observations apply to agribusiness in the developed world. As Michael Perelman observes, the intensive raised bed techniques of early modern Europe compare quite favorably to the outputs per acre of today's mechanized agribusiness. For example, he mentions a seventeenth century Paris gentleman who produced 44 tons of vegetables per acre; modern methods in the U.S. produce only 15 tons of onions or 8.6 tons of tomatoes--the highest-yielding crops--per acre.[99] In the modern Green Revolution,

> the really revolutionary changes in American agriculture have not been directed toward increasing yields.... Actually, the unique achievement of U.S. agriculture is not the production of maximum crop yields [per acre] but the harnessing of fossil fuel energy to replace human energy in agriculture.[100]

Conclusion.

Overall, the importance of economy of scale was summed up very well by Barry Stein, in his concluding remarks on a survey of the empirical literature:

> Such uncertainty and variability suggest that technical economies of scale are not the primary determinant of either competitive ability or true efficiency. Available data indicate first, that in most industries the penalties for operating plants well below the apparent optimal scale are not great; second, the presence of substantial relatively constant costs (added to those directly associated with production) dilutes even those clear advantages of greater productive scale; and third, there is no strong case to be made for significant economies of firm (as against plant) size.[101]

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[98] Lappé, *Food First*, p. 189.
[99] Michael Perelman, *Classical Political Economy: Primitive Accumulation and the Social Division of Labor* (Totowa, N.J.: Rowman & Allanheld; London: F. Pinter, 1984, c 1983) pp. 41-42.
[100] Michael Perelman, "Farming for Profit in a Hungry World," pp. 40-41.
[101] *Size, Efficiency, and Community Enterprise*, pp. 24-25.

So why are giant corporations able to survive, despite such manifest violation of all the laws of efficiency? There are really two questions involved here that we need to attend to separately.

First, the evidence above demonstrates that most large plants, let alone multiplant firms, operate far beyond optimal size for economy of scale. Yet they are still profitable despite being less efficient in terms of unit costs even under the conditions of the existing state capitalist economy. Why is this?

The reason is twofold. First, they are protected, by state intervention, from the competitive disadvantages resulting from inefficiency. A state-cartelized oligopoly firm can operate at higher costs and pass its costs on to the consumer, because it is protected from the full vigor of competition from smaller and more efficient producers.

Second, as we already mentioned at the outset of this chapter, the figures above for optimal economy of scale assume the existing input costs, without considering the extent to which the state subsidizes inputs and externalizes a wide range of operating costs on the taxpayer.

In the next chapter, we will consider the whole range of measures by which the state restricts competition and subsidizes inefficiency costs.