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The American System of Manufacture

It was that which gratified me so much at Colonel Colt's, to see the spirit that pervaded the machines; they really had a very decided and peculiar character of judicious contrivance. (English inventor and engineer, James Nasmyth, Parliamentary testimony, 1854; cited in Wallace and Whitworth, 1969, p. 45)

Over the first three-quarters of the nineteenth century output per capita in America grew at 0.3 percent annually. Over the last quarter it leapt to an annual rate of 2.0 percent. Between 1839 and 1899 the share of output in manufacturing rose from 17 to 53 percent (Gallman, 1960, p. 26). In these years America emerged as an industrial power with businesses that were setting the world standard for competitiveness in sector after sector. To understand the transition we have to go beyond the marketplace and into the world of production, for America's economic success was propelled by the establishment of productive enterprises based on new principles.

The American System, as it was described by the British, was the new competition of the middle decades of the nineteenth century. In this chapter the production and organizational principles of the American System are examined in the context of the Connecticut River Valley metalworking industrial district and its early center, the Springfield Armory. I argue that the Springfield Armory was an inadvertent industrial policy agent. But whatever the role of the Armory as a catalyst, the American System established a new standard of international competitiveness that could not be matched by one major but earlier
pacesetter, the small arms industrial district of Birmingham, England. The implication is that the slow decline of Birmingham as a small arms manufacturing area was not caused by restrictive working practices, high or low wages, or managerial failure. Rather, it was the failure to adapt to the principles of production and organization of the new competition of the day.

**The Crystal Palace Exhibition**

The Crystal Palace Exhibition of 1851 was an opportunity for American manufacturers to show off their products. Leading English engineers and military men were startled by what they observed because of the revolutionary production methods that were implied. The response was so positive that some entrepreneurs stayed on or returned to England to set up production facilities. Samuel Colt was one.

With the commencement of production in early 1853, Colonel Colt's London revolver factory became a demonstration site for the new production system. In 1854, the English machine tool maker James Nasmyth described his visit to the Colt factory before a Parliamentary Select Committee on Small Arms as follows:

The first impression was to humble me very considerably. I was in a manner introduced to such a masterly extension of what I knew to be correct principles, but extended in so masterly and wholesale a manner, as made me feel that we were very far behind in carrying out what we know to be good principles. (Wallace and Whitworth, 1969, p. 44)

The Colt factory was a representative of a new system of production that used specialist machines to produce interchangeable parts tested by precision gauges at a time when Britain still practised handicraft methods. Because of the undeveloped state of English machine making, Colt took both machines and men to London (Haven and Belden, 1940, p. 86).

Interchangeability was of special interest to military authorities. It meant that an army could go to battle with spare parts instead of skilled fitters. Before interchangeability an armament with a broken part was useless without a fitter to handcraft a new part. With interchangeable parts, equipment could be returned to service by replacing the defective part with a profit substitute.

Thus the British military was quick to respond to what they observed at Crystal Palace. The revelation of the new methods led to a Department of Ordnance proposal to "...erect a Government establishment capable of producing muskets in large numbers, and at a moderate price, by the introduction of machinery into every part of the manufacture where it was applicable" (Wallace and Whitworth, 1969, p. 91). The proposal meant transcending the traditional British craft-organized arms production system based on private procurement with government assembly and inspection.

In preparation the British government sent a team of officers to the United States "...with the power of buying such machinery as they might consider would be more productive than that used in England..." (Wallace and Whitworth, 1969, p. 91). The machinery they bought formed the basis for the first English government armory, established at Enfield in North London. One team member, John Anderson, the Ordnance Inspector of Machinery and a leading English mechanical inventor, understood the challenge of the American Manufacturing System to British industrial leadership and saw a twofold purpose in constructing the Enfield Armory: to produce a large supply of cheap arms and to educate the British on the advanced production methods of the Americans. In his words:

The American machinery is so different to our own, and so rich in suggestions, that when fully organized it should be thrown open to the study of the machine makers of the kingdom... A few hours at Enfield will show that we shall soon have to contend with no mean competitors in the Americans, who display an originality and common sense... which are not to be despised, but on the contrary are either to be copied or improved upon. (Wallace and Whitworth, 1969, p. 66).

**The Springfield Armory**

The new production methods were first established at the US government armory in Springfield, Massachusetts. Not by coincidence the Springfield Armory is famous as a site of managerial innovation as well. In Alfred Chandler's words, "Modern factory management (but not it must be stressed the management of large modern multi-unit enterprises) had its genesis in the United States in the Springfield Armory" (Chandler, 1977, p. 75). Production at the Springfield Armory involved innovations in technology, management methods, and work practices. In Chandler's

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1 Perhaps the leading explanation for the emergence of America as an industrial power was the pressure of high wages on the development of machinery. English manufacturers, enjoying lower wage costs, did not substitute capital for labor and fell behind in technological development (Habakkuk, 1962). The implicit counter-argument in this chapter is that it was not factor prices reflecting labor scarcity that explains the emergence of the American System but rather the development of new principles of production and organization which established a superior product, virtually independent of relative factor scarcities.
words, "[T]he systems and controls developed at the armory were as
critical to the development of what became known as the 'American
System of Manufacturing' as the new metalworking machinery and
machine tools" (Chandler, 1977, p. 75). Nevertheless the technical
features of the new production system were the most striking, particularly
the concept of interchangeability.

Interchangeable Parts

In the words of J. W. Roe, "By interchangeable manufacturing we mean
the production of complete machines or mechanisms, the corresponding
parts of which are so nearly alike that they will fit into any of the given
mechanisms" (Roe, 1937, p. 755). The American System was based on
the principle of interchangeable parts, but only in rare cases were whole
factories organized according to interchangeability. In fact the first
example, and certainly one of the few, was the Colt Armory of Hartford,
Connecticut, organized by Elisha Root and completed in 1855, in which
"[n]o handwork at all was allowed" (Roe, 1937, p. 757). But by the
mid-nineteenth century many American factories could be found in
which interchangeable methods were in use.

The idea of interchangeability required breaking down products into
their simplest parts, designing a specialist machine capable of producing
each piece, and inspecting each part with a custom-designed set of
gauges. As distinct from European practice, where a fitter tailor-made
each part, interchangeability meant that parts could be machine processed
and assembled by workers who had not been apprenticed in the craft
tradition. At the same time, considerable skill was required for the
design and making of the ubiquitous specialist machines, fixtures, and
gauges.

Many American factories used specialist machines but did not achieve
interchangeability particularly as the precision standards were rapidly
and incessantly upgraded. One historian, David Hounshell, distinguishes
"armory practice" where interchangeability was systematically pursued
and achieved from the American System which signifies specialist
machines but which continued to rely upon craftsmen to handfit parts
(Hounshell, 1984). Nevertheless, interchangeability was an ideal that
gave direction to the American System.

3 The Americans were not surprised because such experiments had been going on since
about 1800 when Eli Whitney amazed a group of Army officials with such a test using
ten guns (Roe, 1937, p. 755). Thomas Jefferson, in a letter to James Monroe, wrote:
"He has invented molds and machines for making all the pieces of his locks so exactly
equal, that take 100 locks to pieces and mingle their parts and the hundred locks may be
put together as well by taking the pieces which come to hand" (Ford, 1926, cited in Roe,
1937). Jefferson had become an interchangeability enthusiast after meeting a French
workman named LeBlanc while minister to France over a decade before (Roe, 1937).
French manufacturers, however, are not known to have pursued the idea.

4 A machine made at the Ames Manufacturing Company and shipped to the Enfield
Armory in the 1850s was returned to the newly opened Springfield Armory Museum
over a hundred years later. According to Enfield officials it had been in operation for
most of that time.

Influenced by Colt, an English delegation of machine makers and
military men visited New England and conducted a famous test of the
the interchangeability claim at the Springfield Armory. They dismantled
ten Springfield muskets, each produced in a different year between 1844
and 1853, and put the same parts from each rifle in a separate box. The
muskets were then haphazardly reassembled. To the surprise of some of
the visitors but none of the Americans, the performance of the
muskets was unaffected. The English team set about purchasing the
full range of machines and gauges, as well as hiring American machinists,
to set up at the new Enfield Armory in North London (Smiles, pp.

Specialist Machines and Precision Gauges

The American System required the design of a special machine for each
individual operation. The first special machine deployed by the
Springfield Armory was a woodworking lathe invented by Thomas
Blanchard and exhibited in 1819. By 1826 Blanchard had built 14
different machines at the Springfield Armory, each of which performed
a single operation in the making of a gun stock (Smith, 1977, p. 135).

A number of shops emerged that specialized in the building of machine
tools for interchangeable manufacture. Robbins and Lawrence, located
up the Connecticut River at Windsor, Vermont, mounted an impressive
exhibition at Crystal Palace and along with the American Manufacturing
Company, the Ames Manufacturing Company, and Pratt and Whitney
received orders from the visiting British delegation (Roe, 1937, p. 758).
All supplied the Springfield Armory with specialist machines.

To ensure that the machining operations were meeting the tolerances
so that the machined part could move on to the next machine without
the requirement of handfitting, a system of specialized gauges was
developed. One was for the operator, a second for a supervisor, and a third master gauge was used to check the first two periodically. Shops also emerged that specialized in the making of gauges and fixtures.

Production without Fitters

The British team that visited the Springfield Armory saw interchangeable parts and a system of specialist machines, but it also saw an unfamiliar organization of work.

The British were familiar with production methods that depended upon the feel of the craftsman to ensure a proper fit, but not the formal measurement methods of the American System. The traditional craftsman working with his file was no longer the prominent figure. Interchangeability meant that departments within factories could assemble pieces produced in preceding stages without fitters. As Henry Ford observed in the next century: "In mass production there are no fitters" (Ford, 1926, p. 822). Instead of a craftsman producing each part to a noncodifiable standard, the American System designed specified tolerances into the machines. A failure to meet the specifications was indicated by gauges which could be read by an operator.

The extent to which the new methods deskill craft labor is disputed by historians. John Hall, the inventor-machine maker who was probably the first to propose that an entire factory be organized according to the principle of interchangeability, was given a government contract to do so on a small scale at Harpers Ferry Armory (Smith, 1977). He bragged that “[o]ne boy by the aid of these machines can perform more work than 10 men with files, in the same time, and with greater accuracy” (Smith, 1977, p. 240). The operation of Blanchard's lathes is reputed to have had similar, if less dramatic, effects in the gunstock division of the Springfield Armory. By 1926, Blanchard's battery of 14 specialist machines had, in the words of Merritt Roe Smith, “...completely mechanized the process of stocking and eliminated the need for skilled labor in one of the three major divisions of armory production” (Smith, 1977, p. 135).

The widespread substitution of detail labor for craft labor is also implied by Colonel Roswell Lee who wrote in reply to an Ordnance Officer seeking employment for his son in 1925:

...I think some other trade would be more beneficial to him, as there are but very few in the Armory that work at all branches...and although it might afford him a living yet it would not be a trade that he could set up and carry on for himself under ordinary circumstances...A carpenter and joiner, cabinetmaker or Black or White Smith, would be preferable in my opinion... (Uselding, 1973, p. 76)

But Charles Fitch, writing a century ago, argued that the demands of precision work limited the use of unskilled labor:

Machinery may contract the province of certain skilled trades...but the fact remains that the increased fineness and accuracy required in the manufacture of firearms demands the most skillful and experienced oversight, and unskilled labor can only be employed with the best results upon limited portions of the work. (Fitch, 1883, p. 6)

Felicia Deyrup observed that increased mechanization divided the workers into two groups with marked wage differences. She refers to one study of the Springfield Armory in the 1840s that "noted a decided diminution in the skill of the average arms worker after 1820" but "arms making remained...among the most highly skilled occupations in American industry" (Deyrup, 1948, p. 100).

Available evidence, then, does not warrant an unambiguous conclusion that interchangeability and specialist machines as deployed at the Springfield Armory systematically deskilled the labor force. However, it certainly altered its composition.

Management Control by Information Systems

For Colonel Lee, the barrier to quality and reliability in armaments production was the control that fitters exercised over the shopfloor. Thus Lee was receptive to the new methods of production because they provided a means of shifting control of the factory from the craftsman to the manager, a process he had initiated in 1815 when assuming command of the Springfield Armory. But the power of managerial supervisors was limited by the personal methods of control. Lee sought impersonal methods of control. His task was to establish production control by devising methods of forcing worker accountability to production schedules and for material usage that did not depend upon the personal relationship between supervisors and workers. In Lee's view, workers would always establish the standards of output and quality under such a system.

The claim that the Springfield Armory was the original site of modern factory management is based on Lee's creation of impersonal or bureaucratic management control methods which entailed new managerial tasks. First, Lee created middle management posts of assistant master armerer for each "principle branch of work" to advance quality control by a verifiable inspection system (Uselding, 1973, p. 72). Both the worker and the assistant master armerer cum inspector put a signatory

* Glen Hutloff (1988) makes this point.
mark on each piece made. In this way any malfunction in the field could be traced to an individual worker and inspector. Second, Lee put clerks under the supervision of the master armorer to control material wastage and monitor the performance of both workers and management. The clerk’s job was to maintain a day book with records of all of the materials and tools received by the department. These amounts were transcribed monthly into a ledger book which kept track of monthly totals of materials received, on the debit side, and products produced, work in progress, inventories, and scrap on the credit side. In addition, each foreman kept a similar ledger for each worker. Any excess waste or unaccountable materials were deducted from the workers’ pay. These accounts were consolidated by the master armorer for the factory as a whole. The result was that Lee could monitor the performance of each worker, foreman, shop, and branch. The 1819 report to the War Department’s Ordnance Department proclaimed: “Complete accountability is established and enforced throughout; and if there is any error committed, it will be discovered on a comparison with the books and it can be traced to its source” (Chandler, 1977, p. 74).

The innovations in organization and production at the Springfield Armory were mutually reinforcing. Together they represented the first steps toward the mass production paradigm that provided a vision for achieving advances in production efficiency in every sector of industry. Colonel Lee did not use the information he demanded of subordinates to develop product costings or estimate rates of return on capital.

Claims for the productivity potential of the new system were made at the time. Blanchard bragged that his recessing machine for carving out a space for locks in gun stocks could “. . . make a closer joint in one minute than a Stocker can in one hour” (Smith, 1977, p. 134, emphasis in original). The visiting English team noted that, whereas in the United Kingdom a worker would make eight to ten stocks in a week, the Blanchard turning lathe could provide a stock in 22 minutes.

Nevertheless, the Springfield Armory did not exploit the potential for driving throughput up and prices down. As shown in table 1, Deyrup estimated that the cost of the Springfield musket dropped slightly between 1821 and 1831 but then rose erratically over ensuing decades. In Deyrup’s words, “Mechanization, however great its value in improving the quality of arms, failed . . . to bring a marked reduction in costs” (Deyrup, 1948, p. 132). Springfield Armory guns were expensive, as were the products of private firms that established interchangeability in other sectors such as Singer sewing machines, McCormick reapers and Columbia bicycles (Hounshell, 1984, p. 9). Colonel Lee used interchangeability to create a new system of factory governance that could ensure a safe and reliable supply of quality armaments to the military; it was not used to drive down prices.

Nord did Lee pursue the time and motion measures of “scientific management”. But the impersonal system of management that originated at the Armory did portend a definition of management in America as “the art or science, concerned with planning, directing, and controlling the work of human beings . . . ” (Burbidge, 1968, p. 3) just as the establishment of specialist machines anticipated the rise of mass production. The vision of an entirely new order of production was coming into focus. Was the American System of Manufactures as practised at the Armory but a stage in a technologically determined trajectory to mass production and Big Business? While this topic reappears in the next chapter another dimension of the Springfield Armory suggests space for institutional alternatives.6

Table 1 Costs or prices of Springfield musket and breech-loading rifle, 1798–1858

<table>
<thead>
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<th>Contract price ($)</th>
<th>Ordnance Department estimate of cost ($)</th>
<th>Deyrup’s estimate of cost ($)</th>
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<tr>
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<td>1858</td>
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6 Sabel and Zeitlin (1985) examine a large number of historical cases that suggest an alternative flexible specialization path to mass production. Flexible specialization as a strategy for industrial growth is explored in chapters 7 and 8.
The Springfield Armory as Inadvertent Industrial Policy

The small arms that shocked the British at the Crystal Palace Exhibition had not been organized by vertically integrated Big Business enterprises. Nor had the industry emerged spontaneously by entrepreneurs responding to, and coordinated by, prices in the free market. In the first place arms manufacturing was protected by tariffs (Deyrup, 1948, p. 41). Secondly, the consumer was the government. Thirdly, in the words of Deyrup, “the early [arms] industry acquired a spirit of cooperation and mutual helpfulness which was one of its most conspicuous features” (Deyrup, 1948, p. 55). The spirit of cooperation did not emerge spontaneously: it was part of the social fabric of an industrial district with the Springfield Armory at the center. In fact, the Springfield Armory was more than the center of an industrial district; it performed a number of economic functions that merit its consideration as America’s first active industrial policy.

Coordinator of Activities

In the early decades of the nineteenth century, the Armory played the coordinator role attributed to the invisible hand of the market in economic theory or the plan in the vertically integrated business enterprise. The Armory was the center of a supplier network of private firms all along the Connecticut River Valley. While many produced their own products, others specialized in stocks, barrels, bayonets, lockwork, mountings, and other components (Deyrup, 1948, p. 44). This supplier network combined elements of cooperation and competition and operated as an industrial district.

An industrial district is a means of coordination that combines elements of market and plan. It suggests a system of firms producing complementary as well as substitutable products and linked by associative institutions; the conventional presupposition of a sector is of a group of indistinguishable firms producing substitute products and integrated only by prices in the market.

The small firms within the industrial district were like departments within a single firm in that they produced complementary products and services but they were not captives of a single hierarchy and they could develop independent design and proprietary product capabilities with the active support of the central “office”, in this case the Armory. The small firms were also like independent units coordinated by the market, but cooperation allowed individual firms to develop specialities which, in turn, insulated them from the market pressures of “commodity” producers. At the same time no firm was exempt from competition; even the Armory, like private firms, often had to bid for contracts.

As a coordinator of diverse economic activities the Armory played a role that would later be played by middle management in a vertically integrated managerial hierarchy. But it also performed two other roles: provider of collective services and promoter of new methods. In pursuing these roles the Armory can be described as an industrial policy.

Provider of Collective Services

Deyrup (1948, p. 66) writes that the contract system between the Department of Ordnance and the Springfield Armory literally brought the industry into existence. The constitutive “spirit of mutual helpfulness” manifested itself in a number of non-market exchanges of mutual benefit and the delivery of collective services by the Springfield Armory to the nascent manufacturing firms.

1 Exchange of advice and information: knowledge flowed freely with respect to “interchangeability, gun design, manufacturing processes and machine tools” (Deyrup, 1948, p. 66). Expert Armory mechanics visited supplier factories and offered advice, and workers from other plants “freely examined the Armory’s tools and machinery, and in return the Armory occasionally took castings of valuable machines developed by the contractors” (Deyrup, 1948, p. 119). Furthermore the Armory “openly aided contractors by advising them of strategic times for applying for contracts” (Deyrup, 1948, p. 66).

2 Exchange of raw materials: on occasion the Armory bought and inspected materials for its suppliers “for which return was made in money or parts” (Deyrup, 1948, pp. 66, 119). Deyrup (1948, p. 66) adds that raw materials were often exchanged and paid for with “other stocks which because of requirements as to size, shape, or extent of seasoning were usable by one party only”. Thus neither the Armory nor the contractors used market power to leverage parts prices against the other. Had they done so the efficiency of raw material usage would have suffered.

3 Sharing of tools and machine patterns: “Tools which were difficult for a contractor to acquire or limited in their uses were loaned by the Springfield Armory” (Deyrup, 1948, p. 66). In addition, “[p]atterns for machines were frequently exchanged” (Deyrup, 1948, p. 66).

4 Sharing of specialist services: “Specialized services, such as difficult forging or grinding, were also exchanged. A very common service

An example of a passive industrial policy, by contrast, would be protective tariffs.
with which the Armory favored contractors was rolling the bar iron. . .into the various sizes required for making the different parts of the gun (Deyrup, 1948, p. 67). According to Deyrup the Armory only charged a "nominal fee" for using its rolling mill to roll the iron of suppliers to specified sizes.

Sharing of skilled labor: the Armory loaned skilled labor to the suppliers. In exchange, writes Deyrup, "[c]ontractors paid the transportation expenses and the regular Springfield Armory rate of wages to the workers they borrowed. Afterwards workers might return and continue in their positions . . . unless the Armory was willing that they should leave its service". Thus the contractors were able to acquire the services of highly skilled pattern makers and tool makers, useful for a short period only. In this connection in 1818 Lee informed the New England contractors that "[s]hould you be in want of any workmen in your establishment such as first rate barrel welders - trihammers men-forgers, filers, stockers or finishers, you can probably be supplied from this place, by giving me information, mentioning the number and description you may want" (Deyrup, 1948, p. 67).

Agreement on wages: Superintendent Lee entered into agreements with private firms not to "outbid one another in the labor market" (Deyrup, 1948, p. 67). The idea was not to create a perfect labor market, but to regulate the allocation of labor as done by middle management in Big Business.

Thus the Armory was both a coordinator of economic activities and a supplier of collective services. But the developmental role of the Armory stretched to a third activity: as the promoter of interchangeability, it was the purveyor of new principles of production. The pressure for interchangeability emanated from outside the Armory and was crucial in the shaping of the Armory itself.

**Promoter of Production Rationalization**

The unique features of the Springfield Armory began with the key idea of the American System: interchangeability. The development of interchangeability of parts in the Springfield Armory was the culmination of a long and expensive effort financed by the Ordnance Department of the Department of War dating from the War of 1812. Following that war, the Ordnance Department was created and given jurisdiction over the federal armories at Harpers Ferry and Springfield, as well as over government contracts to private armories. The early Chiefs of Ordnance were determined to upgrade the safety and durability of armaments. As already noted, a faulty weapon was dangerous to its user, and a weapon with a single faulty part was useless without the availability of a skilled fitter. Referring to the first two Chiefs of Ordnance, Merritt Roe Smith writes, "both men became zealous advocates of the 'uniformity system' and relentlessly pursued the idea of introducing it at the national armories" (Smith, 1977, p. 107).

The impact of the government's drive to establish uniformity was not limited to the publicly owned armories or primary contractors to the Department of Ordnance. The Armory came to monitor the performance of subcontractors in terms of meeting the test of interchangeability, for every firm that wanted to supply the Armory had to meet the new standards of precision which could be tested by gauges. But, as noted above, it played a developmental role in assisting firms to meet the standards.

Thus the Springfield Armory was not simply a coordinator of a network of firms, but a setter of standards and a purveyor of new methods. The gauge-tested system created new standards of performance that were required of suppliers as well. In this the Springfield Armory was a force not only for technological convergence but also for production method convergence (Hutloff, 1988).

The availability in one geographical area of a complete range of specialist metalworking services made the region attractive to entrepreneurs who were developing any of a wide variety of new products. In other cases craftsmen in machine making, trained at the Armory on the principles of interchangeability and cognizant of the need for specific machines, set up private firms or were employed by machine tool makers to sell to the Armory. Thus the Ordnance Department fostered the development of an industrial district of networked machine tool makers and metal and wood fabricators that would come to produce machines, components, and parts for virtually every manufacturing sector.

The inter-industry ripple effects of interchangeability on American industry were not lost on John Anderson:

> . . . this system of special tools is extending into almost every branch of industry where articles have to be repeated. This applies to furniture, hardware, clocks, watches, small arms, ammunition, and to an endless variety of other things. (Rosenberg, 1972, p. 97)

In this sense the government's promotion of interchangeability was a catalyst for the spread of the American System. By exerting pressure for the adoption of best-practice manufacturing principles the government, however unintentionally, was pursuing an industrial policy. It might not have been a deliberate policy based on a long-term strategy for
building America's industrial base but, at least for a time, it worked as if it had been.

The Birmingham Small Arms Manufacturers

In the mid-nineteenth century, Birmingham, England, was also a regional center for small arms manufacturing. The inability of the industry to supply firearms made with interchangeable parts led the British government to restructure it. The first step was to establish the Enfield Armory which was owned and operated by the government. Previously, British armories had only inspected arms that had been produced elsewhere, primarily in Birmingham. The Enfield Armory, as noted above, was supplied with American-made machines and utilized the American System of production. Thus began the slow decline of the Birmingham small arms manufacturing industry.

While a definitive story of the decline awaits a careful historical analysis, a production-oriented comparison with the Connecticut River Valley metalworking industrial district suggests first that the Birmingham small arms industry was based upon different principles of production and organization and second that it did not prove capable of adapting to the new methods and organization. The following evidence is supportive of the claim.

Birmingham arms manufacturers were organized by handicraft methods utilizing highly skilled labor. Firms could produce hundreds of product types and could shift product lines altogether. Catalogues with 500 different types and sizes of steam engines, for example, were common (citations in Rosenberg's introduction to Wallis and Whitworth, 1969, p. 72). When the demand for guns declined, such firms could shift to shoe buckles or brass buttons. Thus these firms were extremely flexible, but within the limits of handicraft manufacturing methods. In the words of Rosenberg:

> The apparent adaptiveness of the Birmingham metal trades was deceiving, however, for it was adaptive only within the limits of a sharply circumscribed technology. The Birmingham metal trades were capable of producing any of a wide range of articles which could be produced by highly skilled and ingenious craftsmen working only with tools and the simplest machinery... (Wallace and Whitworth, 1969, p. 78)

Large size and the lack of specialization amongst firms made many Birmingham general engineering workshops inflexible in a second way: length of run. J.R. Richardson, an English engineering shop owner, explained his reluctance to buy American machines in the following terms:

It was not that the English engineers did not understand American methods, but that Americans did not as a rule understand the conditions which obtained in large engineering works in England having a big general practice. There must be a large run of work. Even the most enthusiastic Americans had told him that a large quantity was not needed, that it could be done perfectly well with a dozen, but very often a dozen was a large quantity. (Orcutt, 1902, pp. 72-3)

From this quote it would appear that the Birmingham gunmaking industry was less like an industrial district of specialist firms and more like an economics textbook sector of homogeneous firms all producing and competing over the same product.

Finally, the Birmingham gunmaking industry did not enjoy three services supplied by the Springfield Armory: administrative coordinator of activities, particularly between machine tool makers and gunmakers, supplier of collective services, and promoter of new production methods. The success of the Connecticut River Valley arms makers was based upon the development of the new methods associated with interchangeability and with the protean capacity of the district to subdivide and spread the new methods to other branches of industry.

Market Failure Rationale for a Sector Development Agency

The Armory's activities can be explained in terms of the economic theory of market failure. The Armory provided three services undersupplied by the market: information, labor education, and technology transfer. The Armory invested in information that benefited the community but for which private firms could not establish property rights. The very concept of interchangeability is an example. The Armory also financed labor training for which the benefits were realized by private firms that could hire away skilled workers without paying the price for their training costs. In addition, the Armory served as an alternative to the patent system as a promoter of technological innovation but one which did not entail restricting the benefits to licensed firms. Thus by developing new machines that could be readily copied the Armory stimulated the spread of new production methods.

Finally, the Armory was a catalyst for a technological transformation which depended upon joint action amongst a group of firms. While it was not in the interests of any single firm acting alone to specialize in one phase of the new production system, it was in the interest of each

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* Clearly, more research has to be done on the actual degree of specialization and inter-firm networking before this claim can be demonstrated with confidence.
of a group of firms, each specializing in complementary phases of production, to make the transition. Thus success for each individual firm depended upon other firms making parallel moves in the complementary processes. While the real world did not fit this model precisely, the Armory was in a position to coordinate such moves across a group of firms. The private interests of firms could then be met only through joint action because no single firm could risk specializing unless it was part of a coordinated effort.

Conclusion: The Springfield Armory as Industrial Policy without a Concept

The industrial district is an alternative means of mobilizing and coordinating a cluster of vertically related production activities to either a managerial hierarchy within a single firm or by prices in the market. The autonomy of individual producing units allows each unit the opportunity to supply a range of buying firms and to design and even supply proprietary products independently. In the case of the Connecticut River Valley arms manufacturing district, the fact that the firms were not connected by market alone allowed a flow of information and skilled labor across firms as well as products and money. Furthermore, operating within the umbrella supplied by the Springfield Armory, as a government agency, provided a degree of relief from the day-to-day pressures of the market so that firms could think long term.

The Springfield Armory’s role as a development agent was powerful but short lived. The shift occurred abruptly in 1841 when the War Department prohibited the Armory from rolling iron to specified sizes for Armory contractors because of inconvenience to the Armory. This prohibition, writes Deyrup (1948, p. 119), “was symbolic of the end of cooperation between the Springfield Armory and the contractors”. Worse, the “spirit of cooperation and mutual helpfulness…among the arms makers…disappeared when the industry became independent of government aid” (Deyrup, 1948, p. 55).

The Connecticut Valley metalworking district did not continue to develop into a learning district that could carry on adapting as challenges and opportunities unfolded. One reason was that the idea of an industrial district was missing. The idea of an industrial district would have made evident the roles that the Armory had played as coordinator of independent business units, as provider of collective services such as labor training programs, and as a catalyst for technological upgrading. But since the industrial district functions of the Armory were not appreciated the local government was not under pressure to assume an industrial policy role as the federal government withdrew. Nor were individual firms that had benefited from joint action, implicit in the idea of an industrial district, put under pressure to assume individual responsibility or obligation to the maintenance of the district.

The conventional wisdom is that modernization meant the transcendence of small firms by large firms. From this perspective, continued technological advance demanded that the industrial district surrounding the Springfield Armory be replaced by vertically integrated corporations. But recently a competing perspective has re-emerged to challenge the dominant view. The competing perspective holds that the Connecticut River Valley metalworking industrial faced a historical, if unrealized, choice. One direction was to build systematically on the elements of the existing industrial district and develop it into a system of flexibly specialized firms (Piore and Sabel, 1984; Sabel and Zeitlin, 1985). Another led towards the development of a single giant firm in which each productive unit was but a department. In fact, neither path was chosen and the region declined as an industrial center. Whatever chance the industrial district model had was overwhelmed, at least in the public eye, by the emergence of the vertically integrated managerial enterprise to which we turn next. But we will return to the idea of an industrial district as an alternative to mass production in chapters 7 and 8, where the Third Italy is examined as an illustration of the New Competition.

* The evolution of the concept of an industrial district is explored in chapter 8, as is the interaction between the refinement of the concept and institution making in the Third Italy. The claim with respect to the Springfield Armory is that Colonel Lee and his associates lacked a conceptual analysis of the mutual dependence of firms which was required if the district was to continue to evolve. In this, the participants were role bearers of the hidden structures, and not self-conscious agents concerned about how to maintain or refine such structures.
2

Big Business: Mass Production and Managerial Hierarchy

A Transformed Economic Landscape

If the Springfield Armory was an organizational catalyst of the American System of manufacturing, the railroad companies were the same for mass production. Only two to three decades separated the first "modern factory management" (Chandler, 1977, p. 75) at the Springfield Armory and the professional managerial hierarchies which governed the railroads. No railroad better symbolized the new organizational form than that run by the Pennsylvania Railroad Company. In the 1850s, when even the largest American textile firms had considerably under 1,000 employees, the Pennsylvania had 4,000. But in the ensuing years railroads created a new scale and mode of economic organization. By 1865, the Pennsylvania had 30,000 employees. It was the largest business enterprise in the world in terms of revenues, assets, and employees (Livesay, 1975, p. 35). The Pennsylvania, in league with half a dozen other railroads, spearheaded an expansion of railroad receipts from $40 million in 1851 to $130 million in 1860 and $334 million in 1867 (Livesay, 1975, p. 31).

The corporate enterprises that were created to run the railroads were emulated in leading sectors of late nineteenth century American industry, including steel, petroleum, chemicals, electrical equipment, standardized machinery makers, and processed food. By 1917, the 278 firms in America with over $20 million in assets produced about a quarter of all manufacturing output (Navin, 1970, cited in Chandler, 1977, p. 346). The new administrative giants combined, under a single managerial hierarchy, a geographically scattered and diverse range of business and production activities. Coordination by managerial hierarchy replaced coordination by market.

The financial requirements of the corporate enterprises were of a new magnitude: whereas the largest pre-Civil War industrial firms were capitalized at around $1 million, US Steel was incorporated in 1901 with a capital value of $1 billion (Porter, 1973, p. 9). In the 1890s, investment bankers created and managed industrial securities markets to mobilize the finance required by the newly emerging corporate giants (Davis, 1966; Best and Humphries, 1986). As ownership became increasingly dispersed, a managerial class took charge of production and distribution in many enterprises. In others, majority share owners or investment bankers used their control over finance to wield influence over corporate executives. Big Business had arrived.

Two Perspectives on the Rise of Big Business

That the economic landscape was transformed is beyond dispute; the reason why is contested. Contemporaneously, classical economic theory was giving way to neoclassical economics. The focus of the classical economists on class relations amongst landlords, capitalists, and workers and the implications for distribution and growth gave way to concerns about individual choices in the market and the implications for the optimal resource allocation. Neoclassical theory sought to demonstrate how, given certain assumptions, a decentralized market economy of atomistic individuals could be both self-regulating and utility maximizing. Issues of production, technological change, and business organization were shunted aside by the ascendency of neoclassical economics.

Classical economic theory had two other offshoots. Marx used the classical labor theory of value to predict increasing concentration of production and immiseration of the working class. The facts that real wages increased and that the wage share of income stayed roughly constant with the establishment of Big Business is not consistent with Marx's prediction of proletarian impoverishment, whether absolute or relative.

The Cambridge, England, school of economics, as a holdout of classic economic concerns, does not explain prices and distribution by either neoclassical utility theory or Marxian labor time. The Cambridge tradition maintains that distribution cannot be explained independently of relations of property and power but offers no explanation of distribution. Like neoclassical economic theory, the Cambridge classical tradition is primarily a theory of exchange, but one that explains prices without reference to utility. Production, like distribution, is left unexplained.

Consequently, economic theory in both its neoclassical and classical variants suffers from severe limitations in attempting to explain the rise
of Big Business. In such theories the market is treated ahistorically. It is as if the market was a natural object rather than a social institution shaped, in part, by social conventions and power relations. For a historical account of markets we must turn to the institutionalist tradition.

The leading institutional account of the rise of Big Business is that of Alfred Chandler. For Chandler, the emergence of Big Business was means for driving down costs by increasing throughput: the speed and volume of material flow in production. Size was not a cause but a consequence of throughput. In Chandler's words:

Increases in productivity and decreases in unit costs (often identified with economies of scale) resulted far more from the increase in the volume and velocity of throughput than from a growth in the size of the factory or plant. (Chandler, 1977, p. 281).

Furthermore, Big Business was the only way to increase throughput and thereby reduce costs. Again in Chandler's words:

To maintain and continue a high volume of flow demanded organizational innovation. It could be achieved only by creating an administrative hierarchy operated by many full-time salaried managers. (Chandler, 1977, p. 236)

The managerial hierarchy of the larger enterprises did not stop with production: "[T]hey administered the flow from the suppliers of the raw materials through all the processes of production and distribution to the retailer or ultimate consumer" (Chandler, 1977, p. 283).

For Chandler, the railroad was a prerequisite for the spread of the managerial enterprise for three reasons. First, the railroads enhanced the volume and velocity of transport flow from raw material to factory, and from factory to consumer. Second, the railroads were great organizational innovators that created the management systems required to execute mass production. Third, the railroads supplied the right of way used by the telegraph industry which, in turn, established the communications system to coordinate the flow of materials and goods across widely scattered branches.

Once the railroads were established, Big Business emerged rapidly in those industries in which high throughput technologies could be deployed. Driving costs down by administrative coordination created profits in the form of quasi-rents to the early birds in a sector.¹

Followers, however, had to struggle for a market share against a firm already achieving throughput economies.

Chandler's account is consistent with orthodox economic theory in that the winners and losers in the competitive struggle are determined by efficiency; at the same time, Big Business contradicts the assumption of perfect competition upon which the properties of allocative efficiency and economic self-regulation depend. The omnipresence, in Chandler's perspective, of a divergence between productive and allocative efficiency suggests that monopolistic, not atomistic, competition is the norm in the American economy. Furthermore, violation of the allocative efficiency criterion suggests a permanent and pervasive role for regulatory agencies, a subject not taken up by Chandler.

A competing historical explanation for the rise of Big Business focuses on the predatory drive to monopolize exemplified by US Steel's control of iron ore deposits, or Standard Oil's control of oil pipelines. The predator seeks to dominate rivals by gaining control over a critical link in the vertical production and distribution chain between raw material and final consumer.

The predatory story cannot readily account for why some market control schemes work and others fail, for late nineteenth and early twentieth century America was littered with unsuccessful attempts to control markets by horizontal merger activity (Livermore, cited in Chandler, 1977, pp. 337ff). The elements of productive efficiency must be integrated with the drive for market control to explain why some efforts to create Big Business failed and others succeeded.

More sophisticated versions of the market control explanation go some distance towards such integration. James Livingston (1987, p. 72), writes that "...the innovation we know as the modern corporate system was an economic solution to a stubborn social impasse, not merely an administrative response to market integration or technological imperatives". For Livingston, the social impasse was a consequence of, on the one hand, the combined existence of competitive prices in product markets and administered prices in labor markets and, on the other, an increasing tendency to overproduction. Overproduction in competitive markets generated lower prices. But, because workers were organized, wages did not drop. The consequence was a rise in real wages, a squeeze on profits, and a slowing of growth.

"Ruinous competition" is a tendency associated with industries in production methods in other firms. But to the extent that the lower costs are due to organizational features, such as experience and teamwork, they may depend on elements that are not easily reproduced or purchased in the market. These issues are developed in chapter 4.

¹ Rent is a return to a factor that is fixed in supply above the return required to coax it to market. The first firm to drive costs down would be receiving a form of rent in that the price would be determined by higher cost competitors. A quasi-rent, unlike a rent from natural monopolies, can be competed away by the introduction of the same
which firms have high fixed costs. Faced with declining gross revenues, companies attempt to recover profits by dropping prices and selling more at lower margins. While it would be collectively rational for the companies to reduce output and increase margins, it is privately rational to chase each other down a declining demand curve. The problem is analogous to the free-rider problem of public goods. In both cases the private and collective rationality split requires cooperation if private interests are to be met. The problem of ruinous or cutthroat competition is associated with high fixed cost industries because prices can drop much further in these industries and still cover variable costs. This means that companies can be hemorrhaging in cash flow but still operating.

The response of capitalists to the risk of ruinous competition took two forms: first, to seek control of product markets to coordinate supply and demand at profit-making price levels; second, to seek control of work organization to establish mass production. According to this account, Big Business emerged, not for reasons of efficiency, but to organize markets to counter the tendency to ruinous competition and reduce the collective power of workers.

Livingston's market control perspective depends upon three historically specific developments: first, the tendency to overproduction based on high fixed costs leading to "ruinous competition"; second, the capacity of workers to resist money wage decreases by collective action; third, the capacity of capitalists to replace the invisible with the visible hand in the product market and to introduce new production methods in the factory.

Were workers capable of resisting wage cuts by collective action in the 1870s and 1880s? Livingston cites the research of a number of leading labor historians suggesting that they were. Herbert Gutman, David Montgomery, and Lawrence Goodwyn describe the formal and informal means of collective action which shaped the development of the American working class in this period. The intensity of the class struggle at the Homestead Strike in 1892 lends credibility to the theses of both worker collective action and Carnegie's commitment to break it.

That prices dropped is beyond dispute. The wholesale price index collapsed from 193 in 1864 to 68 in 1896. While all such indicators are subject to qualification (for example, 1864 was a war year), a series of economic studies have documented the drop in commodity prices, the rise in real wages, and the squeeze on profits (Livingston, 1987, p. 76). Today, a broad consensus supports the claim of a profit squeeze along with higher real wages between the early 1870s and the mid-1890s.

However, Livingston does not explain why overproduction and cutthroat competition emerged when and where they did. Market control analysis, by itself, cannot provide an explanation of the ascendancy of Big Business in America because it ignores precisely those sources of overproduction that are central to Chandler's account of mass production and managerial hierarchy. But at the same time, Livingston's account relaxes the immanent organizational logic of Chandler, and his notion of a social impasse resulting from a tension between the external dynamics of inter-firm competition and the intra-firm dynamics of the class struggle is worth pursuing. It suggests that the specific resolution of that impasse was important to understanding the ensuing evolution of industrial, business, and work organizations.

In this chapter, I examine developments in production and business organization that spawned the tendency to overproduction and cutthroat competition, which, in turn, induced innovations in productive organization. I start with the principles of mass production and hierarchy, the organizational building blocks of Big Business. I conclude that the American corporation was created to establish market control but control turned out to be a moving target. In chapter 3, I argue that the logic of the rise of Big Business, based upon the principles of flow, scientific management, and managerial hierarchy, led to the pursuit of inter-firm cooperation and government regulation for the same reason: pursuit of market control.

Mass Production

"...[T]he basic axiom of mass production," writes Chandler (1977, p. 257), is that "economies and lower unit costs resulted from an intensification of the speed of materials through an establishment rather than from enlarging its size." For Chandler, and mass production, the focus is on economies of time. The principle of flow and "scientific management" are both about economies of time; they became guiding principles for designing production facilities in America.

The Principle of Flow

The American System was not mass production. Interchangeability of parts, specialist machines, and precision gauges were used for the
purpose of producing a standardized product. Each is also an element in mass production. But the American System did not include another element which is fundamental to mass production—organizing production to exploit economies of time or, in Chandler’s concept, to increase the speed and volume of throughput. The same idea is captured by the principle of flow, a production engineering concept. In the words of Burbidge:

If there is such a thing as a master principle of production, one which governs or overrules all other principles, then it is probably the principle of flow. (Burbidge, 1968, p. 38)

Mass production is the American System plus the principle of flow. But organizing production facilities according to the principle of flow had far-reaching implications. This can be seen by comparing a functional with a flow-based organization.

Machines in early American factories, as in factories elsewhere, were laid out according to function. The lathes would be grouped in one location, the grinders in another, and the drills in yet another. Production involved moving materials and semi-finished products around the factory in batches. Thus a batch might start in the milling area before proceeding to the grinding shop after which it might return for additional milling before moving to the boring department before proceeding to a subassembly department.

Every product in a batch would complete each machining operation before the batch proceeded to the next operation. The number of machines in each functional group would depend upon the cycle time of the respective machines. If machining operation A took three times as much time as operation B, then three A machines would be necessary for each B machine to ensure that production could proceed without bottlenecks. The machining operations would then be in balance (Robinson, 1931, p. 25). Increasing the efficient scale of output in a batch production system involved adding another round of the balanced mix of machines. But adding more machines did not increase the rate of throughput, only the scale of output. In fact, increasing traffic congestion and work-in-progress inventories created diseconomies and increased the complexity of scheduling as ever more batches crisscrossed one another.

Establishing a balance of processes could generate economies of large scale and thus scale efficiency. But this was countered by the throughput inefficiency of batch production (as measured by the ratio of the time that a product is being machined to the time the product is in the production system). One way to increase throughput efficiency was to replace functional machine layout with a flowline sequential layout.

The idea of a flowline is to lay out the machines in the order of the machining operations. Thus, instead of transporting batches from department to department, the machining operations would be laid out in a series that corresponded to the sequence required for production. A flowline held out the promise of less transport and handling time as goods could be moved directly from machine to machine rather than from department to department. Furthermore, intermediate inventories declined as the operations were streamlined.

Different time cycles for each machine created a challenge to arrange the machines in the order of the production sequence, much as batch production created pressures to expand production capacity until a balance of processes was achieved. Flowline arrangements made it obvious that each stage had a different time cycle; consequently, bottlenecks would occur at the machines with longer cycles. Developing a flowline for products that embodied a series of components or that used a variety of machines was a formidable challenge to mechanical engineers. The advance of time economies on any one machine would immediately create excess capacity for that machine or lead to bottlenecks at the next machine along the line.

The vision of a flowline concentrated the attention of mechanical engineers on bottlenecks as barriers to throughput. By shortening the time cycle of the machine requiring the longest time cycle, engineers could speed up the whole line. But each time the bottleneck was relieved at one machine station, it reappeared elsewhere. The layout engineers were again stuck with one of three options: run a machine below its potential, add machines at the bottleneck station, or reduce the time cycle required by the slower machines (Burbidge, 1968, p. 37).
By the 1880s the pursuit of flowline methods had led from flowline to continuous flow processes. Whereas under flowline products continue to be machined in batches even though the plant is laid out in the order of the machining operations, under continuous flow products move individually through the sequence of machines: no two products are ever at the same stage of production. The idea was to link functionally distinct specialist machines into a single complex machine that took material in one end and pushed the processed product out the other.

Continuous process technologies came first to the refining and distilling industries because these industries utilized gas and liquid materials. But another example from Chandler is the Bonsack machine which revolutionized cigarette making. Whereas previously a highly skilled laborer could produce 3,000 cigarettes per day, the endless tape of a Bonsack machine took in tobacco at one end, compressed it, wrapped it with paper, pasted the paper, and deposited cigarettes at the other end. Fifteen Bonsack machines, each producing 120,000 cigarettes per day, could have saturated the demand for cigarettes in 1880 America. The cost dropped from 60 pence to 10 pence per 1,000. The result?

Not surprisingly, the first two firms to adopt the Bonsack machine - those of James B. Duke in the United States and Wills in Britain - dominated the cigarette industry... in their own countries. Within a decade they were joined in battle for the world market. (Chandler, 1977, p. 250)

Designing complex integrated machines capable of exploiting economies of time became a challenge for mechanical engineers in all industries. Where it was possible, it created an opportunity to establish market dominance.

Henry Ford's genius was to apply the principle of flow to a metalworking industry that required a large number of complex components. The Model T, more than any other application before or after, captured the public imagination.

In the spring of 1913, Ford engineers broke the production process of the magneto coil down into 29 complementary operations performed by 29 different workers (Hounshell, 1984, p. 248). In the process each operation was mechanized and material flow was speeded up. The time taken to make a magneto dropped from 20 to 13 minutes. The magneto was produced on an assembly line, but not a moving assembly line. Workers stood in a row along a sliding surface performing the same operation on each product and then hand pushed it two or three feet along to the next worker for the next task.

The magneto line suggests a positive relation between rate of throughput, process complexity, and minimum efficient size of plant.

Whereas under the old workbench method a one-person shop could assemble magneto, maximizing throughput on the flow line meant 29 linked operations and 29 workers standing side by side. In this case, increasing throughput led to increased size; maximizing throughput dictated placing the machines side by side. Thus it was not always "big" machines such as steel blast furnaces or chemical processing plants that created economies of scale; rather, it was the logic of combining machines to maximize throughput. This meant large investments in machines and transfer mechanisms.

Within a year Ford engineers had applied and extended the flowline principle to the assembly of motors and transmissions and to final assembly itself. In the summer of 1913, in an experiment, a Model T chassis was pulled slowly across 250 feet of factory floor and the time required for assembly was decreased from 13 hours to five hours and 50 minutes. In January 1914, Ford installed the first automatic conveyor belt, modelled after the overhead trolley deployed by meatpackers, and within two months cars were being assembled in an hour and a half (Hounshell, 1984, pp. 254-6).

The first firm in an industry to use mass production methods to set a new low cost floor could be assured of dominant market share and margins to afford self-financing. Other mass production firsts in a sector included Carnegie, Rockefeller, du Pont, Eastman, Diamond Match, Procter and Gamble, Campbell, and Heinz (Chandler, 1977). In each of these cases productivity leaped as a consequence of establishing flowline principles of production. However, furniture, leather products, and textiles are industries that were not restructured according to the dictates of the flowline. In each of the latter cases, and for whatever reason, production engineers were not successful in creating flowlines that substantially increased the rate of throughput. In these cases, efforts to create Big Business floundered in debt.

Scientific Management

The systematic application of science to production and the development of flowline principles created new challenges for scientists and engineers. But new challenges were also created for the organization of people, in this case workers. Driving down costs by pushing up the velocity and volume of throughput depended upon synchronizing work activities with the new technological opportunities. Workers, unlike machines, could consciously resist the new system and, unlike managers, they could not be motivated by a managerial career ladder. The redefinition of work activities to separate planning, the prerogative of managers,
from doing, the activity of workers, became the defining characteristic of "scientific management".

At the time of Frederick W. Taylor, existing management control systems were dependent upon foremen. Carnegie Company, as an example of a leading company of the 1880s, used a factory management system based upon routing slips that accompanied each order through the production stages and upon which foremen were responsible for recording the costs in terms of labor, materials, and machine usage. But the informational control systems were often opposed or inadequately filled in by the foremen. The hiring of clerks for recording purposes went some distance towards improving the quality of information but the clerks lacked the authority to confront the foremen and workers who controlled operations. In the words of Chandler (1977, p. 266): "[e]ffective coordination of throughput required the placing of vigorous management controls over these despots". The term "despots" here refers to the foremen, labor subcontractors, and craft laborers who governed the flow of materials and products.

Taylor pursued numerous avenues to increase throughput. He sought alloys to make machines to increase cutting speeds, and devised mathematical formulae to design optimal machining systems. But he is most famous for redesigning the methods of work according to principles established in his "time and motion" experiments. For Taylor the design of the machine and of work were reducible to the same logic. Just as the principle of interchangeable parts had led to the decomposition of production into a series of precisely measured and endlessly repetitive movements, each of which could be done by a specialized machine, Taylor sought to decompose worker tasks into a series of precisely measured and endlessly repetitive movements.

Taylor's experiment with an immigrant pig-iron handler illustrates his meticulous rearrangement of the method and timing of work activities. Each pig weighed 92 pounds and the handler had to pick it up and carry it a few yards to a pile. The average handler hauled 12.5 tons per day, but Taylor was able to increase worker productivity nearly fourfold by applying his time and motion methods. In Taylor's words:

Schmidt started to work, and all day long, and at regular intervals, was told by the man who stood over him with a watch, "now pick up a pig and walk. Now sit down and rest. Now work - Now rest," etc. He worked when he was told to work and rested when he was told to rest, and half past five in the afternoon had his 47 1/2 tons loaded on the car. . .One man after another was picked out and trained to handle pig iron at the rate of 47 1/2 tons per day until all the pig iron was handled at this rate and the men were receiving 60 percent more wages than the workmen around them. (Taylor, 1967, p. 47)

For Taylor, effective supervision depended upon time and motion studies. Only then do supervisors have an "objective" measure for comparison with actual worker effort and only then are workers' activities dictated by the economies of time. Scientific management required that workers' movements be synchronized with the flow of the materials through the machinery. Craftsmen, who historically controlled the definition and pace of work, were to be replaced by acquiescent employees whose every motion was proscribed by scientific plan. The new principles radically redefined the tasks of lower management as well as labor. Taylor underscored the increased responsibilities of management:

The managers assume new burdens, new duties and responsibilities never dreamed of in the past. . .for instance, the burden of gathering together all of the traditional knowledge which in the past has been possessed by the workmen and then of classifying, tabulating, and reducing this knowledge to rules, laws and formulae which are immensely helpful to the workers in doing their daily work. (Taylor, 1967, p. 36)

It became lower management's function to plan and organize the activities of every worker. The minute specialization required intricate coordination and planning. Neither the definition of work nor the flow of production would any longer be dependent upon the skill or pace imposed by workers. As usual, Taylor's language was unambiguous on this point:

The work of every workman is fully planned out by the management at least one day in advance, and each man receives in most cases complete written instructions. . .This task requires not only what is to be done but how it is to be done and the exact time allowed for doing it. (Taylor, 1967, p. 39)

Taylor's mission was not to establish despotic managerial methods but "scientific" methods. In fact, his system called for an end to the foreman as general manager and the substitution of a planning department to administer the factory. Workers would report to and be assisted by a staff of eight clerks in the planning department. Individual clerks would specialize in time and motion studies for job analysis, in speed for setting standards of output, in routing for scheduling the flow of orders, in instructions for setting daily work plans, in inspection for refining controls and keeping constant check on all costs, and in personnel for recruiting and firing workers and on repair for maintenance. The task of the planning department was not to motivate workers, at least not directly. That was the function of an incentive wage system based upon detailed job analysis. Each worker would be paid a differential piece rate: lower rates for less than standard output, and higher rates for greater than standard output. Taylor impelled managers
to observe the link between work effort and pay as fundamental to the operation of scientific management.

Although Taylor's ideal work and management organizational recommendations were probably never carried out in a single factory, work organization was reconstituted in the American factory with the arrival of mass production. The management quest for high rates of throughput was translated to the shopfloor as the need for a pliable labor force willing to operate the machines to full capacity. Labor responded by building trade unions that organized most of the mass production industries. Eventually a compromise was achieved that gave management its most fundamental demand - control over the processes and operations of work. Managers and staff alone would have responsibility for planning work along the lines of the Taylorist system. Workers' responsibilities were to obey instructions. The company had no responsibilities for upgrading worker skills and could freely lay workers off during business downturns. Management's fear of dependence on skilled workers led to the design of jobs so that little training was required and workers, like parts, could be rendered interchangeable.

Workers gained the rights to organize, seniority, a grievance procedure, and high wages. Pay was determined by evaluation and job classification systems and not by the skills that a worker possessed. Any disagreement could be aired and much of unions' activities involved grievances. The resulting system is described as follows by Michael Piore and Charles Sabel:

The logic of the system of job classifications and seniority rights, and the judicial process by which they are supervised, operates to ensure ever more of factory life in a net of rules with an ever finer mesh. (Piore and Sabel, 1984, p. 114)

I will argue in chapter 5 that the limitations of the American system of shopfloor control have become apparent with the emergence of an alternative production paradigm. A New Competition has exposed the system of shopfloor control as the Achilles heel of American capitalism. Flexible production systems geared to high quality have set standards that the American mass producer cannot meet without jettisoning the organization of work upon which it has been based. But this is jumping ahead of the story.

Hierarchical Organization

Mass production is not equivalent to Big Business. The principles of mass production can be employed for a single phase of production. Big Business, however, involves the creation of a managerial hierarchy to coordinate, monitor, and plan over multiple phases along the production chain.

The rationale for mass production is to achieve economies of time by organizing production according to the principle of flow. The rationale for vertical integration is not so obvious. For Chandler, Big Business emerged purely for reasons of production efficiency. In this section, I will examine the principles of organization that emerged with Big Business in America. My account draws heavily on Chandler's work.

Centralized Administration and Decentralized Operations

Establishing flowline production systems required the reorganization of management as well as work. The Pennsylvania Railroad Company was not the first three-tiered managerial hierarchy. That accomplishment belongs to the Western Railroad, and was prompted for reasons of safety following a head-on collision in 1841. The Western, which operated over 150 miles between Worcester and Albany, established three divisions and three layers of salaried management.

The Western did not use the military model of hierarchy in which authority and information flowed directly from top to bottom along a single chain of command. Instead, management at the Western was organized into three specialist chains and one general chain of command emanating from the head office. Each of three chief specialists in the head office had authority over their professional subordinates in the divisions who, as a consequence were responsible not to the line or divisional superintendent but to their professional counterpart in the head office. Thus, for example, the senior mechanic in each division had authority over mechanics in his division and reported directly to the master mechanic in headquarters.

Parallel chains of command meant that lower management specialists could exercise authority over higher management in the general management chain of command. For example, the authority for starting and stopping trains and sticking to schedules did not flow from the president to the general superintendent to the division superintendent and on down to the conductor. Instead, in order to facilitate coordination amongst trains such authority was delegated to the conductors. Every conductor was given a timetable established by a committee of middle and lower line management. But no one, from the president on down, could direct the movement of a train except the conductor. The conductor was responsible for adhering to the time schedule; without assigning authority to the conductor, responsibility would be dissipated.

The Western's overlapping command form of organization was a substantial modification of the military hierarchy in which authority
and information travel uninterruptedly from top to bottom along the same channel. It was successful in improving the safety of the railroads. As a multiple branch system it also offered opportunities for increasing the throughput of traffic compared with market coordination across independent business units: transshipments could be minimized, uniform equipment could be installed, common operating standards could be enforced, schedules could be coordinated, finance could be arranged, and overhead expenditures could be shared over greater output. Internalization of such activities within a single firm may not have been the only way to achieve the benefits of multi-unit cooperation, but low cost transportation required some form of cooperation across operating units.

However, overlapping chains of command created two management control problems. The first problem was that performance was impaired by the blurring of responsibility for divisional performance. Neither specialist managers, who were only responsible for their respective functions, nor the division superintendents, who did not have authority over the specialist personnel in their branches, could be held responsible for poor operating performance of the branches. Organizational performance is enhanced by first pinpointing responsibility and second linking authority with responsibility. At the Western Railroad good efforts could go unnoticed and responsibility for bad efforts could be displaced along the hierarchy. A second problem was that staff positions, such as the committee in charge of setting the timetable, were also line, or authority, positions for other activities. This meant that staff or interdivisional activities such as establishing common procedures, coordinating material flows or providing collective services were being performed by men who also had line responsibility. Individuals held dual roles of middle management and staff.

To overcome the tension between specialist and general management chains of command, J. Edgar Thomson of the Pennsylvania Railroad devised, and in 1857 set up, the first decentralized divisional structure based on the “line and staff” distinction (Chandler, 1977, p. 106). His goal was to imitate the motivational and entrepreneurial advantages of small business with the economies of scale of specialist staff in railroading. He sought to combine the advantages of centralization and decentralization by locating responsibility and authority at the divisional level.

The new line and staff form of organization cleanly separated staff (or professional) from line (or managerial) authority positions. While a single line of authority from top to bottom of the organization was the backbone of the managerial hierarchy it was not the only channel of information nor did it establish a single-dimensional conduit for relations of authority. In fact, information flowed along specialist occupational channels and the authority channel had break points that delegated authority for specific purposes along the way.

The critical break in the authority channel was at the divisional headquarters. Divisional managers were given authority to run their divisions just as the conductors on the Western were given authority to direct the movement of the trains. But authority was more substantial for the divisional managers: it meant the power to hire and fire staff personnel, maintain a separate set of books, coordinate functional activities across the division, and even, in some cases, to set prices, propose investment strategies, and implement rationalization programs.

At the same time, the divisions enjoyed access to a wide range of centralized services. The Pennsylvania had a staff in the head office with specialists in finance, engineering, legal matters, and personnel policy as well as general staff managers who coordinated, monitored, and planned across divisions. Staff personnel in the head office had no authority or responsibility except over their immediate offices. They did not issue orders to functional subordinates in the branches of the enterprise and were not responsible for their performances.

The decentralized structure solved problems that had always limited the sustained success of business enterprises over time. First, it freed top management from being caught on the treadmill of day-to-day operational decisionmaking. Once the decentralized divisional structure was in place, Thomson and his advisors could concentrate their energies on long-run considerations including external finance, interdivisional resource allocation, and evaluating middle and lower management.

Second, the decentralized structure eased succession problems by creating experienced managerial decisionmakers who could step into top positions. Decisionmaking by general managers in the field encouraged initiative and independent thought. As Charles E. Perkins, President of the Chicago, Burlington & Quincy Railroad, put it: “Men’s minds and abilities grow and expand with use and responsibility” (Chandler, 1977, p. 181). Many who learned the new management methods on the railroads, such as Andrew Carnegie, took their skills to new industries. The virtues of decentralization in developing “minds and abilities” did not extend below managers to workers who, instead, came under the dictates of scientific management.

Management Accounts: Supervising without Supervisors

We have seen that obtaining the benefits of scale led the top management of the railroads to create a decentralized administrative hierarchy. Decentralization, however, created potential for inefficiency unless a
surrogate for market discipline could be created. The problem was not how managers could control hourly workers but how top management could control lower management within an operationally decentralized hierarchy. Personal systems of supervision were labor intensive, cost inefficient, and highly subjective. The challenge was to create objective measures of performance.

Financial statements measure the financial condition of a company for purposes of stockholders and creditors. But balance sheets and income statements are not management tools; they do not provide performance criteria, reveal sources of operating inefficiency, or offer means of evaluating subordinate management performance. This is the terrain of management accounts.

The development of management accounting was as integral to the rise of Big Business in America as was the development of scientific management. But a single name such as that of Frederick Taylor is not synonymous with its creation. Instead, management accounting evolved through a series of stages set in motion by the early railroad executives. In the early 1850s railroad executives began monitoring the performance of subunits with operating ratios: direct costs, labor, materials, energy, and other costs that vary with output, divided by the sales attributed to the operating unit. The greater was the gross margin (the percentage difference between direct costs and sales), the greater was the contribution of the unit to overhead or collective expenses of the entire enterprise. But an objective measure of direct costs was not simple. Expenses came in a variety of seemingly incomparable units. How could the costs of maintenance, running a station, and coordinating schedules, for example, be summed up and compared across railroad districts for measuring performance?

The railroad men responded to the challenge. In the late 1860s Albert Fink, a civil engineer, redesigned all the statistical data of the Louisville and Nashville Railroad according to common categories of cost rather than department or function. Every expense was recorded within one of four categories and converted by formula into the common unit of costs per ton-mile. Thereafter costs per ton-mile became the statistical basis for pricesetting, monitoring performance, and controlling subordinates within the managerial hierarchy (Chandler, 1977, p. 116). Top management used these statistics to drive down costs relentlessly. The best means was increasing the utilization of capacity. Systems were set up to keep track of every car owned by a railroad company and its contribution to reducing ton-mile costs. Rates were set at the maximum consistent with full utilization.

The use of direct cost measures was applied mercilessly in the emerging mass production industries. Carnegie, who was trained at the Pennsylvania Railroad, named his first plant the Edgar Thomson Works after his partner and teacher of organizational principles. Carnegie’s cost sheets were meticulous. As reported by James Bridge:

The minutest details of cost of materials and labor in every department appeared from day to day and week to week in the accounts; and soon every man about the place was made to realize it. The men felt and often remarked that the eyes of the company were always on them through the books. (Bridge, 1903, p. 85, cited in Chandler, 1977, p. 268)

But, remarkably, Carnegie’s justification for incessant updating of plant and equipment on the basis of establishing a competitive edge in product costs paid little attention to overhead and capital costs. The costs in Carnegie’s expression “Watch the costs and the profits will take care of themselves” (Livesay, 1975, p. 101) referred to the direct costs of labor and material detailed on his cost sheets. H. Thomas Johnson writes:

Carnegie’s operating strategy was to push his own direct cost below those of all competitors so that he could charge prices that would always ensure enough demand to keep his plant running at full capacity . . . Secure in his knowledge that his costs were the lowest in the industry, Carnegie then engaged in merciless price-cutting during economic recessions. While competing firms went under, he still made profits. (Johnson, 1981, p. 515)

Led by Carnegie’s relentless pursuit of technological modernization, steel production quadrupled between 1870 and 1900. Between 1880 and 1900, Carnegie increased the rate of investment by a factor of ten. Like the railroad top management, Carnegie evaluated performance in terms of operating ratios. Operating ratios worked for Carnegie. But financial indicators, particularly for monitoring and planning multiple product enterprises, depended upon measurements that accounted for capital structure as well as operating ratios.

Management accounts were converted into a powerful planning instrument with the development of a formula for combining cost and capital accounts by Donaldson Brown at Du Pont in 1915. Brown’s formula states that $R$ (return on investment) equals $P$ (ratio of net profit to sales) times $T$ (capital turnover, or ratio of sales to investment). $P$ was not new. Measuring earnings as a percentage of sales was as old as bookkeeping. It is the information that constitutes the income or profit and loss account of a business enterprise. Likewise, $T$ was not new in that it uses the data found in the balance sheet. But defining turnover as the ratio of output to investment, breaking it down by department, and linking it to the cost accounts was new.

The beauty of Brown’s formula was its simplicity and comprehensiveness. Figure 1 breaks $T$ and $P$ down into their component parts. Every manager could understand it and respond to goals defined in terms of
it; at the same time it accounted for virtually everything that could be measured in every department. For top management it was like an X-ray cutting through to the bones beneath the surface flesh; the source of any divergence from plans or company norms could be pinpointed. Thus, if a division's returns were down, top management could quickly scan the components of both capital productivity and profit margins and isolate the source. Each division prepared reports monthly, and sometimes daily, so that top management could immediately identify unexpected variations and seek corrections.

The opportunity to apply and extend Donaldson Brown's accounting framework at General Motors soon arose. In 1919, General Motors was nearly bankrupt following a severe inventory crisis. The major stockholders, Du Pont and J.P. Morgan, installed a new management team which included Brown to gain control over a disorganized and uncoordinated group of divisions. Little information, let alone financial control instruments, existed. Within two years, General Motors was drastically reorganized and converted into an enormously successful business enterprise by a series of organizational innovations that allowed "coordinated control of decentralized operations" (Sloan, 1965, p. 139). The positive effects were indicated by the increase in average annual turnover of total inventories from 1.5 in 1921 to 6.3 in 1925. It is likely that similar productivity increases occurred in other working capital items such as cash and accounts receivable and in fixed capital (Johnson, 1978, p. 510).

**Standard Volume Pricing**

Carnegie's costs sheets were inadequate for a second reason: they did not account for phases of the business cycle. Managers would look good during upswings in the business cycle and bad during downswings independently of their actual performance. But worse, Carnegie's cost sheets were not designed to anticipate the business cycle, which could have had disastrous consequences. If, for example, Carnegie invested heavily in output-increasing capacity which came on line during the early stages of a prolonged slump, the company would be at a competitive disadvantage compared with non-investing rivals that did not have to cover the costs of the new plant and equipment.

The system of financial controls developed at General Motors addressed this problem. In the process a pricing system was created that accounted for the existence of the business cycle. Alfred P. Sloan Jr, chief executive officer of General Motors, was acutely aware that basing prices on costs would intensify the already highly cyclical nature of the automobile market. Volume production with high fixed costs meant
that costs per unit of output would increase in economic downturns and decrease in upturns. General Motors had no intention of reinforcing such swings because of the potentially devastating organizational effects. To solve this pricing problem Brown developed the idea of "standard pricing".

General Motors was not guided by the policy of maximizing profits: as stated by Donaldson Brown, "...the object of management is not necessarily the highest attainable rate of return on capital, but rather the highest return consistent with attainable volume..." (emphasis in Sloan, 1965, p. 141). Profits, Brown argued, could not be pursued at the "sacrifice of wholesome expansion".

The financial goal of General Motors was to make a long-run return on investment of 20 percent when output equalled 80 percent of capacity, the "standard volume". "Long run" meant over the business cycle. The resulting "standard price" took account of the inadvisability of adjusting prices to costs independently of the business cycle. If General Motors increased prices in times of downturns to cover higher fixed costs per unit output and reduced prices in business upturns, the impact of the business cycle would have been intensified. The existence of high fixed costs and constant prices meant that profits adjusted dramatically. Thus the problem for top management was to devise a standard for evaluating performance that was detached from the variations of profits over the business cycle. Otherwise divisional managers would be faulted for downswings in the business cycle, a factor over which they had no control.

To distinguish between planned variations in profits caused by swings in the business cycle and controllable variations caused by operating inefficiencies, General Motors devised a "flexible budget" to compare actual profits with the planned profits over a range of actual output levels. Thus a standard price was calculated at standard volume for a 20 percent rate of return. The forecast established "standard" values for each of the major factors affecting return on investment such as fixed and variable costs and capital turnover rates. The purpose was to establish norms for comparing the performance of operating units and as performance targets for operating units.4

In addition, General Motors' system of financial controls increased its capacity to respond rapidly to market changes and less vulnerable to cashflow and inventory crises that plagued the automobile industry. Whereas the economic downturn of 1918–19 put General Motors in the control of its creditors, the same company survived a decline in sales from a peak of 1.90 million total units worldwide in 1929 to 0.53 million units in 1932 and from a new peak of 1.93 million units in 1937 to only 1.11 million units in 1938 (Sloan, 1965, p. 214). No other firm had such capability.

The system of financial controls at General Motors was a far cry from Carnegie's cost sheets. Not only were overhead and fixed costs included in the calculation, but divisional managers were not held responsible for items that they could not control. At the same time General Motors was a decentralized system in that responsibility and authority for operations were lodged with the divisional managers. Thus "the coordinated control of decentralized operations" underlay an organizational form that could expand without loss in efficiency beyond anything imagined before. It also allowed for planned contraction in output in ways that were unintelligible to managers trained on Carnegie's cost sheets. Chandler summarizes:

With these innovations, modern managers had completed the essential tools by which the visible hand of management was able to replace the invisible hand of market forces in coordinating and monitoring economic activities. (Chandler, 1977, p. 448)

A Firm's Concept, Strategic Planning and Product Diversification

In one lengthy sentence, Alfred Sloan identifies the "concept" or unique idea that guided General Motors' competitive strategy. Sloan sets the scene by dividing the history of the automobile industry into three periods:

There was the period before 1908, which with its expensive cars was entirely that of a class market; then the period from 1908 to the mid-twenties, which was dominated by mass market, ruled by Ford and his concept of basic transportation at a low dollar price; and after that, the period of the mass market served by better and better cars, or what might be thought of as the mass-class market, with increasing diversity. This last I think I may correctly identify as the General Motors concept. (Sloan, 1965, p. 150, his emphasis)

Crucial to the success of General Motors during Alfred Sloan's 45 year reign, 23 years as chief executive officer, was that every new corporate diversification opportunity was tested for consistency with the General Motors "concept". General Motors became involved in numerous industries but always returned to cars because no product better fitted the organizational capabilities founded on the mass-class concept. I will illustrate the mass-class concept with three examples of

4 Using the flexible budget to adjust accounts for the uncontrollable variations in fixed costs per unit output, the comptroller's office could measure the norm for each of the key turnover and operating ratios and make comparisons with the actual results.
product diversification as described by Sloan, and then comment briefly on the idea of a firm's "concept". It is a recurring idea, particularly in the latter chapters of the book.

General Motors established the diesel locomotive industry in America. Within a decade of entering the locomotive industry in the early 1930s, it outsold all of the other locomotive manufacturers combined. Why? First General Motors initiated the concept of a standard locomotive when all other manufacturers produced customized vehicles, and second General Motors developed the diesel engine, a German invention, while the rest of the industry retained steam power (Sloan, 1965, p. 352).

Similarly, General Motors led the revolution in the refrigerator industry. Concerned that the car business would be declared non-essential during the First World War, in 1918 the then head of General Motors, William C. Durant, purchased Guardian Frigerator Company, a company that had sold 34 refrigerators in its three-year history. General Motors followed the diesel locomotive model: it offered a standardized product based on new technology, in this case Freon gas that was developed by General Motors chemists. In 1921, the first full year of mass production operation, General Motors sold 2,100 refrigerators which increased to 63,500 in 1925 as Frigidaire's market share climbed to over 50 percent. Prices were driven down from $714 in 1922 for a wood refrigerator with brine tank and water-cooled compressors to $468 for a steel cabinet refrigerator with an air-cooled compressor and direct-cooling coils weighing about 40 percent of the earlier model.6

General Motors entered the aircraft industry in 1919 with the acquisition of the Dayton Wright Airplane Company. In the 1920s and early 1930s General Motors bought major interests in Fokker, Bendix, and North American, and played a major role in building managerial organizations in each. The reason behind the acquisitions is given by Sloan:

Our original motive for investing in the aviation industry...[was]...the feeling that the industry might somehow produce a flyer plane which could compete with the automobile...(Sloan, 1965, p. 368)

Bendix and North American became Big Business during the Second World War. Whereas each had sales of $40 million in 1940, each was in the $700-800 million mark by 1944. Nevertheless, General Motors withdrew from the aircraft industry following the War. Why? In 1942 Sloan reasoned that the General Motors concept was inconsistent with any of the three aircraft markets that he foresaw. The military market, in the words of Sloan, "would involve a large amount of engineering and development work with continuous modification of low-volume models" (Sloan, 1965, p. 372). In the commercial field Sloan foresaw a rapidly expanding market but "sales volume to a manufacturer would be limited". Finally, the market for small private planes "would not become a serious competitor of the motorcar in the foreseeable future" unless there was some revolutionary breakthrough in safety (Sloan, 1965, p. 372). Consequently General Motors maintained North American as an accessories supplier but otherwise withdrew from the aircraft industry.

General Motors' locomotive and refrigerator divisions were also sold. The reason was that inadequate market size precluded employing General Motors' mass production techniques successfully. Both locomotives and planes were sold to companies with smaller production capacities and less rigid production methods. Neither these products nor refrigerators fitted the second feature in the General Motors concept - a class good. Furthermore, class had a double meaning. It meant income level, but also lifestyle. Class in the General Motors notion of mass-class encompassed the idea of annual model changes. A class product denoted recent vintage as well as model. Each of these notions was one of the criteria by which General Motors determined whether a product could achieve the volume that was consistent with their distinctive organizational capabilities and overhead structure.

However, as we shall see in the next chapter, top management at General Motors did not always take market size as a given. Strategic planning involved shaping the market for transportation to fit General Motors' organizational and production capabilities.

For Sloan, strategic planning and a corporation's concept were not the same thing. A firm's concept defines its distinctive competence - the one activity or purpose that gives a firm a unique and inimitable position in the market and with which any specific strategy must be compatible. A firm's concept is like a compass - it gives direction to an organization by shaping its priorities. Without a clear concept, a firm risks losing cohesiveness by spreading its resources into disparate activities. Every firm with a sustained record of success has a concept that distinguishes it in the market, but to thrive a firm must continue to refine, develop, and act upon its concept in a world in which change

6 Continuous modification is my emphasis. Ironically, continuous improvement is what distinguishes the New Competition from the Old which General Motors represents. However, General Motors 1987 supplier's manual describes General Motors' new management philosophy of "continuous improvement".
is ever present. A firm can reshape its concept but it is like a person altering his or her personality: it does not happen often or easily.⁷

Conclusion: Production Efficiency and Market Control

Not only does Chandler describe the transformation of the American economy to one dominated by Big Business, but he also describes the emergence of an industrial managerial class that does not fit into the capitalistic-worker dichotomy. The managerial class did not derive economic power from ownership. Their ascendancy was a quiet revolution which coincided with a radical transformation of the economy. The owning class maintained legal power over firms and sat on the boards of directors, but the power to make production decisions was relinquished to the managerial class, who had become the real directors of production.

Certainly, many of the pathbreakers to the new order based on mass production were not simply managers. But being a manager as well as a capitalist created men who fitted uneasily in the capitalist class. Owner-managers of mass production enterprises, such as Carnegie, du Pont, and Ford, saw themselves as technocratic leaders of a new productive order. Carnegie maintained emotional allegiances, however loose and contradictory, to the Chartist movement that inspired his father in Scotland, du Pont was more an organizer of the managerial class than the working class, and Ford shattered the going wage with his $5 day in 1913, a move that was resented by other owners.

Furthermore, whatever the intention of the organizers of mass production enterprises, the new system had an internal logic that democratized consumption in two ways. First, it improved the consumption capacities of the working class. Mass production depended upon and created the first mass consumption society. Incomes increased partly through higher nominal wages, but more by the increased efficiency of production which meant lower prices and a vastly improved standard of living to the worker and his or her family. But mass production did not simply mean more goods; it also meant the emergence of universal or democratic goods that were consumed by capitalist, manager, and worker alike.

No product better exemplified the new age than the car. Whereas the first cars were a toy of the elite, the Model T was designed to be affordable to Henry Ford’s farmer father. Ford was not the first metal-

⁷ A firm’s culture, a close relative of a firm’s concept, is examined in chapter 3; the idea of strategy is further developed in chapter 5.

fabricating firm to manufacture a universal product. Singer’s sewing machines and Pope’s bicycles were designed for a mass market. But Ford’s Model T became the symbol of the potential of mass consumption. At a time when luxury cars were selling for over $4,000, Ford dropped the price of the Model T from $950 in 1909 to $360 in 1916 while sales expanded from 12,000 to 577,000 cars; over the same period Ford’s market share surged from under a tenth to nearly a half (Hounshell, 1984, p. 224). Ford ushered in an enterprise strategy that was alien to economic theory, for that theory held that the evil of monopoly and monopolistic competition was that it restricted output to hold prices up. Ford, instead, relentlessly expanded output and reduced prices.

But Chandler’s description of these developments denies any contingent features to business and industrial organization. If the American economy was to be modernized it had to fit the imperatives of Big Business. While Chandler addresses issues of class, his class analysis is derivative of a deeper efficiency imperative which drove the organization transformation.⁸ Whereas Chandler’s analysis is institutional, ironically, the Chandlerian perspective has no space for institutional diversity. Instead, the efficiency imperative is imposed by an organizational logic: administrative coordination transcends market coordination because it is more efficient in the marketplace. Chandler’s perspective implies a teleological sequence of stages dictated by ever more efficient means of economic coordination.

The competing market control account stresses the emergence of Big Business as a particular response engineered by top management to counter a late nineteenth century profit squeeze between cutthroat competition on the one hand and organized labor’s resistance to wage reductions and new production methods on the other. But the market control story does not explain why Big Business took the particular form it took in terms of the organization of work, of hierarchy, or of supplier relations. Furthermore, while Big Business may have been designed to bring market stability to mass production industry, it did not solve the problem of capitalist instability. In fact it created new sources of instability not addressed by Chandler.

The reason is that the high fixed cost structure of mass production alters the dynamics of market adjustment: prices can plummet much further and still exceed variable costs.⁹ Scale economies present firms

⁸ Chandler describes the rise of the managerial class and the decline of owners and financiers that accompanied the spread of the modern business enterprise. He does not draw out implications for the working class and, with it, the strategic limits to Big Business. This matter is examined in chapter 5.

⁹ For a diagrammatical illustration see Scherer (1979, pp. 205–8). Naomi Lamoreaux (1985) specifies the conditions under which cutthroat competition is likely to occur.
with the strategic opportunity to drop prices and expand production. The gamble is that profits can be sustained by selling greater volume at lower prices. But the pursuit of greater sales in a static or declining market must reduce the market share of rivals which, in turn, can trigger a price war.

Thus the same production methods that generated increased throughput and market share also altered the self-regulating mechanism of prices in the market and increased the vulnerability of whole sectors to market downturns. The new potentially destructive dynamics were quickly understood by the participants. The guiding idea became to supersede or control markets wherever possible. Vertical integration was but a first step.

As we shall see in the next chapter, the creation of the corporation was only one means of regulating supply and demand. The desire for market control led to institutional innovations in the form of inter-firm cooperation as well. This implies that an understanding of internal business organization is incomplete without accounting for interrelationships between specific forms of inter-firm coordination, or market regulation, and productive organization.

Finally, did the rise of Big Business solve forever the problem of production as implied by the efficiency paradigm? I will argue later that the limitations of the institutional matrix known as Big Business only became apparent with the rise of the New Competition in the mid-twentieth century. American Big Business found itself incapable of responding to competitive strategies of continuous improvement and product quality based upon flexible production methods. The production organization of American Big Business was designed for another purpose: high throughput of standardized products.

Both the Chandlerian organizational evolution and the market control accounts offer something crucial to understanding the organization of the American economy: Chandler offers an unmatched description of the organization and efficiency of Big Business, and the market control perspective gives independent explanatory power to the struggle for stability by business managers and for a higher standard of living by the working class. In short, American Big Business meant both efficiency and the pursuit of market control; neither its accomplishments nor its failings can be explained in terms of one alone.

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**Postscript on Economics of Time in Economics**

The notion of economics of time begins with Adam Smith. Ironically, the first pages of Adam Smith’s *The Wealth of Nations* describe the gains in productivity from specialization by price coordination not within the market but by administrative coordination within the firm. From one angle, it is a description that fits the American System in that the source of productivity gain is specialization as opposed to throughput, the hallmark of mass production.

Chandler’s visible hand of managerial coordination has a different function from Smith’s invisible hand of market coordination. Administrative coordination is not a backup that swings into action because of market imperfections; it is a superior form of organization which enhances economies of time.

But Smith could be interpreted within the throughput paradigm as well. Smith did not ignore time. For Smith one of the three sources of productivity gain ensuing from the division of labor was “the saving of the time which is commonly lost in passing from one species of work to another...” (Smith, 1776, p. 112). Ironically, this simple insight goes some distance to making sense of the New Competition described in chapter 5. But Smith’s economies of time became defined in economics in terms of specialization and not throughput, for the criterion of competitive success in conventional economic theory is not throughput but allocative efficiency. The timeless dimension of optimal allocation theory makes it blind to both the Chandlerian and the New Competition’s sources of time economies.
Big Business and Sector Regulation

Between 1850 and America's entry into the First World War, 12 recessions can be identified in which output dropped 10 percent below its long-term trend (Best and Connolly, 1982, pp. 150-1). Employees and owners alike suffered during downturns waiting for the next upswing. Each downturn left in its wake unemployment, bankruptcies, and depressed communities. But upswings always came.

Capitalist reality was consistent with competitive market theory. Imbalances between demand and supply in a market automatically set in motion self-correcting forces. A key assumption for the self-correcting principle to work is rising marginal costs which act as a constraint governing the behavior of firms. For example, a firm facing rising marginal costs has no choice but to respond to a reduction in market prices with a reduction in production levels, a response that counters the original pressure pushing prices downward. In the theoretical model, firms have no strategic options: they are constrained by the competitive structure to engage in stabilizing behavior.

Big Business, however, is inconsistent with the assumptions required by the theoretical model of a spontaneous self-regulating market. Mass production relaxes the constraint of rising marginal costs which, in turn, creates a strategic possibility not open to the firm in the perfect competition model: the mass producer can react to a condition of excess supply by increasing supply. The strategy would be to increase market share and compensate for lower margins with higher volume. The first problem is that increased sales and lower costs would come at the expense of rivals' market share. The second problem is that rivals would not likely sit by while their market share dwindled: they too would turn to a strategy of higher volume and lower prices.

The laws of supply and demand are profoundly altered with the new cost structure and demand conditions. The “law” of supply assumes that each price has a unique output level which is governed by rising costs. But any such unique mapping of cost to supply is denied if costs do not rise with increases in production levels. Under the new conditions firms can make strategic choices that were denied them under the assumption of rising marginal costs and perfect competition. Firms may react to lower prices with lower, the same, or higher production levels: it depends upon their strategic choice which, by definition, will be related to the actual or expected strategies of rival firms.

The inclusion of strategy into the analysis of output decisions renders meaningless the textbook supply curve derived by mapping costs to output and output to price. One far-reaching real world implication is that prices are no longer sufficient to coordinate demand and supply and ensure that markets are self-regulating. The claim is not that Big Business meant market instability; it is that stability cannot be explained in terms of the price adjustment model of conventional theory. A second implication is that an explanation of Big Business and market stability requires an alteration in the most fundamental presumption of conventional economic theory — the presumption that individual action is sufficient to achieve private interest.

Mass producers are confronted with an environment analogous to that characterized by the tragedy of the commons. In the case of the commons, the fear of overgrazing can induce pre-emptive grazing by neighbors. The tragedy is that the mere threat of a free rider will induce free-rider activity. In the case of competition amongst mass producers, the awareness that a rival can respond to unsold goods in the market by expanding supply and dropping prices, may be enough to engender a pre-emptive price drop and lead to a price war. For the follower will be at a double disadvantage: the early bird will enjoy economies from increased market share, and the follower will suffer diseconomies with reduced sales.

The tragedy of the commons and the potential for cutthroat competition both stem from the same logic: a split between private and collective rationality. While it may be privately rational to overgraze or drop prices, it is collectively irrational because of the effects it has on the actions of others. In both cases collective well-being depends upon private responsibility to act in the collective interest and against the immediate private interest. Administered regulation is about establishing rules to guide private action when market competition does not ensure that private and collective rationality converge.

In the last chapter, intra-firm organizational responses to the tendency to overproduction were explored. In this chapter, I argue that the pursuit of stability by Big Business led managers beyond the integration
of mass production and mass distribution, standard volume pricing, and product diversification to interfim modes of organization or sector regulation. The term “regulation” connotes administrative methods of balancing supply and demand in a market; the term “sector” signifies that such administrative methods apply to producers selling a similar product in the same market.  

A variety of forms of sector regulation succeeded the emergence of Big Business. One—dominant-firm regulation—occurs when a dominant producer establishes and enforces informal rules which guide the pricing decisions of rivals and thereby governs the adjustment process in a sector. In this case the dominant firm possesses the power to enforce the rules by the threat of financial ruin to violators.

A second means of sector regulation is inter-firm cooperation by means of collective action. Cooperation can be formal as in cartels, or informal as in the establishment of norms amongst firms that share a long-run stake in an industry. The idea behind collective inter-firm action is also to alter the dynamics of market adjustment. Government regulation, in the form of corporate law, antitrust policy, and regulatory agencies, is yet a third form of inter-firm organization to pursue stability in the age of Big Business.

In this chapter, I will examine each of the new forms of regulation associated with mass production. I will then turn to two foreign examples, the case of rationalization cartels in Germany and the persistence of spontaneous market adjustment in the United Kingdom. The German example is presented to introduce the argument that the form of sector regulation reacts back upon the firms within the sector and shapes their development. The British example supports the contention that the decline of Great Britain’s industrial leadership is explained, in part, by the continued dominance of either spontaneous market adjustment or price cartels, neither of which was a catalyst for industrial restructuring.

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1 A sector, for example, the furniture sector, can be divided into subsectors like kitchen cabinets, upholstery, or living-room furniture. A sector evolves over time as the competitive strategies of firms and the needs of purchasers change: for example, the furniture sector may evolve into what would be better described as an interior design and furnishings sector. Finally, a sector can be considered vertically as well as horizontally, particularly for industrial policy purposes. Here the wooden furniture sector might include makers of metal accessories such as hinges and handles for cabinets. My point is that the definition of any particular sector depends upon the purpose of analysis and the state of its development and that the definition of a sector, like that of a market, must never be considered static, for the purpose of strategic competition is to redraw market and thereby sector boundaries.

2 The sum that Morgan paid Carnegie was equivalent to half of the national savings of the United Kingdom at the time (Best and Humphries, 1986, p. 225).
with the market power of a US Steel. Only then could high profit margins preclude expanded supply.

Judge Gary, the chief executive of US Steel, did what Carnegie’s competitors had never been able to do: ensure that technological change was secondary to the protection of profit margins in the sector as a whole. US Steel was the vehicle: with Gary in charge the leading firm in the sector pursued a strategy of securing a high rate of return on past investments as opposed to a strategy of permanent innovation. Profit margins were no longer used to push out the frontier of steelmaking production methods. Dividends to stockholders became the priority. In the process the organizational capacity to innovate no longer held a privileged place as in the days of Carnegie. As the strategy of the leading firm shifted so too did the organizational characteristics of the firms in the sector. But undermining the organizational capacity to innovate was to render the sector ill equipped to compete with developing sectors elsewhere that organized around strategies of permanent innovation.

Ford and Market Expansion

As noted, Henry Ford had a populist side to his character. The concept of the Ford Motor Company was to produce a universal product that everyone could afford. Ford understood that the transition of the car industry from an upper class to a universal product created a problem of demand. His solution was not to buy up or make deals with competitors, but to expand market size.

Ford’s approach to sector regulation was to establish Ford Motor Company as the lowest cost producer and dominate the industry to such an extent that he could ignore competitors. Ford’s concern, in the early and mid-1920s, was not rivals but inadequate consumer purchasing power. In this Ford looked beyond sector regulation to macro-economic demand management. His attempted solution was to balance mass production with mass consumption by increasing the income of workers. Ford linked the prosperity of the Ford Motor Company to the prosperity of the nation. But even here he saw a private solution. In Ford’s words:

An unemployed man is an out-of-work customer. He cannot buy. An underpaid man is a customer reduced in purchasing power. He cannot buy. Business depression is caused by weakened purchasing power. Purchasing power is weakened by uncertainty or insufficiency of income. The cure of business depression is through purchasing power, and the source of purchasing power is wages. (Ford, 1926, p. 151)

This reasoning was deployed to defend Ford’s break with tradition in doubling the prevailing wages. But the $5 day was not enough. The integration of mass production and mass consumption was a problem that Ford, acting alone, could not solve. If he had not known before, Ford found out in 1931 that macro regulation was beyond the power of individual firms, even giants such as the Ford Motor Company. Ford lost $50 million in that year when the River Rouge plant was shut down and 75,000 workers were sent home for an “indefinite vacation” (Hounshell, 1984, p. 296). Without a means of linking wages to productivity in the economy as a whole, a system for balancing mass production and mass consumption did not exist. Ford was adamantly opposed to one institution which later came to play this role, collective bargaining (Piore and Sabel, 1984, pp. 78–82).

The Ford example demonstrates the difficulty of going it alone in an industry in which new entry cannot be controlled. His mass production methods were imitated by others and his production-based concept of standardization was countered by General Motors’ mass-class concept which Ford eventually had to imitate. Advertising that promoted the car as a symbol of status and lifestyle undermined the utilitarian appeal of Ford’s standard product, and the marketing ideas of a down payment and instalment credit reduced the competitive edge of lowest price (Olney, 1988).

Henry Ford, like the railroad managers before him, did not adjust to the new environment. The Ford Motor Company was quietly rescued by the government during the Second World War. After the war and under the leadership of Henry’s grandson, Henry Ford II, the company slipped quietly under the General Motors umbrella. Ironically, it was General Motors that saved the Ford Motor Company. First, General Motors provided an organizational model (described in chapter 2), a price umbrella, and a training ground for automobile managers. Henry Ford II understood this and used it to rebuild his company in the shadow of the new giant of American industry. But a strategic investment program of General Motors, described below, had as much to do with the revival of Ford as anything done within Ford Motor Company.

General Motors and Market Formation

The strategic planning of General Motors was extraordinary, not only in the persistence with which it pursued the concept of mass-class but the width of its gaze which extended to an inter-sectoral orientation. General Motors perceived the automobile sector as one amongst several competing sectors in a continuously evolving pattern of industries, and
it acted to influence this evolution to secure a favorable position for automobiles. General Motors' planners perceived less threat from other car companies than from the development of alternative modes of transportation. In this General Motors was partly right and partly wrong. As argued in chapter 5, General Motors did not plan for the New Competition.

General Motors suffered no such myopia to the competitive threats of the 1920s, a critical time in which irreversible choices were being made about the formation of the ground transportation system of the United States. It was clear that the future of the automobile industry was dependent upon the progress of alternative collective consumption modes of ground transportation. For in those years the United States had extensive trolley transit and rail systems which had the potential to meet the needs of a growing urban population. The possibility of American transportation being defined in terms of trains and mass transit was the threat that induced a massive strategic investment by General Motors. The following, based upon the account of Bradford Snell, is the ugly side of General Motors' strategic activities. For obvious reasons it is not described by Alfred Sloan, and General Motors disputes Snell's version. However, it demonstrates a strategy analogous to that which lay behind General Motors' withdrawal from the aircraft industry which is described in chapter 2.4

During the mid-1920s General Motors, often in conjunction with Standard Oil of California and Firestone Tire, launched an investment program enabling it first to control and then to dismantle the electric trolley and transit systems of 44 urban areas in 16 states. Often operating through a holding company, National City Lines, the three corporations acquired electric rail systems, uprooted the tracks, and substituted diesel-powered bus systems. After acquisition and conversion, the systems were sold back to local groups, but only with a contractual clause precluding the purchase of new equipment "using any fuel or means of propulsion other than gas" (Snell, 1974, p. 37).

The investments of National City Lines were not made in pursuit of profit in the usual sense of the term. Their purpose was strategic. It was to enlarge the markets for cars, oil, and tires by blocking other modes of transportation, private or public. Once the transit and rail options were precluded by strategic action, the market for ground transportation became defined as a market for cars.

The power of highly organized and strategically oriented firms to shape markets and define consumer options is, like vertical integration,

but one aspect of securing control of supply. But whereas vertical integration limits the opportunities for excluded suppliers of intermediate goods, the actions of National City Lines pre-empted the opportunities for existing and potential suppliers of competing forms of the final product.

Once this irreversible choice was made in favor of cars, General Motors, Ford, and Chrysler could compete amongst themselves for transportation demands in the market. The automobile firms had a superior sector strategy to that of the railroad firms; the leading firm within the sector made strategic investments that led to the definition of transportation needs in terms of a car-based system. The whole automobile sector benefited. The American railroad industry, however, acted passively and without a strategic orientation.

General Motors was not against using the government as a resource to consolidate the position of the automobile industry. Few firms have been more effective in vying for government dollars. General Motors played a leading role in organizing automobile-related groups including the American Road Builders Association, the American Trucking Association, and the American Petroleum Association, as well as the car companies, to lobby in Congress. In fact, Congress diverted its entire transportation budget to roads between the years 1944 and 1961 (O'Connor, 1973, p. 105). The resulting $156 billion between 1945 and 1970 gave the car companies an enormous advantage over the railroads and other forms of mass transit.

These examples are not exhaustive. They are merely meant to illustrate that strategies for pursuing dominant-firm regulation extend beyond horizontal combination.

Cartel Regulation

In the deflationary 1870s national trade associations were formed in most American industries. Their purpose was to establish rules for production quotas and price-setting to counter the tendency to overproduction and price-cutting. But such rules were notoriously difficult to enforce. The next step, for some, was the formation of cartel-like associations with a formal governance structure. The railroads and the lumber industry provide two examples.

The Eastern Trunk Lines Association

The railroad industry was the first to experience high fixed costs. In 1914 the capital to output (or gross operating revenues) ratio in railroads

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4 The same example is developed more fully elsewhere (Best, 1982, pp. 56-8).
was nearly 6, compared with roughly unity for manufacturing as a whole (Scherer, 1979, p. 209). Fixed costs were approximately two-thirds of total costs.

Not surprisingly, the early history of the industry was characterized by cycles of price wars followed by informal agreements reverting to price wars. For example, in the early 1870s the two carriers on the New York City to Chicago run, the Pennsylvania and the New York Central, had an arrangement that set prices at $0.36 per hundredweight of grain. But with the entry of the Baltimore and Ohio in 1874 a price war broke out and prices skidded down to $0.20 per hundredweight in 1876, $0.15 in 1877, and $0.075 in 1879 until a new pricing agreement was established (Scherer, 1979, p. 209). But like the previous agreement it was short lived.

Not by coincidence the cost accounting pioneer, Albert Fink, was also a leader in the movement to establish a formal association amongst independent railroads. Fink, a civil engineer who rose to senior vice-president of the Louisville & Nashville Railroad, understood the economies of railroading. For him, the railroads had two choices: consolidation or cooperation. But only cooperation would secure the long-term development of the industry. Formal association, in Fink’s words, “makes separate, individual existence of these roads possible, and puts a check on the consolidation of these roads. ...It secures all the advantages of consolidation without its disadvantages” (Chandler, 1977, p. 140).

With the collapse of informal pools during the depression of 1873, the railroad men set up formal associations. Fink headed the largest, the Eastern Trunk Lines Association. The annual conventions of the association served as the legislative branch at which rules, procedures, and resolutions were agreed. A central office with a staff served as the executive branch by gathering information, implementing resolutions, and conducting inspections. The weak branch was the judicial. Fink appointed Charles Francis Adams, the successful head of the Massachusetts Board of Railroad Commissioners, as Chairman of the Board of Arbitration (McCraw, 1984, p. 49). It was not enough.

Fink failed to obtain Congressional support for a means of legal redress to violators of association agreements. Without legal sanction, as Fink put it, “the only bond which holds this government together is the intelligence and good faith of the parties composing it” (Chandler, 1977, p. 140). This bond was not enough when challenged by desperate firms attempting to ward off bankruptcy, or by speculators who gained control of railroad companies. By the late 1880s the Eastern Trunk Lines Association was in ruins following a series of price wars. Railroad associations were put out of business formally with the Supreme Court rulings that the Sherman Antitrust Act of 1890 restricted loose combinations.

But the railroads did not give up on government intervention. As we shall see, railroad executives were the leading advocates for the first federal regulatory agency, the Interstate Commerce Commission, established in 1887 (Kolko, 1963, p. 59). Federal commissions were to become a bulwark against both potentially troublesome state commissions and congressional interference.

Fink’s fears of the ill effects from consolidation were well founded. The great innovative enterprises of the mid-1800s did not adapt to the changing environment of the times, particularly the coming of the automobile and the truck. Failing to act collectively and strategically, the once proud industry that had been the wellspring of creative organizational ideas and training ground for American business managers went into near terminal decline. In a precarious financial position, the industry was temporarily taken over by the government during the First World War.

Hoover Associationalism and the Lumber Industry

The First World War was a watershed for sector regulation. The war mobilization effort was facilitated by the trade associations which both represented Big Business and shared power with government in establishing production quotas, setting prices, and coordinating investment and modernization programs.

The associations and individuals that had planned and implemented the war effort were not simply disbanded and sent home in the postwar period. Instead, those in the “problem” industries in particular were given a boost under the leadership of Secretary of Commerce Herbert Hoover. In the postwar debates over regulatory reform, Hoover stressed two points: first, economic order demanded administrative regulation; second, industrial self-government was superior to both monopolistic and statist regulation. The concentration of power in either private or public hands could only be checked by creating intermediate institutions between business and government with the purposes of bringing order and promoting the development of the sector. The primary function of government would be to facilitate the organization of these institutions.

Ironically, under Herbert Hoover the US Department of Commerce was developing an industrial policy, in the sense of creating sector-specific policy instruments, at the same time that the Japanese Ministry of Commerce and Industry was beginning its experiments with similar
specific industrial policy initiatives. One of Hoover’s more ambitious efforts, organizing the lumber industry, has been examined by William Robbins and Ellis Hawley.

Lumber industry activities were a public issue in the 1920s. The lumber companies were caught between users, such as the housing construction and paper industries, complaining about a lack of standards, high prices, and inefficient production methods, and the conservationists, organizing to stop the rapid depletion of America’s forests. While mammoth mills such as Mill B of Weyerhaeuser Timber Company built in 1915 in Everett, Washington, were turning out lumber on a mass production scale, the industry remained highly fragmented. Lumber giants were not as successful in using scale to drive down costs and establish market dominance as Carnegie and Ford had been in their industries. While US Steel’s strategy of gaining control of the basic raw material was pursued by the large lumber companies, the greater dispersal of resources made it ineffective as a means of controlling entry and stabilizing demand for the large mills. The conditions required for monopolistic regulation were not present.

The industry lacked a means of protecting its own lifeblood, namely the forests. Instead, a “tragedy of the commons” was being acted out as companies cut and burned without regard to rapid deforestation. The tendency was exacerbated in hard times as lumber companies were driven by the threat of bankruptcy to savage the forests and flood the market with lumber. For Hoover the solution was a policy of business cooperation to control cutting and to encourage reforestation. The way to do this was industrial self-government by industry association. An association of producers could establish rules for cutting, set standards, seek exports, stabilize markets, and promote a brand of scientific management which, in this case, included the promotion of conservation.

To create a vehicle for self-government Hoover joined with the leaders of the National Lumber Manufacturers, an industry association. At a conference held under the auspices of the Department of Commerce in May 1922, Hoover unveiled a plan to create a self-government agency, the Central Committee on Lumber Standards, to be overseen by a board composed of representatives from the lumber industry and other constituencies related to the industry including manufacturers, wholesalers, architects, railroads, retailers, and wood users (Hawley, 1981, p. 104). The agency could use Department of Commerce facilities, but would be independent of government officials. Voluntary agreements amongst “industrial statesmen” would enable the industry to collectively set standards and regulate supply in response to demand and the need to conserve the resource base. As with the Eastern Trunk Line Association, the agreements were to be monitored by an association-directed staff.

The reforestation and conservation provisions of the Central Committee on Lumber Standards were not deemed adequate by critics, or even by Hoover himself. Hoover reacted by creating two more self-government agencies, the National Committee on Wood Utilization and the National Timber Conservation Board. For Hoover these agencies were “Exhibit A of government by cooperation” and provided an alternative to regulatory agencies run by government officials.

The Great Depression, however, wreaked havoc with Hoover’s model of industrial self-government. Lumbermen responded to the market decline as they always had. Cutting and supply increased, standards and prices plummeted, and conservation pleas were ignored. Interestingly, many lumbermen officials drew the lesson from the failure to control production by cooperation and voluntary agreements that only compulsory agreements overseen by a governmental enforcement agency could save the industry from itself (Robbins, 1981, p. 130).

The election of Franklin D. Roosevelt in 1932 presented the lumbermen with such an opportunity. The American Lumberman praised an early fireside chat in which the president proposed to cure “sick industries by the excision of certain evils. . . such as overproduction, cutthroat competition and other unfair practices” (Robbins, 1981, p. 131). A Lumber Code Authority was established under the auspices of the National Industrial Recovery Act. Not surprisingly, the National Lumber Manufacturers Association drafted the lumber code, and its provisions were remarkably similar to those of Hoover’s private associations with one exception: a federal regulatory authority would compel adherence to the code. Clearly, the trade association had greater potential power over the industry under the statist regulatory regime than under cooperative self-regulating authority vested in Hoover’s associational agencies.

In practice, however, the government was no more successful at policing the various articles of the Code of Fair Competition for the Lumber and Timber Products Industries. The articles were openly flouted by numerous small-scale operators who argued publicly that the provisions were unfair. In 1934, officials of the Lumber Code Authority took one such violator to court. William Belcher was accused of violating various provisions of the code, but the Northern District Court of Alabama dismissed the government’s indictment. The Court ruled that the National Industrial Recovery Act was unconstitutional because it violated the First Article of the Constitution by granting legislative

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5 Japanese industrial policy is examined in chapter 6.
powers to an administrative agency. The Lumber Code Authority did not, according to the Court decision, have the power to establish laws over the citizens of the nation, such as Mr. Belcher. Before the case could be heard in the Supreme Court, an official in the Justice Department, perhaps at President Roosevelt's request, recommended that the Supreme Court dismiss the appeal (Robbins, 1981, p. 142). Thus ended the short history of official cartelization of the lumber industry.

A variety of lessons could be drawn from the failure of cartelization in the lumber industry. It certainly illustrated the difficulties of enforcing inter-firm agreements by either voluntary self-government or by government authority in an industry as fragmented as the lumber industry. Also, it added ammunition to those who held that cartels are simply means of protecting insider large firms against outsider small firms, whatever the rhetoric about serving the public interest. Others saw support for the claim that cartels cannot, by their nature, promote the development of an industry.

**Government Regulation**

In effect, the American public and Congress accepted the claim that mass production undermined the self-regulating market. Regulatory agencies were set up to influence supply and prices in most sectors that Big Business came to dominate. Examples include the Interstate Commerce Commission for railroads, the Federal Reserve System for banks, the Texas Railway Commission for oil and gas, the Securities and Exchange Commission for securities markets, the Civil Aeronautics Board for airlines, the Department of Agriculture for farms, and the Nuclear Regulatory Commission for nuclear power. Each of these agencies, departments, or commissions became part of a fourth, administrative, branch of government.

But United States government regulatory activity is not limited to the actions of regulatory agencies. These agencies operate within a framework of corporate and antitrust law that shapes the organization and actions of firms. I will look first at regulatory features of corporate law followed by antitrust law and practice, before turning to product- or sector-specific regulatory agencies.

**Corporate Law**

Corporations were not always able to buy other firms. In fact, before 1886 a corporation could only be established by an Act of Congress, either national or state. This practice harked back to the chartered trading companies that received their right to trade from Royal assignment. As such their privileges and responsibilities were granted by the sovereign and written into their charters. Early corporations, following tradition, were "artificial" entities, or creations of the state.

However, in 1886 the Supreme Court held in *Santa Clara Co. v. Southern Pacific Railroad* that the corporation was a person under the Fourteenth Amendment of the Constitution and entitled to its protection. The significance of the case was that the Supreme Court moved from an artificial to a natural entity concept of the corporation. For the first time the corporation had "natural" rights which preceded those of the state.

The 1889 New Jersey Incorporation Act was the next step in the break with the artificial entity doctrine: corporations could own shares in other corporations. Thus trusts and holding companies had a legal basis. The upholding of the New Jersey Act by the Supreme Court introduced a further twist: only states were judged to have the power to charter corporations. Given the freedom of a corporation to choose the state in which it was chartered, a corporate charter now meant little more than public registration in the state of either New Jersey or Delaware where the responsibilities of "corporate" citizenship were nonexistent.

A third set of interpretations of the Supreme Court opened the floodgates for corporate merger activity. Over a series of decisions the Supreme Court ruled that the corporation, unlike the partnership, was not subject to the unanimity rule (Horwitz, 1985, p. 201). This meant that important corporate actions only required a simple majority vote of stockholders. The American corporation was now streamlined for action. It had become a legal person that could devour and be devoured by other legal persons. In this the American corporation was not only a person but a cannibal.

As noted, the Supreme Court decisions were not intended to centralize economic power; if anything, the concern of the Supreme Court justices

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6 The material in this section draws heavily from Morton Horwitz (1985).

7 The trust was a short-lived organizational form in the history of American business. It originally meant an organization in which all of the governance rights (as distinct from the ownership rights of purchase and sale, and receipt of profits) of a firm were turned over to one or more trustees. The trustees then held all the voting power of the stocks which they used to hire and fire officers and otherwise manage the firm. A key idea behind the formation of a trust was to centralize the management of a group of firms so that they could operate as one. A holding company, in comparison, did not involve the separation of voting from owning rights; consequently, it did not allow for the same unification of management. A corporation was the next stage, following the trust form, in the separation of ownership and management, in that owners could be completely anonymous as the shares are freely bought and sold in the stock market.
was to decentralize the power of government. But granting the power to charter corporations to the states in tandem with the New Jersey incorporation ruling, meant that a virtual free rein was given to corporate merger activities, including horizontal expansion. Firms could no longer be characterized as passive responders to the market signals of textbook economics; they were active shapers of markets according to corporate strategy. Curbing the new potential for abuse of economic power became the task of antitrust, a topic we turn to next.

**Antitrust Law and Practice**

The first national antitrust legislation was the Sherman Antitrust Act of 1890, enacted to define illegal business practices. Section I declared illegal “every contract, combination in the form of trust or otherwise, or conspiracy, in restraint of trade or commerce” and Section II declared criminal “every person who shall monopolize, or attempt to monopolize, or combine or conspire with any other person or persons, to monopolize any part of the trade or commerce among the several states, or with foreign nations”.

Since Congress did not prescribe how the new law was to be implemented, responsibility for enforcement was taken up by a new antitrust division within the Justice Department. The challenge to the enforcement officials was to establish criteria that made economic sense and were legally enforceable. The Sherman Antitrust Act turned on the criteria for determining “restraint of trade” and “attempt to monopolize”, neither of which had clear economic meaning.

The job of the antitrust division was not simplified by a 1911 Supreme Court decision in which Standard Oil and American Tobacco were found guilty of monopolizing “unreasonably”. The new “rule of reason” criterion increased the difficulty of prosecuting under the Sherman Antitrust Act: firms had to be guilty of restraint of trade or attempting to monopolize, and of having done so unreasonably.

Not surprisingly, the passage of the Sherman Antitrust Act did not counter the trend to concentration in American business. In 1914 the US Congress tried again to reinvigorate antitrust activities with the passage of the Clayton Act and the Federal Trade Commission Act which called for the establishment of the Federal Trade Commission (FTC) as an independent specialized enforcement agency.

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8 One view of the relationship between corporate and antitrust law is stated by Morton Horwitz: “Corporation law and antitrust law are as one” (statement made at a seminar at the University of Massachusetts, March 23, 1987). In this Horwitz means that both, however unintentionally, have promoted the rise of Big Business.

Louis Brandeis was arguably the principal intellectual figure standing behind the Federal Trade Commission Act (McCraw, 1984; Zacharias, 1988). Brandeis' sympathies were toward small business, and he favored the creation of a regulatory commission that would attack Big Business and provide information that would aid small business. It did not work out that way. In the words of the Secretary of Commerce in a letter to the White House, “Instead of striking at the things we mean to hit, it [the bill] does, as a matter of fact, seriously injure the small businessmen whom we are aiming to help” (McCraw, 1984, p. 121).

It was not the intention of either the Congress or the Supreme Court justices to single out loose combinations as illegal and consolidate by merger as legal. Nevertheless, antitrust law has rarely been directed against consolidation. Instead, as concluded by Richard Posner, “...a large proportion of the Department’s cases – and an even larger proportion of the FTC’s – are brought in industries not normally regarded as highly concentrated” (Posner, 1970, p. 410).

The question is: why has antitrust, like corporate law, resulted in consequences which are often the reverse of official intentions? A part of the answer is that the terms “restraint of trade” and “to monopolize” are inherently ambiguous, and efforts to formulate unambiguous criteria for purposes of legal enforcement only bogged down the enforcement agencies in endless legal hassles over definition, with one notable exception. The act of combining to set prices was defined as a restraint of trade. In this case, antitrust officials did not have to demonstrate that trade had been restrained, only that an act to combine prices had occurred. Consequently, the criteria for enforcement became one of legal feasibility: antitrust officials concentrated their energies on activities for which court cases could be won. Ironically, the easiest target of all was organized labor for the crime of fixing wages. In fact, between 1890 and 1929, ten antitrust cases led to imprisonment and in every case the accused was a trade union official (Posner, 1970, p. 391).

The ambiguity with respect to antitrust and monopolization was deepened with the US Steel case of 1920, in which the Chief Justice of

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* The key terms in the Sherman Act are “essentially contested concepts" in that both "restraint of trade" and "monopolization" are theory dependent. Limiting price competition in industrial districts, for example, is a means of countering the “bacilli of depression” in Schumpeterian theory and can be done for purposes of increasing the long-run competitiveness of the industrial district relative to foreign rivals (see the example comparing the North London furniture makers with the furniture-making industrial districts of the Third Italy described in chapter 8). Or what is seen as monopolization by the market control perspective can be the promotion of productive efficiency by the Chandlerian throughput perspective (see chapter 2). The idea of “essentially contested concepts" is developed by Connolly (1974, chapter 1).
the Supreme Court wrote: “The law does not make mere size an offense.” Combined with the earlier “rule of reason” cases involving American Tobacco and Standard Oil in 1911, the burden of proof shifted from Big Business to prove they were not in violation, to the antitrust officials to demonstrate both that a company had engaged in an act of monopolization and that the act had harmful effects.

Thomas McCraw has argued that the reason for the gap between intention and practice of antitrust was that anti-Big Business officials like Brandeis did not understand the economics of size: Big Business, he argues, succeeded because it could produce at lower prices than small business (McCraw, 1984, pp. 97–101). If economics had been able to offer a theory of the firm or a conceptual apparatus for analyzing business organization, it might have been possible to define criteria of restraint of trade. But conventional economics was lodged in a static equilibrium framework and lagged behind the rapidly developing organizational revolution. Consequently, Big Business could often claim, without effective rebuttal, that they were acting for reasons of efficiency and not monopolization.

The way out for Brandeis, according to McCraw, would have been to jettison the procedural due process approach to regulation for a disclosure and publicity, or “sunshine”, approach which seeks consensus, makes broad policy, and advises in advance rather than prosecutes after the violation (McCraw, 1984, pp. 130–1). McCraw argues that the most successful agencies, including the Securities and Exchange Commission (SEC), pursue the sunshine approach and the least successful regulatory agencies, such as the Interstate Commerce Commission and the FTC, pursue the due process approach.

Instead, Brandeis was instrumental in the formation of the FTC according to a legalistic adversarial philosophy of regulation (McCraw, 1984, pp. 122–5). He actively promoted the enforcement approach to regulation without attention to the difficulty inherent in developing clear-cut criteria for distinguishing the harmful from the beneficial effects of size. This inherent ambiguity was amplified by the constitutional restrictions on the FTC to act as a lawmaker. For any effort by the FTC to develop legally enforceable criteria for defining acts such as “restraint of trade” or “monopolization” always risked constitutional conundrums and either a paralyzed or an unsympathetic judicial branch.

McCraw concludes that antitrust policy became, unintentionally, anti-small business because of the lack of an economic theory of Big Business and a legalistic due process concept of enforcement. Terms such as “restraint of trade” and “monopolization” were both rooted in the paradigm of allocative efficiency and the ideal of perfect competition. Consequently, when Big Business could demonstrate that it was the champion of productive efficiency it was little wonder that courts did not find it guilty of monopolization which meant, in textbook economics and antitrust law, that such firms were producing fewer goods at higher prices than if they had less market power. Faced with these obstacles in developing operational criteria and the obvious ability of Big Business to “deliver the goods” should we find it surprising that young antitrust officials, themselves trained in law, turned to the cases of price fixing amongst groups of small firms which were easier to convict?

John Kenneth Galbraith offers a different interpretation of why antitrust law has only rarely been applied to Big Business which implies a different concept of antitrust altogether. Galbraith is critical of any analysis of Big Business, such as that of McCraw and Chandler, that does not account for corporate power. Galbraith argues that the unstate purposes of antitrust law is to reinforce the conventional economic doctrine that defends capitalism on the grounds that it denies power to anyone. It gives the impression, desired by the powerful, that market power is challenged by trustbusters when, in fact, antitrust laws are a “cul de sac in which reform can easily be contained” (1973, p. 209). But Galbraith does not stop here: the concept of antitrust is based upon the erroneous presupposition that price competition is the regulating mechanism of industrial capitalism when, in fact, the real regulating mechanism of Big Business is countervailing power.

Galbraith’s concept of countervailing power presumes the prior existence of market power exercised by dominant firms or quasi-cartels associated with Big Business. To the extent that Big Business is disciplined, it is disciplined not by other firms selling similar products at lower prices but by countervailing power organized by buyers from or sellers to Big Business. Mass retailing enterprises, farmer selling cooperatives, consumer buying cooperatives (most successful in Scandinavia), and labor unions are Galbraithian examples of countervailing power. Whereas the competition of conventional economic theory originates in the existence of rival firms on the same side of the market, countervailing power derives from rivals on the other side of the market (1952, chapter 9). Antitrust activity that breaks up organizations of small firms is not simply ironic; it risks undermining countervailing power, the self-generating regulatory mechanism crucial to capitalism.

But there is more to the story of antitrust and regulatory mechanisms. McCraw’s critique of Brandeis for lacking an adequate economic analysis can be turned against McCraw as well. For McCraw, following Chandler, accepts the conventional view that price competition is the only
regulatory mechanism. The problem begins with Chandler's distinction between center and peripheral sectors. In McCraw's words "[t]hese peripheral firms compete with one another very much in the fashion of Adam Smith's classical model, which remains the model of competition described in economics textbooks" (McCraw, 1984, p. 73). By denying the possibility of alternative regulatory mechanisms, McCraw does not consider the concept of regulation that would have been most consistent with Brandeis's call for government support of small firms, namely the idea of an industrial district as networked groups of small firms engaging in complementary production activities and sharing common services. The inadvertent industrial policy of the Springfield Armory could have served as an example. Admittedly, Brandeis saw potential government services in support of small firms primarily in terms of information; the Springfield Armory engaged in technological transfer and provided collective services including labor education.

In recent times the idea of an industrial district is stretched to account for competitive strategies based upon production flexibility and product innovation. I argue in the chapters on the New Competition that this orientation to regulation has been developed successfully by local governments in post-Second World War Italy and is increasingly being pursued in Japan. These ideas do not deny a role for antitrust, but seek to integrate a concept of antitrust with one of industrial policy.

Regulatory Agencies

American antitrust and corporate law were both conducive to the rise of Big Business, but they did not solve the problem of the potential for cutthroat competition created by high fixed costs. Furthermore, the rise of Big Business itself created a target for populist political campaigns against concentrated economic power which was not disciplined by competition or government.

The concept of the sector-specific regulatory commission was based upon the reality of Big Business and the potential for abuse of concentrated economic power. But whereas the pressure to reduce economic concentration was diffuse and mediated by a political movement, the pressure from Big Business for institutions to promote sector stability was concentrated. Regulatory commissions did not escape this pressure, but lacking an economic theory of regulation neither the architects nor the implementers had concepts by which to channel these pressures. The first federal regulatory commission set the trend.

The Interstate Commerce Commission (ICC) was established by the 1887 Act to Regulate Commerce. The Act was designed to create a public administrative agency to govern the railroads. It forbade cartelization, pooling, and rebating, prescribed that rates be "just and reasonable", and established an administrative agency. Five commissioners were appointed to six-year staggered terms by the President and confirmed by Congress. The commissioners hired a staff to implement their policies. Defining these policies raised a host of unforeseen constitutional problems associated with the ambiguous role of administrative agencies within the American Constitution.

The ICC, like all regulatory agencies, must fit within the constitutional doctrine of separation of powers. Regulatory agencies are part of the executive branch of government in that the commissioners administer laws passed by Congress, but, unlike departments of the executive branch of government, they are not subject to Presidential directive. The regulatory commissioners are appointed by the executive office with the approval of Congress but, once in office, their actions are dictated not by the President but by the charter of the regulatory agency as articulated in the legislation. The legislative charter as well as the rules and practices, both formal and informal, of the regulatory agencies are subject to the test of constitutionality by judicial review. In a sentence, agencies of the executive branch of government cannot pass laws or act as a court of law.

The first problem facing the ICC was a familiar one in the history of antitrust and regulation: the range of its activities was not clearly defined by the framers of the legislation. But a second problem was equally serious: activities that were prescribed, in particular rate fixing, were not based upon sound regulatory principles.

The rate-fixing approach to regulation has never effectively dealt with the ambiguity inherent in establishing "objective" costs. The cost of machinery, for example, can be calculated in historic costs, replacement costs, or market value. But since there is no single definition of "true" capital costs, an opening is created for endless arguments amongst lawyers for and against specific measurements in a realm ill suited to the development of substantive criteria or procedures.

Instead of facing up to the inherent limitations of a rate-setting concept of regulation, Congress identified the problem as a lack of regulatory power which it sought to rectify with the Transportation Act of 1920. This Act "gave the commission power to set minimum railroad rates, to supervise the issuance of railroad securities, to approve the previously forbidden practice of pooling, and to begin comprehensive planning for a systematic national transportation network" (McCraw, 1984, p. 63). Consequently, both railroad and regulatory officials focused on disagreements over costs to the neglect of more important matters including strategic planning and innovation. In fact, sector strategic planning has never been a task of the ICC. It was powerless to stop
the unprecedented merger boom amongst railroads that followed the passage of the Sherman Antitrust Act. Likewise the ICC did not question or call to the public's attention the market-reshaping investments of General Motors.¹¹

The apparent failures of the ICC have led some to reinterpret the underlying purpose behind its creation. Gabriel Kolko argues that the ICC was created by the railroad companies as a counter-strategy to state commissions which could be dominated by anti-Big Business groups. Railroad executives were stunned when, in a general railroad strike in 1877, local militia called out by the Governor of the State of Pennsylvania to protect the Pennsylvania Railroad yards instead joined forces with the striking workers (Friedman, 1989, p. 14). Kolko quotes a 1885 statement of one railroad executive who warned "...all popular forms of government...[will] be attended by the growth and development of communistic ideas" (Kolko, 1963, p. 161). To the extent that Kolko is right it was a short-term victory for the railroad executives. The form of regulation that emerged did not equip them to deal with the real challenges facing their industry.

The legalistic-adversarial concept of regulation is not the only one. A relatively successful regulatory commission in the United States, the SEC, is based upon a disclosure-consensual concept of regulation. James Landis, the author of the major securities legislation, was acutely aware of the tendency for prevailing regulatory practices to generate unintended consequences.¹² To escape this tendency, Landis perceived the proper role of the regulatory commission less as an enforcer of rules, and more as a shaper of the definition of the market itself. This calls for a different definition of the tasks of the commissioners and the staff. First, it demands an intimate knowledge of the industry and the people in it. Second, it demands a creative orientation to propose and develop means of self-enforcement.

Landis pursued alliances within the industry amongst groups that shared his views about definitions of what constituted acceptable and unacceptable actions. The primary responsibility of the commissioner was to account for the otherwise unrepresented general public in these deliberations. The commissioner might seek to form or reconstitute industry associations to generate a consensus in the industry around these definitions. They could then be used as parameters in the legislation.

One powerful weapon of self-enforcement is disclosure: the Securities Act of 1933 and the Securities Exchange Act of 1934 required that any firm using the new issues market and the stock market disclose financial statements and a range of other pertinent information relevant to investors and whistle-blowers (McCraw, 1984, p. 173). Any firm that failed to supply all such information routinely would forfeit its rights of access to the securities markets.

In other cases Landis created a new market to facilitate self-enforcement. For example, the securities Acts required corporations to provide audited financial statements performed by independent accountants. This freed commission staff members for other activities. Landis counted on the professional ethics of accountants to go some distance to ensuring honesty in disclosures, but professional ethics were reinforced by the threat of the loss of license. The auditing standards established by the SEC required the development of a common accounting language. This task was also the preserve of the professional association of accountants. Without such a language the auditing task would be impossible.

Thus Landis' method was to guide industry officials towards a definition of what actions were acceptable and unacceptable within the market and then to find means of enforcing this behavior with a minimum of direct government involvement. Properly designed, the legislation would focus the enforcement energies of the regulatory staff on the intended targets. Secondly, it would establish incentives for self-enforcement. Thirdly, the legislation would define violations in legally enforceable terms. For example, a firm would be penalized for failure to disclose information, auditors' actions would be judged by criteria required for professional licensing, and brokers would be held accountable to association rules.

The SEC is an example of the sunshine approach to regulation which depends upon making information available to the public. Before the SEC disclosure requirements, financial information about corporations was dispersed to investors by investment banks. The securities Acts broke the monopoly control of financial information in order to restore confidence in securities markets, but a side effect was to establish a basis for monitoring the activities of corporations by commission members, or by anyone else for that matter.

Despite its attractiveness, the sunshine approach has rarely been the basis for regulatory activity in the United States. Ironically, it might be more threatening to Big Business than the legalistic-adversarial approach.

¹¹ McCraw argues that the ICC sought to promote "fairness" amongst competing modes of transportation: "The commission regulated transportation rates in such a way as to ensure that each industry - rail, highway, or water - received not those portions of the total traffic most appropriate to its routes, but instead a fair share" (McCraw, 1984, p. 64). An industrial policy based upon an extension of such a fairness principle across industries is precisely the opposite of a strategic industrial policy as pursued by the New Competitors (see chapter 6).

For while the SEC has never demanded internal management accounting information such as the benefit-cost analyses used to make decisions about, for example, product safety or environmental impact, the principle of disclosure provides a basis for requiring such information. Furthermore, the sunshine concept creates pressures for the commission to develop independent sources of industry expertise. For without such information and people, the whistle-blower will be unable to assess effectively the substantive content of the information that is provided.

For whatever reasons, the legal–adversarial concept dominated the regulatory activities of the US government until the emergence of the deregulation movement in the 1970s. By this time the interactions between Big Business and the regulatory commissions were often bound up by layers of rules and judicial decisions that could only be understood by specialist lawyers. At a time of stagflation, regulatory agencies were easy prey for attack from both the left and the right. From the right, regulation was seen as a failed liberal experiment that was hobbling American business with governmental restrictive practices. From the left, the regulators were perceived as captured by the corporations they were supposed to be regulating. From the New Competition perspective, a “regulatory miasma” had emerged that was as choking to flexibility in government–enterprise relations as scientific management was to management–worker relations.\(^\text{13}\)

Both sides agreed that the legalistic–adversarial approach to regulation had not been resoundingly successful. In fact, both regulation and scientific management had become elements of the social inertia that has limited the response of business enterprises to the challenge of the New Competition. But the deregulation school was successful in two ways: first the attack focused on regulation rather than Taylorism, and second the issue was defined in terms of regulation or deregulation and not in terms of the forms of regulation.

To widen further the scope of the debate, I turn next to a third, corporatist concept of regulation that is distinguished by the purpose of promoting industrial modernization. The case of inter-war German rationalization cartels provides an example.

Rationalization Cartels in Germany

As in America, prices in Germany fell between 1873 and the mid-1890s. But unlike in America, cartels were a legal means of market regulation.

Consequently, German mass producers were forming cartels contemporaneously with the merger boom at the turn of the century that created American Big Business. In 1887, only eight of Germany's largest 100 manufacturing and mining firms belonged to cartels; by 1907, 61 out of 100 were cartel members (Kocka, 1980, p. 80). The term “syndicate” referred to cartels with joint marketing agreements, which according to Jurgen Kocka (1980, p. 88) were the most successful such combinations. Kocka (p. 89) estimates that firms that belonged to cartels accounted for roughly 25 percent of German industrial output in 1907, doubling to around 50 percent by 1938.

If the purpose of cartels had been merely to push up profits by controlling prices, they would most likely have been unsuccessful. But German cartels sought more than price control. Often price control was a means to another goal: rationalization of production. According to Robert Brady, the term rationalization, to the Germans, meant a union of two ideas: “universal application of scientific methods and techniques, and cooperative effort in all phases of investigation, production and distribution” (Brady, 1933, p. 6). The application of science to the economy embraced first the organization of production, including plant, equipment, and methods, second synthetic raw material discovery and supply, third technological advance, and fourth economic organization (Brady, 1933, p. 3).\(^\text{14}\)

The implications for competition policy of the efficiency and rationalization perspectives are diametrically opposed. Cartels, according to conventional economic theory and American and British antitrust policy, interfere with markets and thereby protect outdated production methods and work practices from the modernizing influence of price competition. Worse still, in the words of a leading economics textbook, the “...object [of a cartel] is the monopolistic domination of the market”. The result is allocative inefficiency.

Cartels, in German economic thought, are perceived as possible instruments for the promotion of rationalization and economic growth. Robert Liefmann states: “Cartels...were in some of the most important German industries actually a principal cause of the rapid economic development which has characterized the last decades” (Liefmann, 1932, p. 87). Liefmann argues that cartels were a means for promoting the

\(^{13}\) The term “regulatory miasma” is from Robert Reich (1987, chapter 18).

\(^{14}\) In the German language the term for the study of natural sciences does not include a word, such as science, that separates it from the study of humanities. Thus the natural sciences and humanities are translated as naturwissenschaften and geisteswissenschaften and social science as sozialwissenschaften. Science means, in this context, disciplined inquiry and is not conflated with a formalist research methodology (McCloskey, 1985, p. 54).
transition from cottage industry to modern business enterprises: "cartels...led above all to the emergence of firms from the shells of the domestic system" (Liefmann, 1932, p. 64).

From this perspective, cartels can provide the financial and managerial breathing space to enable rationalization of production. Here the term rationalization is extended to imply a structural link between the form of competition amongst firms and the organization of production within firms:

[Rationalization] connects the processes of works reorganization...with the industrial combination movement in both its aspects of financial amalgamation and price control. The novelty consists in the combination of the two ideas—re-grouping as a preliminary to re-organization; that is to say, it excludes on the one hand specialization or standardization carried out by the individual firm, and cartel and trust formation alone on the other. (Warriner, 1931, p. 29)

Given the premise that mass production and perfect competition are incompatible, particularly in an economy as small as that of turn of the century Germany, the right of firms to form cartels was not an issue in economic thought. In 1897 the legality of cartels was confirmed by the Reich's highest court (Kocka, 1980, p. 88). The debate was about the role of government oversight. Until the imposition of government controls during the First World War, when certain sectors were forced to form cartels, the government's stance towards cartels was one of passive observation (Michels, 1928, p. 37).

Immediately after the First World War, governance of the economy became a major issue. The ambitious Wissel-Mollendorff program proposed combining all enterprises and industry associations in a "public law corporation", an economic parliament supervised by the ministry of industry. It failed in the Reichstag but was immediately followed by a more active cartel policy (Michels, 1928, p. 37). In 1919, in cooperation with national trade associations, the government established a code of cartel ethics and the Cartel Mediation Board to settle disputes at the sector level which, in turn, were organized by private boards. Still the government was not involved in supervision or enforcement and the Cartel Mediation Board had no legal means of enforcing its decisions.

Cartel excesses were blamed, in part, for the inflation that led to the Stresemann government assuming semi-dictatorial powers on October 13, 1923.¹⁵ The Cartel Law of November 2, 1923, was issued by government decree without Reichstag enactment (Michels, 1928, p. 43). The Cartel Law strengthened the private boards, not by replacing the personnel with government officials or even vesting the private boards with direct governmental authority, but by converting the Cartel Mediation Board into an official cartel court of final judgement on any disagreements within the private boards.

Cartels, however, were only one form of inter-firm organization created to promote economic rationalization. The Kaiser Wilhelm-Gesellschaft was created by the Reich in 1911 for the purpose of establishing sector-specific scientific laboratories. Laboratories were established in many industries including coal, metallurgy, rubber, metals, textiles, leather, aviation, electrical and hydraulic power, and "psychotechnics" (Brady, 1933, p. 16). Support for the laboratories came from the Reich, state governments, private individuals, and firms.

Cartels and scientific laboratories were key elements in an economic governance structure that judiciously integrated the market and the plan for the purpose of modernizing production. The ideal of a self-regulating economy did not guide governmental economic policymaking. But clearly, rationalization was not the only goal of the government, and the institutions designed to promote rationalization also created an economic governance structure that could be used for other government purposes.

The potential that Germany's industrial structure offered for purposes of top-down state control did not go unnoticed by observers of the German rationalization process. In Brady's 1933 book the potential of the system for political dictatorship is evident:

Any group capable of developing and carrying through a national economic plan in Germany would find much of the necessary machinery already available for use. The Kaiser Wilhelm Society and the Institute for Business Cycle Research would be able to centralize and coordinate scientific research on a national basis. The German Standards Committee could easily expand its activities to include the elaboration of a complete body of national standards and coded practices. The various committees of the National Board for Economy and Efficiency would shortly be able to supply guiding rules for internal organization of all phases of management in all the various branches of industry and commerce. The National Association of German Industry possesses a machinery which could be readily adapted for the purpose of centralizing policy-forming powers for the major industries. Similar adaptations could be made of existing central organizations in agriculture, retail and wholesale trade, banking and finance, shipping, trucking, and railroad transportation, communication, handicrafts, and other fields. (Brady, 1933, pp. 61–2)

In short, the German industrial structure was propelled by privately

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¹⁵ Most accounts attribute the German inflation to other factors. Galbraith, for one, argues that the large overhang of spendable assets combined with a fear of inflation, the large reparations payments, and mismanagement all contributed (1973, pp. 186–95).
directed enterprises which engaged in a variety of private but collective actions, including the creation of active production associations, cartels, and scientific laboratories. Sometimes these actions were purely voluntary, and at other times they were pressed upon unwilling participants. When such organizations were backed by powerful enterprises they had considerable clout in influencing state and banking policies. But the fact that the organizational structure of the economy created a basis for the state to control firms and cartels does not mean that state personnel had either the theoretical understanding of capitalist modernization dynamics or the capability to organize enterprises and inter-firm organizations.

The point is not that cartels lead inevitably to political domination. Cartels were and are commonplace in the Scandinavian countries and Switzerland. Table 2 demonstrates the extent of cartels (defined as an “agreement fixing prices or allocating markets” (Chamberlin, 1933, p. 170) and single-firm monopolies in Sweden. Before and after the Nazi period, European governments have used cartels as an instrument for promoting economic development: “...the price-fixing authority turns out to be a general and powerful Rationalization Board” (Brems, 1954, p. 178). In many countries this “rationalization board” function was taken over by the State. Norway, for example, made cartels compulsory in many industries. The reason can be found in Norway’s antitrust law of 1926, which stated: “...price control is necessary as a permanent element in the industrial organization of the economy” (Brems, 1954, p. 176). Price controls were a means of encouraging “rationalization...by allowing efficient firms more profits...[and] quality goods if particularly profitable prices are fixed...[and saving] superfluous costs if the price authorities refuse to fix the level which covers such costs” (Brems, 1954, p. 176).

Not surprisingly, in post-Second World War Germany the concern was again less about allocative efficiency than about rationalization, including productive modernization and resource mobilization. For Germany, price competition was associated with fragmentation, and the effort of the Allied powers to impose American-type antitrust was perceived by the public as an effort to “...harm Germany’s competitive position in world markets” (Brems, 1954, p. 148). Freedom in the European context means the “freedom by managers to choose monopoly or competition” (Brems, 1954, p. 155). Cartels were banned in 1945 by the victorious powers, but it came as little surprise that exceptions and evasion existed. Nevertheless, in the case of Big Business, mergers and vertical integration had reduced the role of cartels (Kocka, 1980, p. 89).

<table>
<thead>
<tr>
<th>Value of total domestic sales (million kroner)</th>
<th>Cartels</th>
<th>Cartels plus single-firm monopolies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining, iron, steel, and metal works</td>
<td>279.9</td>
<td>39</td>
</tr>
<tr>
<td>Iron, steel, and metal products</td>
<td>256.5</td>
<td>24</td>
</tr>
<tr>
<td>Mechanical shops</td>
<td>462.3</td>
<td>16</td>
</tr>
<tr>
<td>Electrical industry</td>
<td>117.2</td>
<td>54</td>
</tr>
<tr>
<td>Instruments, gold, and silver</td>
<td>29.6</td>
<td>3</td>
</tr>
<tr>
<td>Stone and clay</td>
<td>157.1</td>
<td>55</td>
</tr>
<tr>
<td>Wooden products</td>
<td>228.9</td>
<td>10</td>
</tr>
<tr>
<td>Paper, pulp, and graphical industry</td>
<td>289.5</td>
<td>23</td>
</tr>
<tr>
<td>Food</td>
<td>1,188.1</td>
<td>28</td>
</tr>
<tr>
<td>Textiles</td>
<td>579.3</td>
<td>9</td>
</tr>
<tr>
<td>Leather, hair, and rubber industry</td>
<td>192.5</td>
<td>–</td>
</tr>
<tr>
<td>Chemico-technical</td>
<td>206.7</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>3,987.6</td>
<td>23</td>
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<tr>
<td></td>
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<td>39†</td>
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*Weighted averages.

control as indispensable to this process. It was a model of development that was neither Smithian nor Marxian, but Schumpeterian and mercantilist. It clearly emerged out of a different intellectual and political tradition with respect to the role of the state in the economy. Perhaps the late unification of the German state, in 1871, and its role as the creator of a single national market contributed to a public image of the state as a liberator for economic activities. For the first time, Germans could freely trade across the entire nation. This is in contrast with Britain and America, where public anxieties about excessive state power have been central to democratic struggles over the centuries.
The Old Competition

Market Regulation and the Decline of British Industry

Perhaps the drop of Britain's share of world exports of manufactured products from 33 percent in 1899 to 23 percent in 1929 merely reflected a catching up of the newly industrializing countries of the day, mainly the United States and Germany. But the postwar drop from 25 percent in 1950 to under 8 percent in 1984 could not be so easily dismissed (House of Lords, 1985). Over the same period British per capita income had dropped to roughly half that of her major competitors. Why?

Bernard Elbaum and William Lazonick argue that British firms never adequately responded to the organizational innovations that propelled mass production into both the staple industries such as textiles, steel, and shipbuilding, and the new sectors, including cars and electrical products. Instead, firms remained small, vertically specialized, and coordinated by the market at a time when firms in similar industries elsewhere were vertically integrating and introducing managerial hierarchies to achieve economies of scale. Thus the industrial organization of Britain, created in an age before mass production, was ill-equipped to restructure production according to the new principles. Collectively, British firms were ill-equipped to confront the invasion of foreign products and firms based on the new principles of production and organization.

Modern managerial enterprises came late to Britain. The central office, functionally departmentalized organizational form created in the United States to carry through the strategy of vertical integration was never widespread, and the multidivisional organizational form suited to the diversification movement in the United States of the late 1920s and 1930s was not adopted in Britain until the 1960s (Hannah, 1980, p. 60). Imposing a multidivisional form on firms that had already established mass production, as occurred in the United States, was one thing, but imposing it on a holding company structure that had not implemented production rationalization was another. The benefits of divisional decentralization were likely to be lost on organizations that had not been administratively centralized.

Multidivisional firms are not the only institutional rationalization agent; banks too can develop and implement sector rationalization strategies. In Germany, banks led in the promotion of industrial combination and rationalization in key sectors such as mining, machinery, steel, and electrical products. The objects of sector reorganization were, as Riesser put it in 1911, “...to get rid of troublesome competition, to combine the successive stages in the process of production, or to diminish the costs of production” (Riesser, 1911, p. 369). In the United States J.P. Morgan played a key role in converting cutthroat competition into the “harmony” and a “community of interests” of Big Business via mergers that created giant oligopolies such as American Telephone and Telegraph, General Electric Company, International Harvester Company, Mercantile Marine Trust, and US Steel (Winkler, 1930, p. 168; Sinclair, 1981).

Montagu Norman, the head of the Bank of England, unsuccessfully attempted a similar sector rationalization project in the British steel industry in 1931-2. He organized a Bank of England subsidiary, the Bankers Industrial Development Company, to create a source of equity capital to finance the amalgamation of the industry (Tolliday, 1986). It did not work. Historically the British merchant banks had financed governments, trade, and the staple industries including railroads, but were never seriously involved in promoting sector rationalization as in either Germany or the United States (Best and Humphries, 1986).

In the United Kingdom the task of sector restructuring was eventually taken up by the government after the Second World War. A number of staple industries and automobile manufacturing were nationalized. But industrial reorganization in the nationalized sectors was based on the assumption that big was efficient. Production irrationalities would be solved by changing ownership and creating large companies with market power.

Economists in the Keynesian tradition identified Britain's economic problem as a lack of demand that could be solved by fiscal and monetary policies, including exchange rate adjustments and, if required, trade controls. The organization of production was an abandoned topic in academic circles. Within the business world, management and much of the business press blamed labor unions for restrictive practices on the shopfloor. Nowhere was the misorganization of production itself an issue. As long as the problem was defined in terms of the sphere of circulation or distribution institutional rigidity persisted.

Conclusions

The first conclusion to be drawn is that the emergence of mass production altered coordination mechanisms. In chapter 2 we saw that the rise of Big Business meant the integration of mass production and mass distribution. In this chapter we examined the next step: the sectoral regulation of Big Business. Since cartels were outlawed in the United States some combination of mergers, government regulation, price leadership, and tacit collusion was established. The term "regulation" signifies that the coordination of supply and demand in a sector is not
by either price or administration alone, but by some combination of the two.

The second conclusion is that the effects of federal government antitrust policies tended to be plagued by unintended consequences. Antitrust, by penalizing loose combinations, gave incentives to merger activity and the consolidation of activities within a single firm. In fact, to the extent that antitrust policy gave incentives to develop vertically integrated enterprises McCraw (1986, p. 41) has argued that US antitrust policy has been an inadvertent but powerful industrial policy.

Corporate law, as well, has been an inadvertent industrial policy, for it shapes the strategic options available to firms and affects the dynamics of sector evolution. America's official public policy toward industry has been preoccupied with the issue of allocative efficiency; its inadvertent industrial policy has promoted productive efficiency. The official policy signalled to enterprises that either market or hierarchical coordination are legal but that inter-firm cooperation is subject to criminal offense. We can now account for what has been a paradox: namely, that United States antitrust activity was created, in theory, to counter economic concentration but worked, in practice, to promote economic concentration. Public policy towards industry did both: official policy countered Big Business while a second inadvertent policy promoted Big Business.

The third conclusion is that the form of inter-firm coordination affects long-run sector dynamics. In some cases the regulators consciously shaped the accumulation dynamics of the industry; in other cases they did not. In all cases there was a temptation for the regulated and the regulators to establish a cozy relationship. But cozy relationships were not in the best interests of the sector as a whole, for long-term vitality of a sector requires both cooperation and competition. Cooperation alone can remove the cutthroat competition that erodes the financial resources required for the long-term development of the sector; competition alone can ensure the competitive pressure required for a large organization to remain innovative and responsive to new challenges and opportunities. We can say that public policy towards industry should administer a paradox (as opposed to establishing an ideal); it should promote both competition and cooperation.

The fourth conclusion is that the concept of regulation in conventional economic discourse is defined in terms of price competition or governmental regulation of industry. This is hardly surprising: both micro-economics and Keynesian theory are largely silent on the internal organization of the business enterprise let alone organized inter-firm relationships. While Galbraith's concept of countervailing power is a step in the right direction, he, like Chandler and McCraw, stops with the large firm: the assumption of passive undifferentiated enterprises spontaneously and anonymously regulated by price in the market re-emerges to explain non-Big Business parts of industry (the market system for Galbraith, the periphery for McCraw). In this both Chandlerian and Galbraithian perspectives overplay the notion of a dual economy and thereby conceal a constitutive feature of the New Competition: consultative inter-firm relations between large and small firms organized into supplier networks. But this is part of a larger critique of both perspectives for treating American Big Business as the single ideal form of business organization. Neither perspective accounts for the limited strategic capabilities of Big Business or the possibilities of other organizational forms. In this, the New Competition came as a surprise to more than the managers of Big Business.