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BRIE Research Paper #1
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AUTHOR'S NOTE

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CREATIVE DESTRUCTION AND AUTOMOTIVE FIRMS

> The opening up of new markets, foreign or domestic, and the organizational development from the craft shop and factory to such concerns as U.S. Steel illustrate the same process of industrial mutation ... that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of Creative Destruction is the essential fact about capitalism. It is what capitalism consists in and what every capitalist concern has got to live in.[1]

In the forty years between 1935 and 1975, automotive production changed little. Workers moved in atonal synchrony around a conveyor belt. Jobs were sharply defined such that the talents of the workforce were not much employed; individual initiative by a worker in completing his assembly line job was not much encouraged. When innovations occurred in the production process, the changes generally increased the productivity of the workforce through increasing the division of labor. The auto industry was the prototypical "Taylorist" system of production.

Since 1975, automotive firms have undertaken a transformation of their internal organization, their products, and their production processes. Firms have redefined what being a motor manufacturer means. Their mutatations have simultaneously disposed of subsidiaries and workers and added other

1. J. A. Schumpeter, *Capitalism, Socialism, and Democracy*, 3rd Edition (New York: Harper & Row, 1950, p. 82-83). cf. Marx on capitalism. "Everything that has a fixed form, such as the product, appears as merely a moment, a vanishing moment, in this movement. The direct production process itself here appears only as a moment. The conditions and objectifications of the process are themselves equally moments of it, and its only subjects are the individuals, but individuals in mutual relationships, which they equally reproduce and produce anew. The constant process of their own movement, in which they renew themselves even as they renew the world of wealth they create." *The Grudrisse*, in *The Marx-Engels Reader*, 2nd Edition, Robert C. Tucker, ed. (New York: Norton, 1978) p. 290.

subsidiaries and workers, but with differing skills, differing competencies.

Consider General Motors' history over the last 50 years: the past successes and recent struggles of this "ideal-type" automotive manufacturer encapsulate the dynamic nature of the world automotive industry. For decades, GM delivered high sales, high profit, high wages, and high employment. Academic analysts saw in GM an illustration of that which made American business firms world dominant. Chandler regarded GM's system of administrative coordination and decentralization as the proto-type of modern management; the Sloan/Dupont management system accounted for GM's triumph over Ford. Peter Drucker's *Idea of the Corporation* used GM as a case study for the social benefits of a well run and responsible corporation. John K. Galbraith, no friend of the large corporation, examined the proposition that firms dominated consumer markets with reference to GM. Ralph Nader and associates viewed GM as a study in the pathology of corporate power. GM was the preeminent American corporation, and was vilified or praised as such. Its decreasing market share, its loss of "profit-leadership" to Ford, its desire to learn from Toyota the lessons of Japanese management, and its reliance on allied companies for sub-compact cars are signs of the competitive malaise afflicting GM.

GM's problems are not idiosyncratic; they are repeated in other automotive firms and in other industrial sectors to a greater or lesser extent. Readers of the business press are familiar with denunciations of Roger Smith and the senior management of GM. Incompetence, short-sightedness, absence of strategic vision are among the barbs leveled. These personal insults seem a bit gratuitous. Afterall, the detractors of GM's management would concede that the management system described by Chandler as being responsible for GM's past riches is essentially unchanged. If not Smith, then someone else would be the target of shareholder anger. What has happened to GM is that world automotive markets changed. Those products and processes in which GM had distinctive competencies were no longer as well suited as previously for consumer demands. The complex and highly specialized production system GM used to its great advantage proved to be less well adapted to an environment of variable and changing consumer tastes. GM in particular, and American firms in general, have been forced by

changing markets to restructure themselves at a time when world capacity for industrial production has dramatically increased relative to demand, and where demand reflects consumer preferences different from those that historically characterized the American market. Smith and senior management undoubtedly have managerial failings, but GM faced a difficult set of choices imposed by the structure of markets.

General Motor's response has been an extraordinary mutation in the 1980's. At a time when American manufacturing companies are routinely denounced as having forsaken their long-run futures by failing to invest, GM's capital investments for 1980 through 1986 exceeded $40 billion. With this investment, GM has become one of the world's leading robot manufacturers, software companies, mortgage financiers, financial institutions, and electronics firms.[2] In 1985 and 1986, the firm absorbed 126,000 new employees, employees with skills and competencies different from the company's traditional areas of expertise.[3] GM has (or will soon) shed 100,000 employees by closing dozens of facilities, including such historic mainstays of motor manufacturing as Fisher Body. The process through which the world's largest automaker produces its cars utilized 425 robots in 1981, 6,000 robots in 1986, with robotization to peak in 1990 with perhaps 15,000.[4] GM plans to spend an additional $40 billion through 1991 on its Manufacturing Automation Protocol (MAP) systems.[5] Most other automotive firms are engaged in similar mutation. These are not declining firms in a declining industry, but firms caught in the vortex of creative destruction in a dynamic industry.

How may we understand this process of industrial and organizational mutation? What do these changes imply for the employees of automotive firms and for the governments of the major industrial countries? Can the American automotive firms and their workers resurrect their "historic compromise" of the

2. General Motors Acceptance Company, were it a bank, would be the nation's fifth largest, with assets of $75 billion in 1985. It is the nation's second largest mortgage service company, having acquired Colonial Mortgage and Northwest Mortgage companies. GMAC remains the nation's largest car loan underwriter. *The Economist*, September 6, 1986.

3. General Motors, *Annual Report, 1986*. The employees are from the acquisitions by GM of Hughes Aircraft and Electronic Data Systems.

4. *Ward's Automotive Report*, July 7, 1986.

5. *Management Information Systems Weekly*, March 17, 1986.

1950's, 1960's, and early 1970's of high wages, high employment, high profit? The answer to these questions depends upon the interaction among the choices and constraints confronted by automotive firms.

The Organization of Automobile Produduction

In examining automotive production systems, we find three generic models: a batch system of production in which relatively individualized units of a product emerge; the Fordist system employed by GM and Ford in which high volumes of a standard product are created; and a "flexible" system of production, in which the volume of production and the attributes of products are variable. Each of these systems is viable under some market circumstances. Within these choices, firms need to choose the capital intensity/labor intensity of production, and the amount of skilled labor used in production.

In the auto industry, what you sell under what conditions determines how you make it. That is to say, the characteristics of the market in which you sell determine production systems and the technology these embody: in the long run, the character of demand determines the character of supply. Some mix of products and production choices will be optimal for a firm. Continuing with GM for the moment, GM's strategy in North America was determined by the demand profile of that market. North American consumers, in aggregate, historically preferred millions of relatively inexpensive, large (and fuel inefficient) cars. Eighty percent or so of the cars sold could be categorized as standardized products sold on the basis of price (with a few styling changes tossed in).

When price matters most to consumers in a large market, firms such as GM will buy specialized machinery capable of doing one or several tasks with great efficiency. Labor will be divided as far as possible. Factors of production will be concentrated in as few locations as is possible. Under these conditions, the company with the largest production runs will generally be most profitable, so companies will emphasize increasing production runs, even at the expense of product variety or of a skilled labor force. Because automobile sales are cyclical, however, firms will expand production capacity only to the point of minimum expected demand. GM's strategy of Fordism reflected

the conditions of the American market, and produced prosperity for those associated with GM.

GM, we should note, never fully implemented the optimal Fordist strategy because of political, market, and labor constraints. For instance, GM's policies of increasing division of labor, and of treating workers as a variable cost (hence, expendable) during downturns is consistent with increasing the division of labor, but it helped produce a hostile management-labor relationship that limited the ability of GM to deploy labor flexibly. Systems of seniority and rigid job classification became the United Auto Workers' response to Fordism.

Another example of a constraint on GM's strategy concerns exports. Foreign countries were generally unwilling to accept large volumes of car exports from GM's concentrated production plants, so GM (and Ford) became multinational producers, despite the inefficiencies of diverse production locations. GM accepted the limitations on its optimal strategies, recognizing that, at least sometimes, various optimal strategies are in contradiction to each other. For GM, the inefficiencies imposed by constraints did not much affect prosperity as long as the American consumer remained loyal to GM's products.

Toyota Motor Company, by way of contrast, developed a different organization of production. Toyota, by the 1970s, sold fuel efficient, high quality products to the mass market in Japan and North America, employing a highly committed work force located in geographically concentrated production complexes, while forcing a network of supplier firms and their workers to bear the costs and risks of business cycle downturns and other such fluctuations in consumer demand. This particular mix of product and production process evolved from the market conditions facing Japanese producers: a highly competitive domestic market, a national requirement to export to foreign markets, and the consequent uncertainty of demand. This constellation of product and process proved to be extraordinarily successful as demand in world automotive markets developed characteristics quite similar to those under which Japanese firms had been operating.

Were GM, however, to attempt to replicate Toyota's product line and production process, GM would find that its previous investments, previous marketing strategies, its existing work force, its existing corporate organization would all act as

constraints on the ability of GM to duplicate Toyota's forces of production. If a firm does not already have production and product strategies that match existing market conditions, we should not expect that firm to easily rearrange itself. Just as some optimal choices are in contradiction to other optimal choices, previous choices constrain future choices.

Let us take, for instance, the relationship between low per-unit labor costs and a cooperative labor force. Many analysts of the automotive industry are now persuaded that the New United Motor Manufactures, Inc. (NUMMI) plant at Fremont, California demonstrates that American workers, placed in a "Japanese" work environment, will achieve levels of productivity and work commitment (at least in the short-run) comparable to those found in Japanese automotive factories. Wage rates matter much less to lower per-unit labor costs than do work rules, employee commitment, and other aspects of work organization. Following the examples of Japanese and German automotive manufacturers, American producers are now eagerly attempting to implement non-confrontational systems of production.

Creating cooperative work practices will be difficult for the American firms, the enthusiastic reports in the business press notwithstanding. The main impediments to cooperation are the strategies U.S. firms are following with regard to automation and multinational production. Why should Chrysler's workers cooperate with a firm that is replacing Chrysler workers by establishing low-wage maquiladoras in Mexico to provide components for Chrysler cars? Why would GM's workers accept GM's imports of Korean cars? Why should other GM plants follow the lead of the Pontiac (Michigan) plant in accepting team production when cooperative labor relations did not prevent GM from closing the Pontiac plant? Why should Ford's workers cooperate with the replacement of labor by capital equipment, or with the imports of Mexican-made Fords and Mercurys?

The success of Japanese firms in inducing cooperation from their workforce is partly the consequence of the alliance of interests between firm and workforce, especially regarding employment. This alliance of worker-firm interests is made possible by prosperity and by home country production. The American firms did not start in the early 1980s with conditions of prosperity and exclusive domestic production. Cooperative

labor relations are difficult to introduce in the absence of these conditions.

Other influences on cooperative management-labor relations include the type of product the firm produces, the mix of skills used in producing the product, and by the degree of competition in a firm's chosen market. Assume, for the purposes of this discussion, a regime of free trade. A firm in the specialty market whose production competency is a by-product of the skills of its labor force is likely to develop cooperative work relations, and is less likely to be vulnerable to other firms' strategies to take its markets.

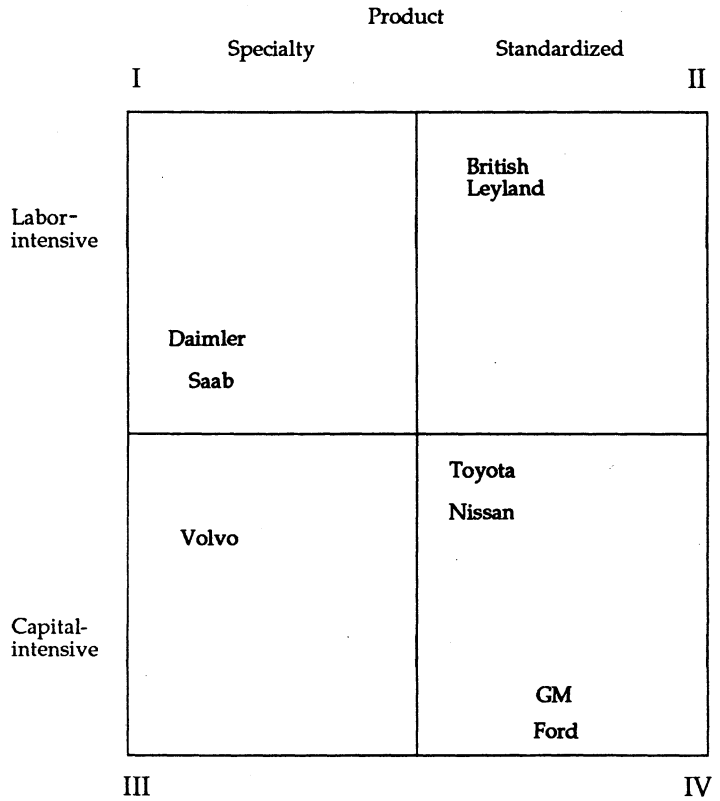
Imagine another firm with a relatively capital intensive production process with an unskilled labor force whose products are sold in the standardized or mass market. This firm will compete with other firms on the basis of product price; the wages paid to its workforce are then a threat to a firm's profitability. Firms can overcome this zero-sum situation by increasing the capital intensity of their production process, thereby increasing their productivity, though usually at the expense of overall levels of employment if not per capita wages. But, in a situation in which many firms have comparable capital endowments in the production process, wage levels are the basis of competition; increasing the capital intensity of production might only defer wage reductions for employees.

Cooperative relations depend then on the degree of competition in the mass market. For those firms unfortunate enough to produce a standardized product using labor intensive methods of production in a situation of intense inter-firm competition, cooperative management-labor relations are highly unlikely.[6]

Figure 1 is a representation of the relationship between product (specialty or standardized) and production process (relative labor- or capital-intensity). Assuming both a regime of free trade and wage costs that are not fixed costs for a firm, cooperative relations are most likely for firms in or approaching quadrant I, least likely for firms in quadrant II. The relations between management and labor for firms in quadrant III will depend on the competitive circumstances, but assuming increasing or constant sales, compromise will be possible. The conditions for compromise will not always be present in

6. This situation, of course, describes the circumstances of early capitalism.

FIGURE 1
PRODUCT ATTRIBUTES, CIRCA 1975



Source: adapted from Figure 4, below; data from company annual reports, and from OECD, *Long-Term Outlook*.

quadrant IV. In a highly competitive automotive market, some workers will find themselves subject to peripheralization. If labor costs are fixed costs to a firm, however, the firm will necessarily adopt tactics to employ worker skill to increase the value-added of the final product.

Per-unit labor cost is determined by the general tenor of labor relations, by the history of authority relations, by work organization, and by worker commitment. Product quality and productive efficiency are strongly influenced by the relations between management and the labor force. The reader of the business press also knows that nations and industries have varying patterns of work organization. We might then safely conclude that, even if managers of automotive firms are now in agreement that cooperative relations with their work forces are a crucial competitive advantage, achieving the cooperation if it is not already present may require firms to surrender other important firm goals (e.g., internationalization of component production) or to give up cooperative relations.

Optimal strategies are hard to achieve, sometimes impossible. In years past, American firms could pass on to consumers the price consequences of contradictory strategies. But market conditions no longer reflect supplier dominance of consumer markets, nor will suppliers regain dominance soon. Within five to seven years, world-wide consumer demand for automobiles will be substantially exceeded by firms' capacity to produce cars. Dozens of new plants, many newly built by Japanese companies, are due to be on line by 1990, by which time the world economy is forecasted to by enduring some sort of business cycle downturn. Some, if not most, automotive firms will suffer profit losses within the next five years.

This analysis is reflected by the stock market valuation of automotive firm stocks, which, in each country save Germany, sell substantially below the price usually warranted by the per share earnings of auto firms. Fierce competition, particularly within the domestic American market, magnifies the importance of the right choices regarding product and process. Decreasing profitability is not the worst consequence for firms: failure for some is likely.

For a firm such as GM, uncertain market conditions and the possibility that some company strategies may be contradictory produce what may appear to outsiders as confusion regarding

company goals and the strategies to implement these. Firms, in an uncertain market, will in fact frequently be puzzled as to appropriate strategies: experimentation with different systems of production often follows.

GM appears to be experimenting with several models of production and work organization, each of which have clear advantages and disadvantages.

- At the Saginaw steering system plant, GM has established a highly automated system with 26 manufacturing cells, employing a total of 40 workers who produce 1450 steering mechanisms per shift. The plant is rumored to have had substantial problems with its Manufacturing Automated Protocol system, rumors which were heightened when the Chairman of Digital Electric Company, Kenneth Olson, contended MAP to be a system that had so far essentially failed. GM is apparently using this plant's production system as a case study on the frontiers of automation.
- At the new Hamtramck plant, a Flexible Manufacturing System has been installed to produce some of GM's high-value cars (e.g., Allante, Seville). The line speed is reported in the automotive press to be working at 30 cars per hour, scarcely half of the expected speed.
- The Saturn project is GM's attempt to introduce a fixed-cost workforce in a technologically sophisticated production system as a way of producing inexpensive cars. Highly skilled workers, a no lay-off understanding, and flexible job categories will mark a break with usual GM production methods. GM has scaled back this experiment to 50% of its original expected production run, and no longer expects to produce the lowest priced cars sold in the United States.
- GM and Toyota's joint venture, NUMMI, in Fremont, California is widely reported to be a successful venture in production. A Japanese system of production, with plant-specific skills and work teams, have replaced the traditional, rigid plant production hierarchy. Grievances and other measures of worker disaffection are lower under Toyota's operating system than under GM's old system. A dissident union faction, which is said to be gaining strength, and the low demand for the GM version of the car (the Nova) possibly foreshadow harder times for this experiment.

- GM acquired Electronic Data Systems and Hughes as a method of internalizing to GM electronics, computer, and production skills not previously found in GM. (Other firms have similarly sought to internalize "high value-added" production.) The type of skills GM sought to acquire with EDS and Hughes, however, are precisely the skills for which an external market now exists. Particularly in the case of former EDS employees, an exit of skilled workers is now occurring. GM might not be successful in appropriating the types of skill it sought in acquiring these companies.

GM's success or failure with these experiment is at this time unclear. GM's willingness to experiment is a clear signal of the uncertainties confronting firms.

Strategies for the Present Market

What are the choices and constraints confronting automotive firms? What factors are at the root of the recent problems of GM and other American firms? What range of firm strategies are likely? Can the conditions of compromise between management and labor be found in the American automotive industry?

The arguments I make in this paper are as follows.[7]

1. Systems of production depend first on market circumstances, particularly on the "demand profile" of a firm's market. In conditions of high market uncertainty regarding levels and directions of consumer demand, an automotive firm will approach an optimal strategy including "rolling" vertical disintegration/integration and foreign outsourcing, combined with attempts to pacify the existing workforce.

We will see a general convergence of strategies among high-volume producers in the automotive industry. The convergence will include an increasing asset intensity of production, increasing capital/labor ratios, increasing integration in the electronics sectors, decreasing integration in the standardized parts sectors, increasing internationalization of production, and the development of clearly defined core and periphery workforces within a single firm.

7. The time horizon used in this paper is 5 to 7 years, with some reference to 15 years. Forecasting beyond that point is not possible with any degree of accuracy.

The convergence will be limited, however, by the existing tenor of firms' labor relations and production organization. That is, the way in which a firm will employ technology will depend on labor organization and on its previous investments.

2. Given market circumstances, firm choice regarding production technology will be decisively influenced by the existing tenor of industrial relations, the strength of a union movement, and by government policies regarding labor.

a. When hostile management-labor relations exist, management will generally opt for the replacement of workers by machinery. The micro-electronic revolution allows firms to rationalize production, or to endow a product with more attributes, or both. That is, firms may use robots to replace workers or use robots to allow workers to tailor a given car to the tastes of a customer or set of customers. A firm's choices regarding deployment of technology (rationalization, or amplification of work, or both) will depend on the level of "trust" between management and labor, and on the "skill" level of the workforce.

b. In the American case, no medium-term commonality of interest between management and labor regarding skill levels and levels of employment is likely.[8] The

8. Do workers have common interests with the owners and managers of private firms under modern capitalism? In orthodox Marxism, the answer is clear—no; in the Durkheimian tradition of "organic solidarity"—usually, yes. With regard to automotive production, the more practical question is "when do interests converge?" The convergence of interests with management will vary among the working class, depending on skill levels and orientation to work (See Charles Sabel, *Work and Politics*.) The convergence of interests with its workers will vary for the business firm, depending on the firm's market position and on whether labor costs are fixed or variable.

The point that the interests of management and labor may or may not converge is worth noting because many, if not most, analyses of management/labor relations in automotive production assume cooperation is not just possible, but the natural order of things. When cooperation does not occur, blame is aimed at stupid management, or greedy shareholders, or obstructionist trade unions, or all.

Upon closer examination, most of these arguments for a fundamental cooperation make three unsound assumptions:

-constant or increasing market share per firm;
-stable consumer preferences; and
-stable skills.

When we relax these assumptions and allow for dynamic competition, for decreasing sales, for changing or unstable consumer preferences, and for changing skill mixes, the presumption on behalf of a coalition of interests collapses. Under such conditions, we might hypothesize, the union has a long-term interest in cooperation (protect employment), but not a short-term interest (protect existing job categories and wages); the firm has a short-term interest in cooperation (stability, worker contentment) but not a long-

UAW is faced with an unpalatable choice regarding guaranteed employment for a firm's core workers in return for less certain employment and wages for a firm's peripheral workers. The previous explorations of common interests between management and labor made unrealistic assumptions about market and firm conditions.

c. Firms do depend, and will increasingly, depend on highly skilled employees in the automotive sector, but these skills are different from those found in the existing workforce.[9] These skills are those often associated with engineering and computer workers—the employees of EDS and Hughes are proto-types of skilled workforces needed by the auto manufacturer. But, in the United States, the labor mobility of these employees works against a firm's efforts to internalize this type of labor.

Subcontracting becomes an attractive option under these circumstances. This creates the paradox of a successful (i.e., profitable) firm without high levels of employment. The key question is who bears risks of 1) uncertain demand and 2) labor mobility. Whether firms practice internal labor markets or external labor markets will depend on the strength of the trade union movement and state policies. Firms will, left to themselves, follow an "external market" strategy, even though an argument can be made that firms would, in the long-term, benefits from internal markets.

d. Some parts of a large firm may be able to adopt a "Daimler" style system of production, with highly skilled, well-paid workers producing an expensive

term interest (reduce fixed costs), and the individual worker may have common interests with neither firm nor union.

The crucial question, given the assumptions of dynamic change, is who will bear the risk of changing markets and changing production mixes—shareholder or worker?

9. By skill, I mean an attribute of an employee for which an external-to-firm demand exists. Others (e.g., Wolfgang Streeck, and Barbara Baran) have defined skills in a different, broader way. I am using skill in a narrower, economic sense in order to examine firm behavior in light of labor markets. Hence, skill in this sense does not imply increasing employee discretion or motivation per se; the production arrangements found at NUMMI may increase employee discretion and motivation, but these do not necessarily change the skill-capital mix. Another range of skills excluded from this analysis is typified by the "Ding-man," a highly skilled worker who beats dents out of car bodies, but who is paid nothing extra for this skill. I am excluding plant-specific skills. I am also assuming that auto production is characterized by changing skills, upskilling, and deskilling.

product targeted for the luxury market. Owing to limited demand for "high-end" products, this would require the UAW in the U.S. to surrender firm-wide bargaining—an unlikely outcome. The UAW will continue, however, to act as though a single automotive industry with a single homogeneous market exists, even though at least three distinct markets are present in the United States.[10]

e. Even if a firm concedes that part of its workforce is a fixed cost, the firm will continue to rely upon peripheral workers and peripheral firms to bear the costs of business cycle downturns. The usual pattern will be to either subcontract parts production, or to establish foreign subsidiaries or affiliates in low wage countries, or both.

f. A coalition of interests may still exist between a firm and its semi-skilled assembly workers once a firm has substantially shed much of its labor force (e.g., Honda and Chrysler). When a firm has subcontracted much of its component production, the remaining workers, assuming high levels of employee motivation, are crucial for the ability of a firm to produce a high quality, cheap product.

The arguments I advance in this paper are still hypotheses with some presumption of evidence in their favor. Much research, particularly in the factory regarding the actual employment of men and machines, needs to be done.[11]

10. Strictly speaking, no automotive industry as such exists anywhere, though perhaps one might be able to speak of several automotive industries. Automobile sales takes place in several different markets, which each have different "appropriate" systems of production and strategy. In this paper, I will focus mostly on the "mass" market—80% of sales in the U.S. As a rule of thumb, car prices in this market range from more than $6,000 to less than $16,000, in 1986 dollars.

The unit of analysis in this paper is the business firm. The nature of the firm will strongly influence firm strategy. Hence, GM, a company with profitability as its principle aim, will exhibit different behavior from Volkswagen, a firm in which German federal and state governments have substantial equity stakes.

11. For examples of the necessary type of research, please see Lowell Turner, *Are Labor-Management Partnerships for Competitiveness Possible in America?* and Lowell Turner and Jana Gold, *Perceptions of Work Reorganization.*

STRATEGIES, CHOICES & CONSTRAINTS

Theoretically, we might well find as many production strategies as we find motor vehicle manufacturers. A manufacturer beginning anew would choose what product range to produce and what system of production to employ: the ratio of capital to labor ($\Delta K/\Delta L$), the system of labor organization, and the way in which capital (and its embedded technology) is deployed. The firm would also make a location of production decision, and make choices regarding the level of value-added of the final product created within the firm's boundaries: vertical integration, alliances, and outsourcing. Regarding each decision for this new automotive producer, we would find three motifs: risk and the cost of capital; the elasticity of demand for capital and labor; and technological innovation in product and process.

In practice, we find few new producers in the automotive industry, and existing firms, such as GM, Toyota, and Ford, cannot create themselves wholly anew. Managers are partially constrained by previous decisions, by the business environment, and by a firm's historical competencies. The principle constraints on firm choice are:

- consumer demand, market conditions, and the firm's previous marketing strategies;
- the existing organization of work, and the traditions of labor organization and militancy;
- the previous investments in the production system, a choice itself influenced by earlier market and labor constraints;
- capital costs, and the rate of return criterion of shareholders and investors; and
- government policy.

In this paper, primary emphasis will be given to market, labor, and investment constraints on automotive firms, and firm strategy in light of these constraints. Elsewhere, I have discussed government influences on firm strategy.[1]

1. Dennis P. Quinn, *Restructuring the Automobile Industry.*

Market Conditions

In the 1950's and 1960's, Galbraith's view that American car manufacturers dictated terms to consumers may have been accurate, but in the 1980's, consumers have an extraordinary range of choices regarding product quality and product price. Few now see GM as commanding consumer demand.

Despite this range of product and price, we may still usefully understand the automotive market as having mass and specialist sub-markets. These sub-markets will have differing sales and production strategies. Choosing to sell to the mass market, for instance, limits one's production options, and firms in this market exhibit some degree of convergence in production strategies. The specialist market, with non-standard products, exhibits a wider range of production strategies. At least at this juncture, production in the mass market is market-driven.

The point of this section is to argue that efficiency in production is a useful concept only in light of market conditions. The much vaunted Japanese, German, and Swedish advantages in producing either mass or specialist cars for the export market is real enough, but is foremost a function of the shifting consumer preferences in the 1970's, in conjunction with favorable macroeconomic conditions for these producers.[2] Were the world's consumers enamored of Mercury Montegos and Olds 88s (circa 1973), America's production system would be the world's leader, as it was for many years. Markets change, and with them change our standard of relative efficiency.

2. Why did consumer preferences change? No satisfactory answer has been given, though some factors may safely be cited. In the American case, the oil shock induced a demand for fuel efficient cars at a time when American producers made few such cars. Once, thanks to this exogenous consumer demand, foreign companies were able to establish dealership networks, parts suppliers, and an advertising presence. Firms such as Toyota could then use marketing, sales and servicing policies to convince American consumers of the superiority of the foreign product. The superior virtues of foreign made cars is insufficient as an explanation, however. Ford and GM have been making cars of indifferent quality for many decades without sparking a consumer revolt. One possible explanation, unproven and maybe unprovable, is that the delegitimation of American institutions associated with the Vietnam War and Watergate extended to other American institutions, including the Big Three auto producers. Ford Motor Company products may always have had warts, but our culture has now changed such that we are willing to examine more critically poor American products.

Consumer Preferences

A distinction is often made between products that are "price competitive" and those that are "quality competitive." Products that compete on the basis of price tend to be standardized, which means that the product is fairly uniform and the technology needed to produce it is widely available. Hence, firms will have comparable "capital endowments" as they produce the product, and lower per unit wage costs will usually be decisive for sales. These products are often aimed at the mass market. Products that compete on the basis of quality tend to be specialized products, aimed at a specific market, one in which consumers tend to be less sensitive to changes in price and more sensitive to changes in product quality. Specialized machinery and skilled labor is often required to produce these products. Unlike "standardized" products, these goods are less vulnerable to wage-based price competition. The automobile market is characterized by both types of goods—the Chevy Chevette and the Jaguar XJ6.

In the mass market, wage and labor organization costs affect the ability of the firms to capture market share as consumers tend to be price sensitive. Since firms have comparable capital endowments, East Asian countries, with lower wages and higher productivity, successfully captured much of the mass market. Newly industrializing countries or countries without a large domestic market tend to enter this market—Yugoslavia and Korea are the most recent entrants. GM and Chrysler hope to capitalize on the competitive advantage of East Asia by developing joint production networks with Korean and Taiwanese, as well as Japanese, firms.

In the specialist market, prices matter less. Quality and brand-name appeal sell cars, and here wage costs are secondary as a basis of competition. Smaller production runs are possible, and scale economies are achieved in part through skilled labor, and not through capital-intensive production. Specialist producers are less vulnerable to import competition. Being a specialist auto producer does not guarantee success, however. Germany's specialist producers—BMW, Porsche, Daimler-Benz, Audi—have fared well; Britain's—Triumph, Rover, MG—often did not. In practice, most large firms attempt to service both markets.

Product and Production

The range and quality of the automobiles that firms seek to sell partly determine the decisions that firms make regarding their production processes. Two strategies are widely employed by auto-manufacturers. The first is to produce a full spectrum of cars, ranging from sub-compact to standard luxury cars; the second is to make and sell a limited range of cars, usually in the luxury car market. A variation found among mass producers and some specialist producers occurs when firms use common components or body types for similar market niches in different countries, or employ common components across different market lines. Most mass automobile producers produce a full line of cars, regardless of whether a firm's production is located in one market or in many. The proto-typical examples of mass producers making world cars are Ford and General Motors. Examples of specialist producers include companies ranging in size from the high volume producer, Daimler-Benz (with luxury car sales of more than half a million world-wide), to Aston Martin, whose sales are counted in the hundreds.

Success in the mass market depends upon reducing production costs, since the consumers in the mass market tended in their purchasing patterns to be sensitive to changes in a product's price. Consumers in the luxury section of the market, on the other hand, tended to be quality or status sensitive, or both. Success in this market depended (and still does) on product differentiation, consumer satisfaction, and status appeal.[3] Although the sale of a luxury car is more profitable than is the sale of a mass car, the auto companies are reluctant to surrender the lower price market on the grounds that this market will eventually promote the sale of the more expensive cars when the consumers, who now purchase cheap cars, acquire enough money to buy more expensive cars: The mass market is an investment in customer loyalty.

If a firm were to offer a full range of automotive products, a firm would need either plant and equipment investment to

3. Specialist auto makers guard their reputations with a zealotry. As an illustration, BMW executives were quoted, in a 1987 article in the New York Times, as complaining that BMW's were in danger of being seen as the "Scarsdale teenager's" typical high school graduation gift, an image apparently not sufficiently "upmarket" for them.

produce at least six types of cars[4], or to accept some inefficiencies in production. In the second case, the manufacturing of a range of cars of varying quality will cause an auto maker to lose some of the advantages of economies of scale, though economies of scope may still occur.[5] This problem can be compounded in the case of multinational producers if the nations served by the firm have markets with different demand profiles. Here, many different product lines, with many different production lines, may be needed. In the case of full product range, the costs of increased capital investment expose the firm to higher market risk.[6]

The solution arrived upon in the 1970s by Ford, General Motors, Volkswagen, and Renault was first, to use common components and body types in many different sales lines, and second, to sell comparable cars in different markets. The Ford Escort is sold, with minor modifications, in both the North American and Western European markets, as is the VW GTI, Renault's Alliance, and GM's J cars. Producing a world car cuts product development costs and allows for increased scale production in component manufacturing.

The world car strategy, however, is in contradiction to the market differentiation strategy, as GM and other firms have discovered. The difficulty is that, by producing common components and line types, the differences among the product lines began to erode. A rational consumer might well wonder why he or she should pay two times as much for a Cadillac Cimarron as

4. *Consumer Reports* distinguishes among six different market segments for automobiles: small cars, sporty cars, compact cars, medium cars, large cars, and vans. This six-fold division understates the market's diversity as cars with widely differing prices are lumped within the same group; e.g., Acura (Honda) Integra at $12,000 and the Chevy Sprint at $6,400 are each listed as being small cars. Small trucks, which are sometimes substitutes for cars, are another important market for automotive producers.

5. David Teece has used the phrase, "economies of scope," to describe situations in which manufacturers are able to profit from the production of related products or variants of the same product. For instance, a four cylinder engine and a six cylinder engine usually will be produced on different assembly lines with different machinery. Though the firm producing the engines will not achieve the same scale economies if it were to manufacture one engine, the firm will achieve some saving. New buildings and new suppliers will not be needed, and so on. See David J. Teece, "Economies of Scope and the Scope of the Enterprise," pp. 223-247.

6. A firm's risk will increase if it funds investment from debt rather than equity, as the cost of servicing the debt remains fixed. Technically, a firm that funds investment from shareholder equity or from net retained income does not increase its risk as the investment is a sunk cost. In practice, shareholders expect higher rates of return from firms that undertake substantial investment.

for a Chevy Cavalier when both are J body cars with but minor modifications? Or sixty percent more for a Buick Century instead of a Chevy Celebrity when both are A body cars? In order to compete at the bottom end of the market, the multinational producers standardized production, but lost product differentiation at the upper end of the market to firms such as Volvo and Daimler, which have no standardized products.

The Japanese manufacturers were able to remain profitable even when they did not achieve full benefits of economies of scale. (The origins of the cost advantage of Japanese producers will be discussed in the two following sections.) Japanese producers, unlike their American counterparts, were (and are) willing to leave men and machines idle, calculating that reducing waste and paying greater attention to detail (fit and finish) would compensate them for lower production volumes. Toyota, for instance, has been able to offer a full range of cars, produce them with little economy of scale disadvantage, and maintain product differentiation. Toyota produces over 20 models in its home market.[7] Japanese firms do not rely on the world car, as do American firms, in producing a full range of cars.[8]

A few producers such as Volvo, Daimler, and BMW have adopted an alternative strategy, which is for a firm to produce a narrow range of higher quality automotive products. Scale economies are still achieved through the use of skilled labor and specialized machinery, though the greater value of the end product means that production costs are less important than is consumer satisfaction. Volvo, for instance, prides itself both on its reputation for safety and on its non-assembly line method of production (a method which GM is said to be copying in part at its Saturn plant). BMW and Porsche rely upon their reputations for high performance (e.g., speed and handling). The combined North American/Western European market for these expensive, specialist cars was estimated to be around 2.3 million in 1986, less than 10% of the total market, but by far the most lucrative part. Of the American luxury market, four German producers

7. Toyota Motor Corp., *Annual Report, 1985.*

8. OECD, *Long Term Outlook for the World Automobile Industry* (see Appendix B, "World Car and Specialization Strategies: Statistical Analysis," pp. 109-116). The conclusion reached in that report was that only American firms approximate the "world car" model of product development. The report does note that Britain and Italy have developed a competitive component market that is independent of the major automotive producers.

(Daimler-Benz, BMW, Audi, and Porsche) have a market share of between one-third and one-half of the total market.[9]

In the 1980s, the major auto firms are adopting converging strategies: both specialization and mass production. Volkswagen has had for many years a specialist division (Audi) as has FIAT (Lancia), and GM and Ford have each sought to purchase one. Both GM's efforts to purchase Jaguar in 1984 and Ford's efforts to buy Alfa Romeo (as with Jaguar in 1984, a state-owned company) failed, but these attempts demonstrate the willingness of the U.S. manufacturers to adopt specialization as a complementary strategy to the world car approach. Ford has, in the meanwhile, opted to import Sierras made by Fordwerke in West Germany, and market them as "Merkurs." GM purchased Lotus, a British auto firm, and negotiated a design contract with an Italian design house, Pinninfarina. Chrysler formed an agreement with Maserati. Honda has created both a specialist division and a separate dealer network to market its "upmarket" car, the Acura. Nissan has its "Z" cars, and Mazda its "Rx" cars. These illustrate the point that the sales strategy of mass production of many lines, sometimes on a world car basis, and the strategy of market specialization; are not mutually exclusive.

The problem has come, however, not on the sales end; firms can establish new subsidiaries (e.g. Honda's Acura) absent the taint of the mass market. A union, however, almost always demands similar working conditions and similar job categories for all plants it unionizes, irrespective of a given plant's target market. The problem has been that, traditionally, differing skills and technology have been used to produce cars for these two different markets, mass or specialist. The tenor of management/union relations, then, will condition the ability of firms to adopt systems of production appropriate for its targeted market.

Systems of Production

Efficiency is not a thing in and of itself; "efficient in terms of what" is always a necessary question. For instance, in comparing Japanese producers to American producers, we need to note that U.S. companies were inefficient relative to foreign firms given new consumer preferences, given the variability in

9. *Economist*, July 12, 1986; *Financial Times*, March 18, 1986.

the level of consumer demand, and given the prevailing exchange rates and other macroeconomic factors. Efficiency in production is therefore a contingent measurement.

Technological innovation, or rather, its adoption and application to production processes and products, is also contingent in its effects on efficiency and competition. In markets with relatively stable consumer preferences ("mature markets" as Abernathy would say), technological innovation tends to have a "conservative effect" that "allows a company to do better what it currently does, not to do something entirely different."[10] In the context of changing consumer demand ("de-maturity" in Abernathy's words), relatively minor innovations in production process and work organization can change the basis of firm competition. It is not technology, and the social organization of work, that determines per se what is and what is not "efficient." Rather, innovation's effect on efficiency and competition is also meaningful only in light of changing consumer preferences and macroeconomic conditions.[11] Hence, understanding efficiency in the automotive industry is understanding firm profitability, not output per worker or some other measure of work.

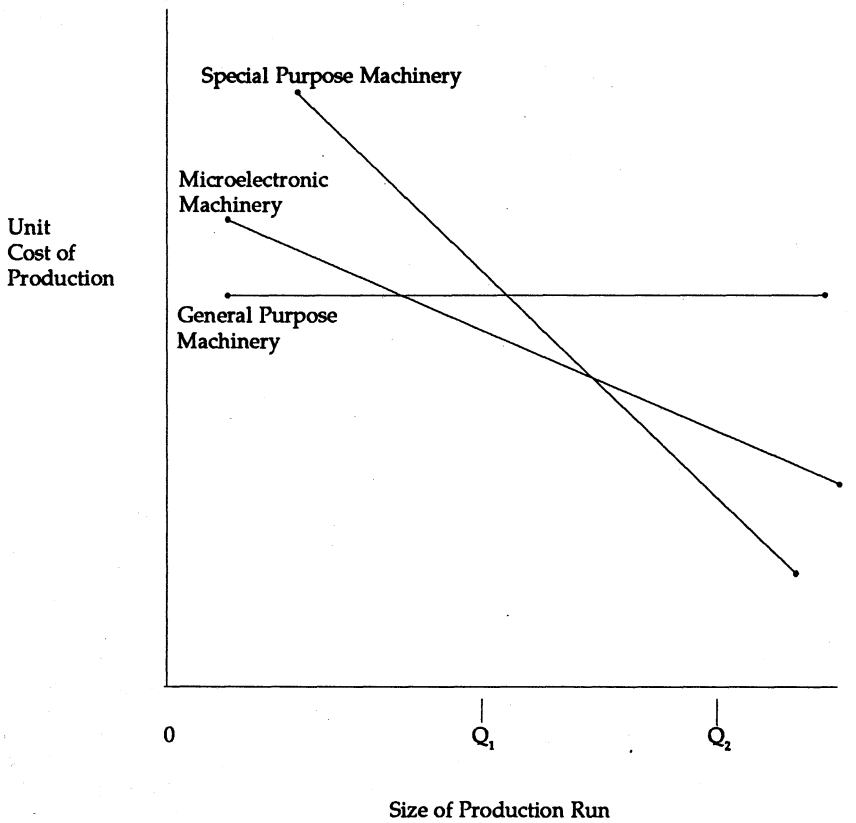
As I noted in the introduction, three methods of making cars are widely employed: the batch system of production in which relatively individualized units of a product emerge; a fordist system in which high volumes of a standard product are created; and a "flexible" system of production, in which the volume of production and the attributes of products are variable. Each of these systems is a viable alternative given certain market conditions and labor traditions.

The relationship between a system of production (worker skills, capital equipment, work rules) and the cost of production can be schematically portrayed (see Figure 2). In the figure, three different types of machines are used as proxies for different systems of production. Each system has a production run for which it is the optimal choice in terms of price. We may infer that the type of product produced (mass or specialist) will also

10. William J. Abernathy, Kim B. Clark, and Alan M. Kantrow. *Industrial Renaissance*, p. 107.

11. "Technology affects competition only to the extent that it—and the way that it—supports or threatens existing commitments: to production systems, to tactical plans and strategic goals, and to the use of resources." Abernathy et al., *Industrial Renaissance*, p. 109. The shift to front wheel drive was seen by Abernathy as being "as destructive to entrenched competence as any tornado on the Kansas plains."

FIGURE 2
UNIT PRODUCTION COST
USING DIFFERENT MACHINES



Source: Watanabe, "Labor-Saving versus Work-Amplifying Effects of Micro-Electronics."

influence the unit cost of production: highly variable products will not be efficiently produced using highly specialized machinery.

Each system of production implies a different range of skills required for the machine operators and for the automotive production process itself. General purpose machinery, and the variable product that emerges from it, can only be produced by relatively skilled employees: variability is a function of employee skill and discretion. With highly specialized machinery, semiskilled or unskilled labor is usually associated, though some maintenance workers and programmers with specialized knowledge are also required. Flexible systems of production are usually associated with microelectronic machinery.[12] The microelectronic machinery usually employed in flexible systems, Watanabe and Streeck each argue, can be used either to rationalize work, thereby replacing labor, or to amplify work, allowing for further differentiation of products. For instance, Japanese companies often choose to produce many variations of a model's exterior even though more of a given model could be stamped out if product variation were minimized: employee productivity (rationalization) is lessened by product variation, but the range of tasks performed by the employee (the vesting of a product with labor value) is increased. Microelectronics allows for the vesting of products, even in the mass market, with

12. A system of production, known as "flexible production," is credited with arranging machines and labor in such a way so as to reduce substantially wage costs through increasing productivity without cutting the wages of the individual worker. This method of production offers the possibility for capital intensive, specialty products. Flexible production has been defined as "consist[ing] of a line of machine tools and transfer machinery which can easily be reprogrammed to manufacture several types of components, or the same type of component to different specifications. The emphasis here is on the "system" so that the different components operate as a whole." OECD, *Long Term Outlook*, p. 64.

In one instance, General Motors, in its Saturn project, is attempting to implement a form of flexible production in which labor flexibility, a cooperative style of labor/management relations, salaried (not hourly) workers, and a no-layoff system of work will combine with new equipment to reduce the number of man hours per car by 75%. GM plans to install 20,000 industrial robots by 1990, many of these in its Spring Hill, Tennessee plant. The flexible production system generally results in an increase in the capital/labor ratio of production, though the labor component tends to be more highly skilled than is the case with more traditional assembly line work. The OECD has argued that flexible production may reduce the Minimum Efficient Size of production of a given type of a specific product; for instance, four-cylinder, fuel injected engines displacing 1800cc. Even if this were true, a broader notion of economies of scale—that is, encompassing the production of many types of engines on the same assembly line using the same machinery and workers—still would be an important consideration in reducing production costs.

attributes heretofore not available cheaply. Hence, the product's value, and the tasks performed to produce it, are said to be amplified. We may infer that different skill levels follow from the rationalization/amplification choice.

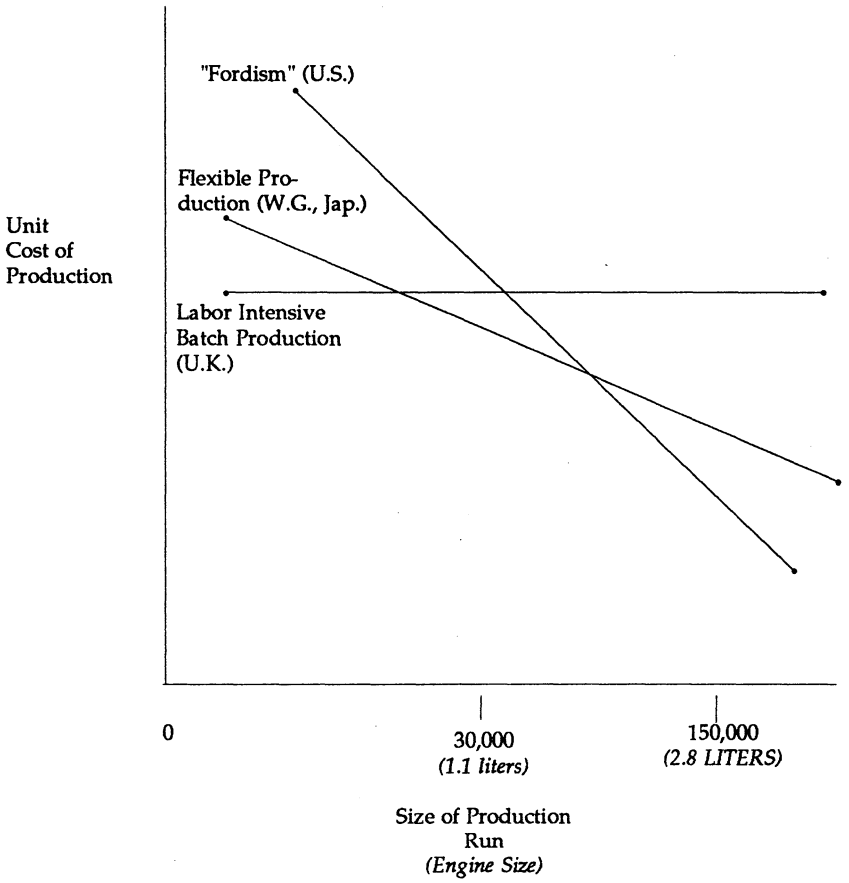
As an illustration of the point that different systems of production are viable given different market circumstances, we might note the experiences of US and UK manufacturers prior to the 1970's. Firms will, as a rule, develop products and processes well suited for their home markets;[13] firms and nations have fields of competency and expertise that are grounded in the characteristics of their domestic markets. Not surprisingly, therefore, American firms were well suited to produce and sell American-style cars in American-type market conditions—Fordism. British firms were well suited to produce and sell British-style cars given British production and market conditions—labor intensive batch production. The British system of work organization generally employed skilled labor in a gang system, who were generally paid through piece rate work. General machinery was used, and the system was relatively labor intensive. The American system of production, as most readers know, was characterized by vast production runs using unskilled and semi-skilled labor to produce a standard product.

The American and British auto industry each evolved in markets with consumer preferences different from those in the rest of the world's market.[14] For instance, in the case of Britain, uncertain consumer demand, resulting from UK government credit restrictions, and tumultuous management-union relations led British firms to manufacturer cars in small factories with a labor intensive system of production—low fixed costs (Jones and Prais; Dunnett). Figure 3 illustrates a rough proxy for measuring national differences, where, we might say, the domestic British motor industry specialized in cars with engines larger than 800cc through to 1300cc (50 cubic inches to 85 cubic

13. See Raymond Vernon, "International Investment and International Trade in the Product Life Cycle," for one of the first discussions of the relationship between product innovation and market size.

14. A variety of government policies in each country contributed to these differences in the demand profiles of the market, though these differences were not always directly the result of state policies. In the case of Great Britain, the barriers to entry included tariffs, engine-bore taxes, the absence of autobahn-style highways, and extensive state subsidies for alternative transport. In the case of the United States, cheap gas, which was partially the result of government policy, explains much of the idiosyncratic American market.

FIGURE 3
UNIT PRODUCTION COST AND WORK ORGANIZATION



Adapted from Watanabe, "Labor-Saving versus Work-Amplifying Effects of Micro-Electronics."
Data from Society of Motor Manfacturers & Traders, *The Motor Industry of Great Britain*, Abernathy, *The Productivity Dilemma*, and various annual reports.

inches), whereas the American industry specialized in cars with engines of six or eight cylinders and engine capacities of at least 170 cubic inches (roughly 3 liters) through to 305 cubic inches or larger (roughly 5 liters).[15]

As a result of these national differences in consumer preferences, American and British firms were sheltered from international competition in their home markets until the mid-1970s. This sheltering produced the benefits of relatively high profits and high wages, at least in the short run, for those in the industry. But, these national differences, and the resulting (limitations on) firm competencies, did have disadvantages. For one, the American and British industries were "pinned" in their home markets; exporting "domestic" American and British products to foreign countries was difficult. (See Williams for a discussion of market failure and BL.) When consumer preferences changed in Britain and the United States, more nearly resembling the preferences of car consumers in the rest of the world, American and British firms discovered a second disadvantage of sheltered markets. Foreign firms, German and Japanese firms in particular, had already developed competencies in producing and selling cars with the features and price now demanded by American and British consumers.

The Japanese and German industries each developed a third alternative system of production, one that might be described as combining the extreme product variability found in batch production with some of the economic benefits associated with volume production: the "flexible" system. This system of production is widely held to be well suited for firms who rely upon export markets. (Japan exported 40% of its car production in 1975, 58% in 1985; Germany exported 51% in 1975, 62% in 1985.) An export strategy generally does not allow a firm to establish very large production runs of uniform products; subtle differences among consumer preferences in different national markets could confound such a strategy. A high premium is

15. Karel Williams, *Why Are the British So Bad at Manufacturing?* published a table showing that in the late 1960s, 55% to 60% of the British new car market was held by cars with engine capacities at or below 1300cc (pp. 278-279). Peter J. S. Dunnett, *The Decline of the British Motor Industry,* attributes much of the differences in engine capacity in British cars to British government policies that taxed cars by the size of the engine bore, and later, the size of the engine itself. William J. Abernathy, *The Productivity Dilemma,* notes that the 1971 Ford Pinto's engine was the first American produced four stroke engine smaller than 100 cubic inches since the 1930s.

therefore placed upon the ability to respond rapidly to fluctuations in consumer demand and consumer taste. Firms in the export sector depend on "pockets of opportunity," and will structure their production process accordingly. Production flexibility in deploying capital and labor is the sine qua non. The ability of firms to successfully export products does not just depend on its production system, however; these firms are hostage to macroeconomic conditions and exchange rates.

Japanese and German firms, even in the "heyday" of the American and British markets, held shares of each market. When world demand shifted in the mass market and in the specialist market shifted to that prevailing in Japan and West Germany respectively, these firms rapidly expanded sales. American and British firms found their traditional product and process competencies substantially eroded as these firms were unable to develop new production and process technologies suited for this rapidly changing environment.

Why did the German and Japanese auto producers develop flexible forms of production and work organization? Did flexibility develop as a response to shifting markets? Or did flexible production precede market changes? Wolfgang Streeck (1985) has argued that, when labor becomes a fixed cost for an employer, firms are forced to develop methods of increasing the value-added of a product and to find markets for which a fixed labor force is an asset. Describing the "elective affinity" between a fixed-cost labor force and a skilled, committed workforce in a flexible system of production, Streeck hypothesizes that firm strategy regarding target markets and deployment of technology is crucially influenced by the traditions of a permanent workforce.

What are the components of flexibility? The production systems of Germany and Japan vary somewhat, as do the final products, so each will be discussed in turn.

The search for origins of the Japanese competitive advantage in autos (and in other industries) has created a cottage industry of "rising sun" experts. In accounting for the price/quality disparity between American and Japanese products, the members of the cottage industry focus first, on the scale economies possible in integrated complexes like Toyota City; second, on the cooperative relations between industry, government and labor; and third, on the relationship between core firms and their

dependent suppliers. Little evidence is available to support the contention that the advantages in production enjoyed by the Japanese are the consequence of either newer technology or greater "capital intensity" in production.[16]

Integrated automotive production complexes in Japan are not unlike those established by Henry Ford in the United States. But, Japanese manufacturing is not a carbon copy of Fordism—vertical integration and tight control of the division of labor. The Japanese firms developed a concern for quality control that was more broadly defined than was the American approach of product inspection.[17] The Japanese automotive industry also developed unique institutional arrangements. For instance, the "Kanban" ("just in time") system of production requires close collaboration between the producer of a car component (be it a separate company or a division of the auto company) and the production line. As only small stocks of supplies are kept (reducing storage and maintenance costs), any interruption of supplies quickly halts the production process. This interruption is apparently rare in integrated Japanese production centers like Toyota City. As Cusumano and others have noted, underlying the "kanban" system of supply is a dependent affiliation relationship between the suppliers of parts and the automotive manufacturer. (This relationship is discussed in the following section.) Concentrating all the factors of production in one complex has long been regarded as being more cost effective than the recent American approach of plant dispersion. The emphasis on quality and the just-in-time system of supply have added to this advantage, as did the central government's exchange rate policies.[18]

16. The evidence "refutes the argument that Japan has achieved its edge in labor productivity by the simple substitution of capital for labor. The unpleasant truth is that Japanese producers use less capital to produce a vehicle than do their U.S. competitors and can sustain a given volume of production with much lower levels of investment." Abernathy et al., *Industrial Renaissance*, p. 62. The American producers are attempting to increase the capital intensity of production so as to offset the Japanese cost advantage.

17. See the chapter on quality control in the Japanese automotive industry in Michael A. Cusumano, *The Japanese Automobile Industry*, pp. 320-373.

18. In accounting for Japan's price advantage in autos, more attention should be paid to Japan's yen policy, since a 20% rise in the yen's 1981 value would (and in 1986 has) eliminated their price advantage in the production of automobiles. For example, Abernathy et al., *Industrial Renaissance*, lists the final delivered cost of a small 1981 Mazda (Toyo Kogyo) car at $4,928; a comparable 1981 Ford cost $6,498. In 1981, the average ¥/$ exchange rate was 220.5. During the fourth week of September 1986, the average ¥/$ exchange rate was 155. All other things being equal, the Mazda would, with the 1986 ex-

The production system used to produce specialist or luxury cars differs from the fordist system. Though this market accounts for approximately 10% of new car sales in Western countries, the "profits per car sold" are much higher in this sector of the market. Engineering, quality, and prestige factors are thought to be of greater influence on buyers in this market than is price. As of yet, only Honda among the Japanese automanufacturers sells many luxury cars.[19] European firms, especially those of Germany and Sweden, dominate this market.[20]

In the specialist market, the comparative advantage of the European specialist firms rests neither in greater efficiency of productive technology per se nor in a more capital intensive production.[21] Rather, the products themselves are endowed with safety and performance enhancing technological developments (e.g., anti-skid braking systems, fuel injection). Product technology is decisive in competition among European specialist firms, and this vesting of the product itself with distinguishing attributes makes these firms relatively invulnerable to price

change rate, cost roughly $7,000. The actual price increases of Japanese cars, however, is substantially less than the appreciation of the yen vis-a-vis the dollar. Japanese companies are willing to reduce profitability to maintain market share.

19. The Japanese firms are attempting to move "up-market," with Honda's Acura division as the first luxury Japanese car. Each of the major firms has established a luxury line of cars. Given the price competition from Korean imports, the Japanese move away from the bottom end of the mass market is a necessary strategic choice. Ironically, the system of "voluntary" quotas allowed the Japanese to introduce "up-scale" models while disassociating themselves from the very cheapest product lines. The inadvertent consequence of the quota system is the penetration of the Japanese firms into a market in which they had no products. The extent of Honda's success (100,000 Acuras sold in the US in 1987) in becoming the number two seller of luxury cars in the United States bodes poorly for other luxury car manufacturers.

20. The Western German auto industry is the world's third largest, with 1985's production volume of 4.17 million cars exceeded only by that of the United States and Japan. German mass producers—VW, Fordwerke, Opel (GM)—are among the few consistently profitable firms in the intensely competitive European car market.) Germany's specialist or luxury market approaches one quarter of total German car sales. In the fifteen years between 1970 and 1985, firm production for all four specialist firms steadily increased: Porsche, a 294% increase (1985 production, 49,400); BMW, a 277% increase (439,500 in 1985); Daimler-Benz, a 190% increase (533,500 in 1985); and Audi, a 125% increase (395,700 in 1985.) These firms are the major competitors for the specialist "branches" of the American and British industries—mainly Cadillac, Lincoln, and Jaguar. *Financial Times*, March 26, 1986; Society for Motor Manufacturers and Traders (SMMT), *The Motor Industry of Great Britain*; OECD, *Long-Term Outlook*.

21. Dunnett, *The Decline of the British Motor Industry*, reprints a table from Great Britain House of Commons, *Fourteenth Report of the Expenditure Committee, 1974-1975: The Motor Vehicle Industry* (London: HMSO, 1975) that shows Volvo, Saab, and Daimler with a higher "fixed assets per man, 1974" than for any of the British car makers, but the "assets per man" ratio was highest of all for Ford, and GM, VW, and FIAT had higher ratios than either Daimler or Saab. p. 126.

competition from Japanese firms.[22] Product quality and brand loyalty, not necessarily economies of scale or other measures of efficiency in production, matter in this luxury market. Frequently, production itself has been labor or skill intensive, largely because of the constraints placed on firms in terms of reducing their labor force: Streeck has gone so far as to argue that Germany's mass producers (e.g., Volkswagen) have reorganized themselves along the model of specialist firms like Daimler.

When the luxury market expanded substantially in both Britain and the United States, the Germans and the Swedes were able to capture substantial market shares.[23] The mass market producers, given that product differentiation is important to sales in the luxury market, found their 1973-82 strategies of both producing a full range of cars with many common components and seeking to expand luxury sales to be contradictory. In neither the United States nor Great Britain did the penetration of the luxury market by overseas competitors have any simple solution for domestic firms. Unlike the mass market, where more productive process technology offers the hope of a more price competitive product, the currency of the specialist

22. See the section on the "Competitiveness of Western European Manufacturers" in Altschuler et al., *The Future of the Automobile.* See also the discussion on specialist manufacturers in OECD, *Long-Term Outlook.*

23. In the British market of 1964, the sales of cars with engines 2 liters or larger (a very rough proxy for luxury sales) was 7% of the total market; in 1979, the figure was 11.5%. In the United States, 3.7% of the car sold (375,000) were described by *Automotive News*, as being "luxury;" in 1985, 9% (or 1 million cars) of cars sold were luxury cars. In the American market, the imports of European luxury cars expanded rapidly after 1977. In 1977, the major European specialist producers exported 83,000 cars—0.7% of the total American market for new cars. In 1980, the Europeans captured 2% of the market with sales of 175,000. In 1985, European sales reached 450,000, for 4% of the total U.S. market. The four largest German specialist firms (Daimler-Benz, BMW, Audi, Porsche) accounted for one third of U.S. luxury sales in 1985, and were expected to capture one half of the market by 1990. Volvo (3.3% of the U.K. market), BMW (1.8%), Daimler/Mercedes (1%), and Saab (.5%) each have larger shares of the British market than do Jaguar or Rolls-Royce. The rates of growth of the sales of the German specialist producers in the British market has been substantial—30% from 1984 to 1985 for BMW, and 25% in the same period for Daimler/Mercedes.

In Britain, the success of European specialist firms is mirrored by the dramatic decline of British Leyland's specialist branches—Jaguar/Rover/Triumph—in the decade of the 1970s. In 1970, BL's specialist firms produced 200,771 cars; in 1980, they produced 80,779—a 60% decrease in production at a time when the specialist producers of other nations generally doubled production. The remaining two British producers of luxury cars are Jaguar (privatized during 1984/1985) and Rolls-Royce, but both companies export most of their products, and have relatively small market shares of the British market—.4% and .04% respectively.

Data drawn from *Financial Times* and SMMT, *The Motor Industry of Great Britain.*

market was and is product differentiation, quality, and customer loyalty. Competency in these areas is not quickly developed.

I have argued that firm strategies are in response primarily to market conditions, though Streeck (1985) notes that labor and political constraints will also influence, sometimes decisively, firm policies regarding product and process. Different production arrangements are appropriate given different market conditions. Batch production by variable-cost, skilled labor is a reasonable production system under conditions of high market uncertainty, in which interruptions of supply and demand occur frequently. Fixed costs remain low, and firms might avoid bankruptcy. In large markets with relatively predictable demand, highly specialized machines with unskilled, variable-cost labor might be the optimal production strategy for a firm. If a firm employs a fixed-cost labor force and produces for export markets, a flexible production system is a prerequisite for economic survival. Should markets develop a convergence of product preferences, a firm using either the batch production system or the fordist production system would have difficulty adapting product and process if bad luck prevails, and the market develops preferences different from existing product lines. Ford, GM, Chrysler, BL, FIAT, and several other major firms were so unlucky in the 1970's and early 1980's. Of most of the Japanese and German automotive firms, we judge "good and good luck."

Production Choices—Important Variables

Regardless of the system of production a firm adopts, some basic choices regarding production need to be made. All firms have an incentive to achieve economies of scale, especially as the development of similar market demands in North America, Japan, Western Europe created a sales market of 25 million new cars per year in 1985. Even specialist producers will attempt to achieve, within their market niche, the lowest per unit cost. Three strategic decisions confront firms as they attempt to achieve economies of scale. These choices concern plant location, degree of vertical integration, and the extent to which one firm will cooperate with other firms in developing and sharing products. This section will provide a general discussion of scale economies, and of the choices firms historically made regarding

achieving scale economies. The extent of the reorganization of automotive production is only apparent against the backdrop of the previous strategies of automotive firms.

Economies of Scale, Economies of Scope

In order to increase its profits, every firm seeks to reduce the per unit cost of producing a product. In a competitive market of standardized products—the mass market—the firm with the largest productions runs will usually be the most profitable as it will benefit from what are called scale economies. A larger manufacturer can afford greater specialization of labor and can purchase machinery suitable to a narrower task, all because large production runs avoid leaving men and machines idle. A smaller producer frequently must purchase general purpose machinery, assign workers to many tasks, and buy component parts of automobiles from an outside supplier instead of manufacturing the products itself. The cost advantage per unit of output (i.e., per car) of the larger firm is attributable to these economies of scale. Larger companies are therefore usually more profitable.[24]

24. The classic discussion of economies of scale is to be found in F.M. Scherer, *Industrial Market Structure and Economic Performance*, especially chapter 4. The first extended discussion of specialization and the division of labor is to be found in Adam Smith's *...The Wealth of Nations*. Smith argued that the extent of specialization is limited by the extent of the available market. Hence, we would expect, following Smith, that economies of scale should increase as barriers to trade diminish, and vice versa. Some analysts have argued that economies of scale is a somewhat misleading concept, and that firms can achieve scale economies under widely varying circumstances. We do know that several of the smaller Japanese firms are profitable despite limited production runs.

For an discussion of recent and possible future changes in the structure of production, particularly with regard to production by "specialist" firms, see Charles F. Sabel, *Work and Politics*, especially chapter 5, "The end of Fordism?" See also the discussion of robots and reprogrammable machines as applied to assembly lines in Alan Altschuler et al., *The Future of the Automobile*.

David Friedman, "Beyond the Age of Ford," has argued that those automotive producers that develop a "small and flexible" production system do not necessarily suffer serious cost disadvantages in comparison to the scale economy producers, and that the "flexible" producers benefit from a wider range of products (presumably corresponding to markets "niches") than do standardized producers. Friedman prints a table showing that Japanese producers have many more different auto bodies and engines than do American producers. He warns that firm strategies that rely on standardization may have serious public policy consequences, and recommends that the U.S. government develop policies to redirect corporate strategy.

I have some reservations about this analysis. The Japanese auto firms do have a "flexible" form of production with a diverse product line. We cannot assume, however, that firms in other countries are capable of replicating their success. A wide range of products cannot account for Japanese profitability. For instance, if we were to list the various range of cars available from British car companies in the 1950s and 1960s, we

Historically, economies of scale have been particularly important for the automobile industry, perhaps more so here than for almost any other consumer durable goods industry, because auto production is capital intensive. That is, the costs servicing the debt associated with the purchase of durable goods (fixed capital) such as machinery and buildings, plus the costs of raw materials and components, comprise the majority of the costs of production: approximately 80% in the U.S. While these costs are mostly fixed, and therefore must be paid, the incremental costs of automotive production are low. Hence, the larger the production run, the lower the long-run average cost of these fixed charges as a percentage of the cost of each unit. For instance, most of the cost to GM of its plants and machinery will come due whether GM produces 2 million cars or 3 million cars. Hence, at 3 million units, the capital cost per unit is a third less than at 2 million units. American firms have sought to produce large volumes of cars that sell at relatively low prices. Labor, by way of contrast, is usually a variable cost, though not so in the Japanese or German industry. That is, when a plant or a production line was not working, the workers in the American industry were (and still usually are) laid-off.

Given the capital intensive nature of automotive production, we may correctly infer that economies of scale are of greater importance in achieving a low cost product than are lower wage rates, a point illustrated by the experience of multinational auto firms in third world countries, where wage rates are extremely low but per unit production costs are usually high. The elements needed in achieving economies of scale—concentrations of plants, machinery, highly developed infrastructures, research facilities, component suppliers, and skilled labor—are generally available only in the industrial countries. As a result, substantial movement of auto production to the developing countries (save Brazil and Mexico) is considered highly unlikely through to

would see that Britain's specialist auto firms were flexible before flexible was fashionable. Unfortunately, they were not profitable. Nor can robotization account for the success of Japanese firms. Honda's Marysville, Ohio plant is profitable though relatively unautomated. A favorable yen/dollar exchange rate, cheap prices on supplier parts, a well-developed reputation for quality, and a highly productive work force would have produced a profitable Japanese auto industry, independent of a diverse product range and flexible production systems. (See the conclusion of Cusumano in his *The Japanese Automobile Industry*.) I suspect, therefore, that the key adjective in "Japanese flexible production" is 'Japanese' and not 'flexible'. Hence, I am doubtful that the U.S. government is capable of successfully redirecting corporate strategy towards a "market niche" approach.

the end of the century.[25] Even when low wages are found in the auto industry of an industrialized nation, this is not enough to insure firm profitability.[26]

The usual threshold measurement for economies of scale is the Minimum Efficient Size (MES).[27] Firms whose production level falls below the MES for cars and their component parts operate at a per unit cost disadvantage to companies whose production runs exceed the MES. Prior to the widespread use of microelectronics, many analysts suggested that production of two million cars per year was the probable minimum overall standard for efficient auto production, a standard consistently exceeded in recent years by only 5 of the 21 major Western auto producers.[28] Therefore, prior to the introduction of microelectronics tools and equipment capable of varying their production-line tasks from one unit to the next, the strategies of automobile firms in the mass market were to develop larger and larger production runs.

GM, Ford, and other larger firms no longer seek to expand production capacity, come what may. In part owing to decreasing MES, and to reduced "break-even" points, the large automotive manufacturers no longer strive for increasing market share.

The OECD and Jones have each argued that the plant-size MES will decrease in the automotive industry owing to increased use of computers and robots, though the capital intensive production that results will have roughly the same effects on competition as MES. The ability to vary the product's attributes from unit to unit, a capacity now demonstrated at many

25. Marina V. N. Whitman, *International Trade and Investment: Two Perspectives* (Princeton University: Department of Economics, Essays in International Trade and Finance, No. 143, 1981), p. 12; United Nations, *Transnational Corporations in the International Auto Industry*, pp. 148-150.

26. For instance, British hourly wage rates are much lower than are those of Germany, and BL (now Rover, Plc.) boasts that its per worker productivity "at 14 cars per man year is already up to the best in Europe." Nonetheless, BL lost £138 million in 1985, GM (Vauxhall) lost £47.4 million, and Talbot (Peugeot, nee Chrysler) lost £12.8 million in 1985. BL, Plc., *Annual Report & Accounts, 1985*; *Financial Times*, February 11, 1986; *Financial Times*, "Vauxhall Pays the Price of Success," March 20, 1986; Peugeot Talbot Motor Company Limited, *Annual Report, 1985*.

27. George Maxcy, *The Multinational Motor Industry*, pp. 199-202; D.G. Rhys, "Economies of Scale in the Motor Industry;" and Peter J. S. Dunnett, *The Decline of the British Motor Industry*.

28. Dunnett, *The Decline of the British Motor Industry*, pp. 22-25; Krish Bhaskar, *The Future of the World Motor Industry*, p. 358; and United Nations, *Transnational Corporations*, p. 21).

Japanese automotive factories, allows a firm to remain profitable at much lower production levels than was thought possible even five years ago.

The microelectronics revolution in production notwithstanding, firms will continue to depreciate fixed costs over as large a production run as is possible, up to the point of capacity. Even among specialist producers, larger production runs (up to full capacity) that reduce per unit fixed costs add to the profitability of a firm. MES is, in a sense, a contingent measure of the standardization of a product, and as a given product market develops diversity, the MES should fall.

Location

A firm's location choices include concentrating all the factors of production in a central location or dispersing auto production among foreign subsidiaries—each of which may specialize in one aspect of auto production (e.g., engines). Absent political pressure from governments to diversify production location, automakers concentrate production in a central location. Until recently, firms from Japan tended to concentrate production in Japan, whereas American and European companies have adopted the multinational production model, as Table 1 reveals. With increasing political pressure has come diversity in production location for Japanese companies.

The benefits of concentrated production can be seen through the experience of Toyota and other Japanese producers. The Japanese auto manufacturers, until the early 1980's, achieved extraordinary success by locating production of autos and their components solely in integrated complexes. Japanese companies and their suppliers are in close proximity, as in Toyota City. By way of contrast, in traditional American production systems, plants are geographically disbursed, and products are shipped to an assembly point; for instance, GM's new Hamtramck assembly plant is 200 miles from the nearest stamping plant.[29] This integration between assembly and supply of parts allows Japanese companies to dispense with dual sourcing (purchasing from more than one supplier per part) as well as much of the costs of storage. Crucial to the success of this system has been the development by Japanese auto firms of a network of

29. *Chilton's Automotive Industries*, January 1983, pp. 18-19.

TABLE 1
AUTO FIRMS—TOTAL PRODUCTION, 1980
(in units of thousands)

	world-wide production	foreign production	foreign as % of total	% of world production
GM	6,712	1,959	29.2	19.2
Ford	4,183	2,294	54.9	12.0
Toyota	3,801	—	—	10.9
Nissan	3,118	—	—	8.9
VW	2,531	899	35.5	7.3
Renault	2,137	424	19.8	6.1
Peugeot	2,019	372	18.4	5.8
FIAT	1,569	219	14.0	4.5
Toyo-Kogyo	1,121	—	—	3.2
Mitsubishi	1,195	—	—	3.2
Chrysler*	1,009	251	24.9	2.9
Honda	957	—	—	2.7
Daimler-Benz	707	80	11.3	2.0
BL	597	71	12.0	1.7
Isuzu	472	—	—	1.4
Suzuki	469	—	—	1.4
All firms	34,877	6,073	19.2	100.0

* includes Latin American subsidiaries, but not European.

Source: United Nations, p. 41. Toyota, Mazda, Honda and Nissan have subsequently established foreign production subsidiaries in the U.S. and elsewhere.

dependent supplier firms. These firms pay lower wages than do the automobile manufacturers (20 to 30% lower), and they absorb some of the risk associated with product development.[30] Thus, Japanese firms were able to create a dual labor force: one connected to the core firms and whose wages the company treated as a fixed cost; a second connected to peripheral firms, whose wages are a variable cost. Along with quality control systems and other productivity measures, this integrated production system with dual wage tiers is said to account for 80% of the cost advantage Japanese companies enjoy over their American counterparts from the 1970's through to the mid-1980's.[31] Japanese production costs were sufficiently low that, even with the costs of transoceanic shipping added to the price, Japanese car costs were approximately $1500-1700 per car cheaper than were similar American cars, and had a 20% to 30% advantage over similar European cars.

Political restraints on exports provide the impetus for the major alternative method of achieving profitable economies of scale. Large firms now usually invest in assembly operations in each of their primary markets. From the firm's perspective, this alternative is less desirable than concentrating production in its home country. Problems of currency adjustments, political changes, and variable workforce cultures increase the risks of investments. And, until the advent of the European Community Common Market and the U.S.-Canada Automotive Agreement, investment outside of the U.S. took place in relatively small markets that did not have a market demand substantial enough to allow firms to benefit from contemporary economies of scale.

The tariff barriers and other entry requirements that governments have imposed on would-be exporting auto firms substantially change the export profit calculations of firms. Tariff barriers can be quite expensive for an exporting firm. For instance, in 1960 France, Britain, and Japan had tariffs on car imports of between 30% and 40%. The uniform tariff of 10.9% on cars imported from outside the European Community is still

30. Cusumano, *The Japanese Automobile Industry*, pp. 192-193, 383.

31. U.S., Department of Transportation, *The U.S. Automotive Industry, 1981*, p. 15.

32. The American figure is a composite drawn from the 1980 and 1981 studies of the American auto industry by the U.S. Department of Transportation, *The U.S. Automotive Industry, 1980*, p. 40; *The U.S. Automotive Industry, 1981*, p. 15). The European data come from the Commission of the European Communities, *The European Automobile Industry* (Luxembourg, 1981), p. 18.

substantial. Some countries (e.g., Brazil, India and Korea) do not permit auto imports at all.[33]

Tariffs are not the only barriers imposed on firms by governments. Twenty-seven countries, including all the major Latin American producer-nations, have domestic content laws, which require varying percentages of the total value of the car to be produced within the country. Eighteen nations, again including the Latin American countries, also impose export requirements on auto firms.[34] Other forms of trade restriction include quota arrangements as well as different taxation rates and safety and pollution standards for imported cars. These limit the ability of concentrated firms to profit from their economies of scale through the export of cars.

All major automotive firms are transnational in location of production, though overseas investment is greatest for those companies most dependent on foreign sales.[35] For instance, Honda, a company which exports 40% of its production to the U.S. in the form of 2 models, was the first to establish an American assembly plant. Toyota, which exports only a fifth of its products (with many more car models) to the U.S., only recently announced plans to create an independent subsidiary in the U.S. By 1990, Japanese auto manufacturers will have the capacity to produce 1.3 million cars inside the United States.[36]

The growing internationalization of production obscures some differences among multinational auto firms in the tactics that they have used to invest in foreign countries. General Motors purchased existing companies (e.g., Opel, Vauxhall), which operated more or less independently from each other until the late 1970s. Ford, on the other hand, established its own subsidiaries, usually by raising capital within the proposed subsidiary's market. Ford's operations have been largely integrated

33. U.S. Department of Transportation, *The U.S. Automotive Industry, 1980*, pp. 51-52.

34. U.S. Congressional Budget Office, *Current Problems of the U.S. Auto Industry and Policies to Address Them* (Washington: GPO, 1980), p. 38.

35. Both Maxcy and Bhaskar seem to agree on this point, though the authors of the UN study believe that the Japanese will remain slow to invest in other countries (*Transnational Corporations*, pp. 85-88).

36. The production capacity will be distributed as follows: Honda, 300,000 cars in two plants, one in Ohio and one in Michigan; Nissan, 125,000 in one plant in Tennessee; Toyota/GM (NUMMI), 250,000 in one plant (Fremont, California); Mazda, 240,000 in one plant (Flat Rock, Mich.); Mitsubishi, 180,000 in one plant in Illinois; and Toyota, 200,000 in one plant (Georgetown, Kentucky). These plants will increase the automobile production capacity of the U.S. industry by 14% over 1985. *Financial Times*, September 5, 1985.

on a world-wide scale since the 1960s, and its European operations have consequentially proven to be profitable. Honda, Mazda, Nissan, and Toyota have opted for "green-field" sites, though Toyota's joint venture with GM at Fremont takes place in an older plant.

The outlines of foreign investment strategies remain roughly similar for the major transnational firms. The majority of capital investment takes place within a firm's home market; in the early 1980s, GM invested $8 billion, or 20% of its total, abroad, and Ford invested approximately $1-2 billion (a third of its total) abroad. Firms will attempt to balance intrafirm trade among countries so as to avoid being a contributor to a nation's balance of trade deficit. The usual method of balancing trade is for subsidiaries to specialize in a component (e.g., engines) or a model line, and to exchange this for the rest of a firm's products. For instance, all of the LTDs that Ford sold in North America in 1982 were manufactured in Ontario, as were all of Chrysler's intermediate-size rear-wheel drive cars.[37] The increasing specialization by the subsidiaries of transnational firms is what helps the firm as a whole achieve the economies of scale necessary for profitability, while avoiding the cost penalties which result from tariffs and other government imposed restraints. And, perhaps most importantly, the firm can then produce a fairly uniform "world" car, though based on common parts rather than on common exteriors. Ford's Escort, VW's Rabbit, GM's "J" car, and the Renault-AMC Alliance are examples of such cars.

Integration

Vertical integration refers to the extent to which a firm will produce all the products needed for the end product. For instance, a completely integrated auto producer would mine coal, iron and alumina ores, would produce steel, aluminum, and plastics, would manufacture all the component parts of the car, and assemble the components. No auto manufacturer is completely integrated, but the integration ratios (value added to the end product produced intrafirm as a percentage of the total value of the product) varies from 20% to 80%.

37. *Ward's Automotive Yearbook, 1982*, p. 134.

Vertical integration allows firms to internalize markets, and to control the quality of the components of the end product with some degree of certainty regarding costs.[38] For multinational producers, vertical integration through component plant dispersion permits them to overcome some of the quality, price, and currency fluctuation disadvantages associated with international production. If they produce components internally, they can control quality and, through transfer pricing policies, can control to some extent the national allocation of the costs of components. Vertical integration also offers the prospect of shaping the technological advances in other fields to the specific needs of the main firm. GM produces many of its own robots, has imposed a standard machine assembly protocol on its many robots and computers, and has purchased Electronic Data Systems (EDS) in order to reduce production costs by harnessing new technological developments. Daimler-Benz's acquisition of AEG, and the efforts by Ford and Chrysler to find suitable high-tech partners are versions of this strategy of vertical integration.

A high degree of vertical integration can be costly for a firm, however. Since the auto business is subject to severe business cycle fluctuations, a fully integrated producer would find much of its capacity idle during economic downturns. By purchasing at least some of its components from suppliers, the assembling firm can pass on part of the risk of downturn to the suppliers—the assembling firm simply reduces purchases when necessary, and the supplying firms will bear the cost of idle labor and equipment. Furthermore, assuming a competitive supplier market, the assembling firms can enforce what amount to monopsony contracts. Chrysler's recent profitability, as well as much of the success of the Japanese auto industry, results from its ability to cut costs through "disintegration." The strategy of disintegration also permits an automotive firm to treat the supplier's workforce as a variable cost without antagonizing its own labor force. Through competitive bidding on contracts, GM can implicitly enforce wage cuts on the workforce of plants such as Hyatt, a ball bearing producer once part of GM but then sold to its employees. The UAW can do little to prevent wage cuts once

38. Alfred Chandler, *The Visible Hand*, argued that vertically integrated companies enjoyed a crucial competitive advantage over less integrated companies during periods of business cycle downturns.

a plant or a firm has been "externalized" from the core automotive firm.

As I will demonstrate in the latter stages of this paper, much of the organizational change of automotive production concerns the integration/disintegration choices made by the automotive firms.

Linkages

Another, rapidly developing, method of achieving profitable economies of scale is for firms to establish linkages amongst themselves. The instruments of linkages vary. One common form of arrangement involves equity exchanges or the creation of a jointly held corporation. For instance, the Mitsubishi-Chrysler agreement foresaw Chrysler acquiring a third of Mitsubishi's automotive division, and for Chrysler to import a Mitsubishi built car, the Dodge Colt. Ford owns approximately 25% of Mazda's equity, and GM has substantial equity stakes in Isuzu, Suzuki, Daewoo (Korea), and Lotus. Other forms of cooperation include joint production agreements. Among the many illustrations are the Honda-BL agreement on joint production of the Acclaim, and the GM-Toyota agreement to manufacture a small car in the U.S. Nearly a score of other agreements are in effect. The final major form of firm linkage is for a firm to purchase auto components from other firms, frequently those with whom the firm has equity ties.

The benefits of these links can be substantial. First, in joint production agreements, the risk of failure is shared, as the costs of development and production are not borne by one company. Second, joint production agreements allow North American and European companies access to Japanese technology and production techniques. The Japanese companies benefit because these agreements are a way of skirting quotas; the BL Acclaim is counted as being of British, not Japanese, manufacture. The importation of cars and parts produced by other firms, but sold by the home company has also proven to be profitable; these "captive imports" give a company access to a model line far more cheaply than it could develop on its own. Chrysler's importing of Mitsubishi cars is one example. Finally, many firms are purchasing components from component suppliers in low-wage

third world countries. This form of linkage allows importing firms to decrease both vertical integration and costs.

Some risks are involved in joint ventures and linkages, particularly for firms whose comparative advantage rests in non-patentable processes or products. The "appropriability" or "non-appropriability" of a firm's products and processes is now regarded as a crucial consideration in the establishment of ventures and licensing agreements (Teece, 1986).

Despite the risks, linkages among auto firms are likely to grow, especially as smaller firms confront the choice between being forced out of markets and developing product and cost sharing agreements.

In attempting to reduce the per unit cost of a product, no one set of choices regarding location, integration, and linkages is universally optimal. Political considerations, the strength of the trade union movement, competitive circumstances, the availability of suppliers, the financial position of the firm are all potential constraints on a firm's choices. GM's strategy, for instance, of vertical integration and geographic dispersion might not be so well suited to current market circumstances, but GM used this strategy to become the world's largest company, and GM remains a profitable company. Should trade protectionism accelerate, should the third world economies in which GM has invested heavily grow rapidly, should the world's automotive markets again show great diversity in product, vertical integration and geographic dispersion might again be a highly successful strategy.

The Organization of Work

The preceding discussion of economies of scale, technological innovation, capital investment, and automation might leave the reader wondering about the human side of production. Labor costs, work rules, and labor productivity are significant contributors to the overall cost structures of firms, even though wages, salaries, and related costs generally average only 20% or so of an auto firm's operating costs.[39] Crucial to any discussion of labor costs is the way in which existing union/management

39. cf. GM's 1984 wage bill (26.8% of total income) and Ford's (18.7% of total income). From respective annual reports.

relations influence the deployment of capital equipment, and the manner in which the equipment is used.

Wage costs paid by firms vary substantially among nations, though—thanks to unionization—rarely within nations. These hourly wage cost differentials, despite much attention by the American news media during the 1980-82 recession, are not necessarily a true measure of the costs to the firm of the work force, especially as 1) comparative wage evaluations are in part skewed by fluctuations in currency values and inflation rates in various countries, 2) firms have different procurement policies regarding automotive components, and 3) worker commitment cannot be evaluated with reference to wage rates.

Firms take a deeper interest in the per unit wage cost of production, a figure influenced not only by wages, but also by plant work rules, labor stoppages, work culture, and other issues in labor productivity. A famous illustration of this point has been made by comparing the nearly identical Ford plants of Saarlouis, West Germany and Halewood in Great Britain. Table 2 illustrates the point that worker productivity is measured poorly by examining only wage rates. Despite Halewood's lower wage rates, Ford Escorts produced in Germany and shipped to Britain cost Ford $1000 less than do Ford Escorts produced at Halewood. Even though some productivity gains were made in Ford's British plants in the subsequent five years, Ford estimated in 1986 that its UK plants still operated at two thirds of the productivity of its German plants.[40] More restrictive work rules and poor management-labor relations are usually credited with accounting for these differences. The German plant is able to use labor more flexibly with less supervision.

The Halewood-Saarlouis comparison has other counterparts, all of which have served to convince firms that per unit labor costs and product quality are a crucial consideration for firm profitability. Firms in the auto industry are therefore attempting to implement non-confrontational, corporatist forms of management-labor relations, which are thought to improve the general tenor of labor relations, work organization, and worker commitment by providing workers with non-material incentives (as well as new material incentives like profit sharing) for better

40. *Financial Times*, February 11, 1986.

TABLE 2
TWO IDENTICAL FORD PLANTS COMPARED: PRODUCTIVITY AT HALEWOOD AND SAARLOUIS—1981

	Halewood	Saarlouis
Daily Auto Output	800	1,200
Employment	10,040	7,762
Man Hours per Car	40	21
Strikes - 1981	20	0
Average Hourly Wage	$8.25	$13.50

Source: *International Herald Tribune,* October 15, 1981. p. 7.

quality work.[41] At least in the case of the United States and Great Britain, the recognition by managers that product quality and productive efficiency are strongly influenced by the labor force is a by-product of the internationalization of competition. That is, nations and firms have varying patterns of work organization, and those countries and firms with cooperative or incorporated work forces have a competitive advantage over those countries and firms with poor management-labor relations.

The emphasis on corporatism and cooperation in the automobile industry is relatively new. The automobile industry is the proto-typical Taylorist industrial production process—deskilled, highly routinized work with the pace of work set by the pace of the assembly line. In industries with standardized products and standardized production processes, a certain degree of industrial hierarchy and routinized work is probably inevitable.[42] Cars may be produced with varying technologies and varying methods of organizing work, but if a firm adopts Fordist

41. See Altschuler et al., *The Future of the Automobile,* chapter 9, "Labor Relations and Employment Adjustment."; and Harry C. Katz, "Collective Bargaining in the U.S. Auto Industry."

42. See Abernathy, *The Productivity Dilemma;* Paul Willman and Graham Winch, *Innovation and Management Control,* pp. 172-191).

practices of assembly, then some form of hierarchy follows.[43] But within these hierarchical work practices, we find major differences in the incentives offered to workers, and in the degree of incorporation of the work force. Traditional Taylorist practices assume that workers find work painful, and that some coercion/compensation incentive structure will motivate workers to an acceptable level. Although few firms openly adopt the Taylorist model—research has shown that people are motivated by non-material as well as material incentives—American and British auto firms most closely approximate it among the major producers.[44] Proposals for reform (i.e., increasing the productivity and motivation of American and British workers) tend to center on giving workers a broader financial stake in the success of the firm, rather than on giving workers voice in the production process, and on establishing internal labor markets.[45] (See Katz, 1985, chapter 6, on proposals for labor reform.)

Automobile firms in Japan and Western Europe have adopted work organizations that reflect their demonstrated reluctance to lay-off workers, and include bonus incentives, less rigid forms of hierarchy, consultative practices, internal labor markets, and team production systems.[46] Worker commitment and worker loyalty apparently follow from the adoption of these practices. In response to the competitive success of Japanese firms in producing a high quality product for the mass market, American firms are experimenting with more cooperative forms of management—the Saturn project, for instance, is said to be patterned after Volvo's work practices, with a limited no-layoff program for most workers.

As I noted in the introduction, the success of American firms in adopting cooperative work practices is limited by the strategies these firms are following with regard to automation and multinational production. We well might wonder why the

43. cf. Abernathy, *The Productivity Dilemma*, and Sabel, *Work and Politics*.

44. Michael Burawoy, *The Politics of Production*, describes the Anglo-American model as the of "market individualism," though he does note the important differences among the American and British factory "regimes."

45. See, for instance, Martin Weitzman's *The Share Economy*; and James Meade's *Alternative Systems of Business Organization and Worker's Remuneration*.

46. Lowell Turner has pointed out to me that several authors, Wolfgang Streeck among them, note that the team system of production has not been readily accepted in Germany.

production systems of other nations produced a different coalition of interests from those found in the United States.

Why do German and Japanese workers exhibit greater productivity and work commitment than do their American and British counterparts? Cultural explanations of the Protestant ethic/Tokugawa ethic sort are by themselves inadequate; in previous decades, the Japanese and German working classes were far from acquiescent.[47] Both the German Social Democratic Party and the Japanese Socialist Party (and the unions associated with them) periodically have been models of socialist militancy. Furthermore, in Germany at least, the "guest workers" labor alongside their German counterparts without their "Turkishness" or "Portugueseness" or "Italianness" impeding "German" efficiency. Another explanation, "peasants to workers" "poverty to comparative wealth," suggests that developing countries, or nations with workforces that have recently migrated from poor areas, might enjoy a cooperative workforce, at least for a period of time.[48] Hence, the Turks in Germany might even be more cooperative than their German comrades. The movement in the United States of assembly plants to Appalachia and the mid-South, beginning with VW (New Stanton, Pa.) and continuing with Nissan, GM, and Toyota, gives evidence that firm managers put some credence in this theory. But, the German and Japanese work forces have become less strike prone than they each were during earlier periods of the 20th century, and American and British factories organized in "corporatist" forms have been productive by Japanese standards, even when using workers socialized under a "Taylorist" regime (e.g., GM/Toyota's Fremont, California plant).

47. The references are to Max Weber and to Robert Bellah, *Tokugawa Religion* (Boston: Beacon, 1957).

48. Dunnett suggests such an explanation: "Perhaps Britain, quite simply, was an unsuitable place to produce cars. In Japan, Brazil and Spain the recent memory of poverty was sufficient to outweigh the tedium of work on the production lines. ... the labor force in Germany, France, Italy and the USA had similar characteristics. All the European car factories employed many guest workers from Southern Europe and North Africa, whilst much of the labor on Detroit's production lines were first-generation black immigrants from the South. Therefore they too had often had a first-hand experience of real poverty." (p. 144).

Sabel's argument is less that the guest workers were poor, but that they were peasants with attitudes towards work that militated against industrial militancy. *Work and Politics*, pp. 101-109.

In their organization of work, firms in both Germany and Japan demonstrate a form of "welfare corporatism" in which the workers and their unions are drawn into the organizational life of the firm to a much greater degree than in the "market individualist" organizations of American and British firms.[49] The differences between the German and Japanese forms of corporatism are substantial: German corporatism is imposed through government institutions as part of the post-war social contract; Japanese corporatism is firm based—"enterprise welfare," to use Dore's phrase. But the common element in these organizational forms is that they act as non-material incentives to supplement material incentives as a method for motivating employees. The effects of corporatist organization of work are not universally applauded, but higher rates of productivity and commitment are thought to follow from adoption of these methods.[50]

German corporatism in the work place results from the imposition by the Federal Government of worker rights legislation in the period between 1949 and 1976, though Streeck notes that some of the specialist automotive producers adopted no-layoffs and other corporatist policies earlier. (See also Thelen, 1987.) Betriebsrats (works councils) were authorized throughout German industry to govern the conditions of work and employment. Mitbestimmung (co-determination) granted German unions a supervisory role in the governance of corporations, though mitbestimmung was restricted (until 1976) to "heavy" industry. Germany's unions are organized into a hierarchical association (the Deutscher Gewerkschaftsbund— DGB) that has been broadly incorporated into government decision-making, especially during those years in which its political ally, the

49. The phrases are taken from Ronald Dore's *British Factory, Japanese Factory.*

50. See James R. Lincoln and Arne L. Kallenberg, "Work Organization and Workforce Committment," *American Sociological Review* Vol. 50 (December 1985); Michael Burawoy, *The Politics of Production,* extends the notion of hegemony to include the organization of workers into corporatism. Of the Japanese, he writes, "It is difficult to penetrate the mythologies of harmony and integration associated with the Japanese hegemonic regime, but for that very reason the task is all the more necessary. It is easy to miss the coercive face of paternalism." *The Politics...,* p. 143.

Claus Offe, *Contradictions of the Welfare State* (Cambridge, MA: MIT, 1984), argues that corporatism is limited by two factors. First, non-incorporated groups (e.g., consumers) are exploited by agreements among producer groups. Second, even in the German case, the labor movement suffers from an asymmetry in terms of responsibility. That is, unions are responsible for their members' actions in a bargained situation, though the umbrella groups of the employers are not so restrained. pp. 290-292.

German Social Democratic Party, governed. The consequence has been labor peace with few interruptions: only 1978 and 1984 were years with extensive strike activity. The influence of trade unions has manifested itself in German industrial policy, which tends to focus on manpower policies, and not on firm- or sector-specific policies.[51] Streeck, in fact, argues that the strategies of German mass market firms to move up-market are a by-product of Germany's industrial relations.

Japanese corporatism is company-specific, and is in many ways a "total institution." One's personal life is said to be subsumed within one's company life.[52] Peer pressure is added to managerial control as a method of inducing high levels of commitment from employees. As in Germany, workers' organizations are said to be consulted prior to the undertaking of new ventures and new innovations.[53] Unlike Germany, employees generally are organized into company unions, rather than into industry-wide unions.[54] Company unions provide management with advantages over an industry-wide union. The lower wages paid to employees in the subcontracting/supplier sector are possible because supplier workers are not organized by the unions of the main companies. Further, company unions in the Japanese automobile sector have been willing to cooperate in the introduction of labor-saving technology and in quality control programs. These corporatist institutions are not without benefit for those employees who work for "core" firms: life-time employment and a bonus-based system of profit sharing. The average wage paid to each Japanese worker is lower than that paid to the auto-worker in America, but employment is less

51. Wyn Grant, *The Political Economy of Industrial Policy* (London: Butterworth, 1982); Claus Offe, *The Contradictions of the Welfare State.* Offe notes that the incorporation of the German unions in the decision-making apparatus of the state delegitimates the union hierarchy. With corporatist arrangements, the unions become responsible in part for layoffs and other wage and benefit reductions.

The union hierarchy in Germany has had its own management troubles. Neue Heimat's bankruptcy highlighted the problems in the DGB. Some observers saw the 1984 "35-hour workweek" strike as an effect by parts of the union hierarchy to reestablish the union's militancy credentials.

52. This is at least the portrait of modern Japan found in William Ouchi's *Theory Z,* (Addison-Wesley, 1981), and, to a lesser extent, in the works by Dore.

53. For instance, Nissan's workers won from management the right to be consulted prior to the introduction of labor-saving technological innovations. *The New York Times,* March 30, 1983

54. In the immediate post-war era, the workers in the automobile industry were organized by an industry-wide union, but the union collapsed after a 1953 strike. See Cusumano, *The Japanese Automobile Industry,* pp. 143-146, 160-185.

cyclical, and authority relations in factories are said to be less "Taylorist."[55]

For whatever reasons, the Japanese and German workforces in the automobile industry are more productive, less prone to work disruptions, and more accepting of technological innovation and changing job classifications than are their American and British counterparts. American and British managers in the auto industry recognize the advantage that cooperative management-labor relations have conferred on German and Japanese firms. American and British managers are adopting a "softer" style of management, but, to date, neither group of managers are willing to grant to workers the related benefits of corporatism or to adopt systems of production that would require increased worker discretion and motivation.

A telling example of this is recounted in Willman and Winch's study of production at British Leyland's Longbridge plant. The retooling process to produce the Metro sedan unilaterally imposed an automated system of production on the workforce, despite some evidence that the "hard rigid automation" employed is more expensive than are more flexible systems. Poor management/labor relations led Leyland management to introduce a system that placed a premium on labor discipline. Willman and Winch concluded that "industrial relations considerations influence the choice of technology, rather than the other way round."[56]

This example suggests that cultural, institutional, and other historical elements are conditioning of work organization, and that the previous traditions of systems of production are not easily discarded.[57] Market pressures may transform firm strategies, but they do not guarantee their success.

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55. See, however, Satoshi Kamata, *Japan in the Passing Lane* (New York: Pantheon, 1982), in which he recounts his experiences working in a Toyota factory. The Japanese title was "Automobile Factory of Despair." Ronald Dore, in the introduction to Kamata's book, puts a rather different face on Kamata's work, noting that, by British standards, the workers were far from disaffected. Dore wryly comments on Kamata's high standing among Kamata's superiors.

56. Willman and Winch, *Innovation and Management Control*, p. 190.

57. Streeck wrote, "... success and failure in manufacturing are of long making; they are the result of complex configurations of forces that seem to be deeply rooted in national and organizational traditions. ... The optimistic idea of scientifically based social engineering, cherished by so many inside and outside the social science professions in the 1960s and 1970s, has lost much of its credibility. A succession of countries have been held up as universal 'models' of industrial relations to be emulated by others, only to prove the point that the immunity barriers of a body politics are too high for cultural transplants to be accepted, and to confirm that a nation's heritage of institutions, attitudes, values, and habits cannot be manipulated at will." (*Industrial Relations and Industrial Change in the Motor Industry*, p. 27).

SHIFTING MARKETS—UNCERTAINTY AND COMPETITION

I argued earlier that expected market conditions dictate firm strategy regarding production and $\Delta K/\Delta L$ mix, though the success or failure of these strategies is strongly influenced by a number of constraints, including work organization. What then are the expected market conditions, and what will this imply for firm strategy?

The demand for cars, although influenced by the sales and marketing strategies of firms, is partially beyond the manufacturers' control. The key components of demand are 1) the average size of households and the labor participation rate of the household members, 2) the expected income of the household, 3) the policies of governments regarding highway construction and mass transit alternatives, 4) the "scrapping rate" of cars, and 5) the price of new cars.[1] The first two components, labor force participation rates and expected income, are closely related (in a mature economy) to changes in the macroeconomic conditions of a nation's economy. That is, movements in the business cycle of a nation are the best predictor of the demand for new cars. Government policies regarding automobiles and mass transit will vary from country to country, and are generally not easily influenced by firms. The scrapping rate of cars generally will determine the replacement demand; car owners usually buy another car when they dispose of their current car. In the mature car markets of North America and Western Europe, the scrapping rate is important for automobile sales as the car replacement market is roughly 85% of the total new car market. Finally, consumers in the mass market are sensitive to changes in the price of new cars, though, surprisingly, not much to the changes in the cost of operating a car (e.g., oil prices).[2]

The demand for new cars is relatively stable in the developed world; these automobile markets are often referred to as being near to saturation. In other words, these markets will grow

1. See OECD, *Long Term Outlook*, Chapter 2, "Future trends in demand;" and J.C. Tanner, *Saturation Levels in Car Ownership: Some Recent Data [TRRL Supplementary Report]* (Crawthorne, UK: TRRL, 1981), pp. 1-8.

2. OECD, *Long Term Outlook*, pp. 16-20.

much less quickly than they grew in the past, and less quickly than the markets of less developed countries. The OECD estimated in 1981 that the demand for new cars would average an annual increase of no more than 2% in all the major car markets, and much less in some cases; the growth rates in Canada, Britain, and Western Germany are estimated to be below 1%. By the mid-1980s, these projections appear to be somewhat optimistic. For instance, the sales of new cars in the major automotive markets approached record levels in 1985—a boom year. In 1981, the OECD estimated that 1985 new car sales in the United States would be 11.3 million, in Western Europe—11.2 million, and in Japan—4.4 million. The actual sales fell short of the OECD's estimate: the U.S.—11 million, in W. Europe—10.7 million, and in Japan, 3.1 million.[3] The limited increase in market demand likely means that, during the next business cycle downturn, many automobile firms will find themselves to be in financial trouble.

Evidence for market saturation can be found in an analysis of the financial results and market shares of the Western European and the U.S. markets in 1984 and 1985. The new car sales market in Europe is both competitive, with six producers capturing between 10.7% and 12.9% of new car sales, and large, with sales of 10.7 million in 1985, nearly matching the record sales year of 1978.[4] Despite near record sales, three of the six major producers (General Motors, Renault, and Peugeot) lost substantial sums of money, almost one and a half billion dollars (10.9 billion FFrancs) in the case of Renault.[5] Ford, Europe

3. The 1985 numbers were calculated from various issues of the *Financial Times* and *Ward's Automotive Report.*

4. The European car market is defined as including the European Community and several Scandinavian countries. The six major producers are (ranked by market share in 1985) Volkswagen (12.9%), FIAT (12.2%), Ford (11.9%), Peugeot (11.6%), General Motors (11.4%), and Renault (10.7%). The magnitude of market shares has been relatively stable. The 1980 figures were 12%, 11.8%, 11%, 14.6%, 8.4%, and 14.7%, respectively. Ironically, both the biggest market share "winner," GM, and the biggest losers, Renault and Peugeot, have lost substantial sums of money during the past 6 years, over $2 billion in the case of GM's European operations. The six smaller "major" producers are BL (now Rover), SEAT (now part of VW), Daimler-Benz, BMW, Volvo, and Alfa Romeo. BL, SEAT, and Alfa have been consistently unprofitable. Daimler, BMW, and Volvo are "specialist" auto producers. These companies have been profitable, but, as the exchange-weighted value of the dollar falls, may become less so as their American markets shrink. See *New York Times,* June 2, 1985; *Financial Times,* April 25, 1985; *Financial Times,* February 4, 1986.

5. Preliminary results for 1987 show that each of the six major European automotive manufacturers made an operating profit. The profitability, despite grim projects, appears to result from internal reorganizations of the sort discussed in the concluding section: in-

earned $326 million in Europe, a return on sales of only 3.4%.[6] These losses occurred even though the Japanese auto-manufacturers have been more or less completely excluded from the French and Italian car markets, and operate within quota systems in Britain and West Germany. To complicate matters for the major auto producers, Nissan and Honda intend to begin assembly operations in the EC, thereby circumventing some of the quota restrictions. Given that the European market is thought to have an overcapacity of roughly 2.5 million cars per year before the Japanese establish assembly operations, the prognosis for the European companies, as the economies of Europe begin to slow, is not good.

The American auto industry continues to be hugely profitable. The combined profits of General Motors, Ford and Chrysler were $9.8 billion in 1984 and $8.1 billion in 1985. These net income figures seem to indicate that the substantial investments in products and production processes had successfully restored the American automobile industry to prosperity. "We're all the way back, America!" was Lee Iacocca's television messsage.

A careful analysis of the sources of the Big Three's prosperity reveals a less sanguine picture. First, much of the success of the Detroit firms results directly from U.S. government subsidies or trade barriers. Seventeen percent (or $1.6 billion) of the net income of these firms came directly from investment tax credits in 1984, and 14% (or $1.2 billion) of net income in 1985.[7] More important to the success of the auto firms has been the "voluntary" quota system imposed by the Japanese government on Japanese firms. The quota system, extended through to April of 1988, has restrained the number of Japanese produced cars in the United States to under 2.3 million cars per year. The International Trade Commission estimated that, without any trade restraints, the Japanese producers would have been able to sell one million more cars in the United States in 1984 than they did, thereby reducing the sales of American firms by

creasing horizontal linkages with allied firms and increasing outsourcing of cheap components, among other tactics.

6. Ford Motor Company, *Annual Report, 1985.*

7. These figures are calculated from the annual reports of each of the major auto firms. These numbers understate tax subsidies. Depreciation allowances, tax deferments, and tax reductions from (the now discontinued) DISC (Domestic International Sales Corporation) are not included here.

10-15%.[8] Second, despite these quotas, American firms did not recapture market share from the Japanese producers. The 1986 share of the total car market held by GM, Ford, and Chrysler (excluding Mitsubishi assembled cars) fell to 71% of the domestic market, which is the market share these firms held in 1981 when the quota system was first introduced.[9] These quotas soon will be less effective in protecting American firms from Japanese competition; I noted earlier that, by 1990, Japanese producers will have the capacity to produce 1.3 million cars in the United States. Finally, both the European specialist producers and Japanese car makers are targeting the luxury car market, and are expected to take half of this market in 1988. Consumer demand in this market is a function of quality and prestige, and less on price. The bad news for the American producers in this market is that consumers do not believe that U.S. made cars are comparable in quality with foreign cars.[10]

The luxury market, however, is expected to grow. *The New York Times*, citing J.D Power & Associates, a well known marketing research firm that specializes in the auto industry, reported that "the number of households with incomes of $50,000 or more is expected to double over the next 10 years, from 9.5 million this year [1986], to 18.8 million in 1995."[11] With the doubling of wealthy households, the American luxury market in cars is estimated to grow to 1.8 million cars by 1990.[12]

8. Quoted in the *Financial Times*, February 15, 1985. The quotas were said to cost the U.S. consumers $16 billion in the first four years of enactment.

9. *Financial Times*, February 20, 1986; *Ward's Automotive Yearbook, 1983*.

10. *Washington Post, Weekly Edition*, November 25, 1985. The Post reported that, of the 1984 model cars rated by consumers as being of good quality, only one of the top ten (#10 at that) cars was made by a domestic manufacturer—the Lincoln Continental. 21 percent of American car buyers were reported as believing that American made cars were of better quality than were Japanese cars.

11. *New York Times*, March 3, 1986.

12. The *New York Times* reported that the Congressional Research Service showed that the proportion of income (not wealth) going to the middle 60% of American families decreased from 53.8% in 1967 to 52.4% in 1983. The income going to the upper 20% rose from 40.4% to 42.9% for the same period. Although the absolute magnitude of income changes might be small, it is the (expected) *marginal* change in income that influences sales in consumer durables such as cars. Robert Z. Lawrence has analyzed changing income patterns in the U.S.: *Can America Compete?* (Washington: Brookings Institution, 1984); "The Middle Class Is Alive and Well," *New York Times*, June 23, 1985. His findings seem to be broadly in line with the CSR's findings, even allowing for category differences; Lawrence divides the work force into even thirds, and focuses on individuals, not households.

In a competitive market, with many firms with established competencies in the production of luxury goods, not all firms can successfully move up-market. Today's mass producers in particular will remain committed to the production of standard products as an investment in a customer base that might one day move from Chevys to Cadillacs. Price competition and surplus capacity will continue to characterize the mass market.

In Europe, where capacity is most clearly over-built, capacity reduction is unlikely to occur through the process of firm bankruptcy. The two weakest major firms, Renault and Peugeot, will not be permitted by the French government to go out of business, we may safely say. The two most "European" companies are Ford and General Motors, with major production and component assembly plants in each major market. Though Ford and GM have no protected national market in Europe that guarantees them a minimum sales volume, these companies are unlikely to withdraw from Europe. VW and FIAT remain profitable. Hence, the usual method of reducing spare capacity in an industry, firm bankruptcy, is unlikely to occur in Europe. Barring an unforeseen increase in market demand, the European mass producers will likely remain unprofitable for the near future.

The unwillingness of governments to permit the bankruptcy of large automobile firms also implies a limit on the willingness of states to accept more imports. For the moment, free trade, more or less, prevails, perhaps in the hope that the world economy will equilibriate so that exchange rate fluctuations will diminish the price advantages of East Asian producers. To date, however, changes in the value of yen, which has appreciated against the dollar by 50% in 18 months, have induced price increases in Japanese products by 17%. Analysts of the world automobile industry still envision Japanese penetration of the American market rising from 28.6% to 40-45% by 1990, and from 10% to 20% of the European market. Fierce competition is forecast.

Optimal Firm Strategies

Firms know that supply exceeds demand, and that some firms will lose in the ensuing competition. They do not know what their market share will be or what sort of products

consumers will want. The specialist market is expected to grow, but, precisely because these products are non-standard, accurate forecasting is baffling. Ford, for instance, successfully introduced the Taurus line of products to the mass market, but the Merkur line has failed (to date) in the luxury market.

In the mass market in particular, a firm needs to anticipate the strategies of its rivals. Hyundai's successful introduction of the $5000 Excel makes unrealizable the original goals of GM's Saturn—the lowest price product made with high capital costs and a fixed cost, though small, work force. Risk and uncertainty regarding the level and direction of consumer demand, and the consequences of competitors' strategies, are unavoidable in automobile sales.

Given the choices—scale, location, integration, organization of work—and constraints—markets, labor, state—outlined in the previous sections, and given the uncertainties regarding demand, what strategies make sense for an automotive firm, especially one concerned with the mass market?

Restructuring the firm's organization to reduce risks from uncertain markets is an evident response. How to reduce risk through internal reorganization, however, is less evident. After all, the strategies Chandler describes at GM and other companies in the early 20th century for reaping the benefits of administrative coordination and reducing externally induced risk are precisely the strategies of the nearly-vertical integration now in disrepute. The consensus in the business strategy field seems to be that a firm should integrate, at most, to the bottom of the business cycle—the minimum guaranteed level of production. Supplier firms should bear the risk of fluctuating demand.

In the standardized parts sector of automobile production, disintegrating even beyond the point of minimum demand seems to be reasonable. Externalizing the production of standardized components allows a firm to eliminate a largely unskilled, unionized, high-wage workforce. This strategy is particularly attractive for firms when low-wage firms (sometimes subsidiaries) in industrializing countries produce acceptable quality components. Costs of production will be reduced though the firm may still some bear risks associated with business cycle downturn.

Disintegration makes little sense, however, in electronics and "high-tech", where the competencies embodied in skilled labor

and specialized machinery are scarce. Microelectronics has transformed both product and production process. An assembler of automobiles that depended on external suppliers for microelectronic competency surrenders its ability to guarantee itself access to applied microelectronics at a price competitive with that of firms already vertically integrated in electronics.

The rule of thumb is, "internalize scarcity, externalize plenty." We would therefore expect to see the asset intensity of automotive production rising for all firms as they buy or develop competencies in microelectronics and add skilled labor in the electronics sector, while shedding unskilled labor in traditional sectors of automotive production, and abandoning suppliers of inputs available in competitive markets.

A second strategy for overcoming risk is to pool it: alliances among firms—cooperation amid competition. Pooling risk minimizes the consequences of a wrong choice by a firm—a marketing mistake, inefficient production, and so on. We should therefore see a substantial increase in the number of joint ventures, component sharing, and equity exchanges.

Some assembly operations will remain central to the organization of automobile firms. Given the choices and constraints, what would a sensible firm do within the factory?

Given that product quality is strongly influenced by the labor force, and given that technological innovation is constrained by the tenor of labor relations, firms have an interest in achieving labor peace with that part of its existing labor force that will remain with the core firm. To that end, firms will attempt to adopt non-confrontational, corporatist methods of production like those pioneered by Swedish and Japanese firms. Tying worker wages to worker output through profit-sharing will be another tactic. Since worker motivation and commitment has been found to be increased by increasing worker discretion, the employee's span of control will increase. Firms will, where possible, train employees in plant-specific or automotive-specific skills; firms will rely on the external labor market where possible in order to acquire scarce skills. Firms are largely unable to reap the benefits of training skilled labor, even if society, firms and workers would all benefit from increasing the knowledge base of production. Hence, creating what sociologists call a "total institution" with plant-specific skills will be the strategy widely adopted in assembly operations.

In examining the world's automobile firms, we find some firms, most notably the Japanese firms, that have already achieved the essential elements of these strategies. The internal organization of Japanese producers has served as something of a proto-type for successful production organization in conditions of market uncertainty, though few believe that Western firms will or should adopt the model. The Japanese firms, as they themselves are forced into international production, are adopting some of the features of international production long-ago introduced by Ford and General Motors, increasing integration among them.

Necessary Contradictions

The strategy of industrial mutation and the strategy of labor incorporation are, of course, contradictory for firms that have been heretofore vertically integrated. Firms will propose disintegration and outsourcing and increasing cooperation with unions simultaneously. Unions are being asked to agree to the "peripheralization" of part of their memberships in order to secure the wages and jobs of the core assembly workers, a task that democratically elected union officials pronounce unpalatable. In this competitive environment, unions may still accept outsourcing and cooperation for fear of harsher economic consequences, but firms may still pay a penalty in terms of employee morale and commitment.

Other aspects of these strategies are also contradictory. Firms are attempting to incorporate scarcity, especially those labor skills associated with high technology and microelectronics. And firms are attempting to do so by relying upon the external labor market. But, scarcity of skills and the presence of an external labor market allow these skilled employees to easily exit the firm. The ease of exit is reinforced by the attempt by firms to introduce team production and to level the pay differences among skilled and unskilled workers. A firm might instead train its own workers via an internal labor market, but unless all other firms in the auto sector and related sectors followed similar practices, a firm might find itself training employees who are soon bid away to other companies. Further, the unwillingness of American companies, in particular, to guarantee employment

means that a wise employee with marketable skills will keep that exit option open if possible.

Short-term labor co-optation and longer-term firm restructuring appears to be a strategy capable of reconciling these contradictions for multinational firms.

Absent political and labor constraints, then, we should find an increasing convergence of automotive firm strategies in the mass market—increasing asset intensity; absorption of scarce skills and technology; shedding of standard products and unskilled, unionized labor; increasing capital intensity; internationalization of production of standard parts or of sub-compact cars, either internal or external to the firm; the development of a clearly defined set of peripheral workers, whose wages are treated as a variable cost, at the same time firms concede to its core workers more certain terms of employment; and increasing employee span of control in assembly.

In practice, we do find political and labor constraints, and these limit the convergence of strategies. We know that German government labor policies and German trade unions limit the ability of firms to rearrange production as the firms see fit. Therefore, Volkswagen's options will be more limited in this process of mutation than will Fordwerke's, which will in turn be much more limited than are the options of Ford, USA. The requirements of an internal labor market must change firm strategy regarding deployment of labor and capital. Those international firms producing in Germany will necessarily reshape their corporate strategies to accommodate the constraints of German labor and state, and will assign to German subsidiaries a role in the firms' international division of labor not otherwise dictated by international economic factors. We also know that Britain's long history of industrial difficulties in the motor industry make unlikely the introduction of production arrangements that depend on trust between management and the work force. Rationalization, not work amplification, is the norm.

Another important political constraint is the sense widely held by governments of *juste retour*. Governments want their "fair-share" of production, arranged to approximate a firm's share of a country's sales market. Governments are also in a position, once investments take place within their borders, to influence the tax treatment of investment, including the

expensing of plant closings. Firms do not have a free hand in using economic factors only in allocating resources.

In light of these constraints, firms will try to produce standardized products in low-wage countries with stable workforces, and reserve both assembly operations and high value-added production for their central markets. In the auto industry, as in other industrial settings, economics is embedded in a political and social context.

STATISTICAL EVIDENCE

The contention that firms and investors expect automobile firms worldwide to face increasing competition and overcapacity is largely confirmed by statistical examination. Perhaps the most widely used measure of future market conditions is the price/earnings ratio of a firm relative to the P/E ratios of all firms in a given stock market. Table 3 lists the P/E ratios for the major automobile producers, and compares these to the national P/E averages. Excepting Daimler-Benz, the 1986 and 1987 P/E ratios give clear indication that automotive stocks are everywhere regarded as riskier investments relative to the averages of national stock prices despite a comparatively high income stream. Increased competition and an impending business cycle downturn are the expectations of investors everywhere. We might safely infer that the next two to four years will be periods in which firms ruthlessly seek to reduce per-unit costs, even if at the expense of more cooperative relations with their workforces.

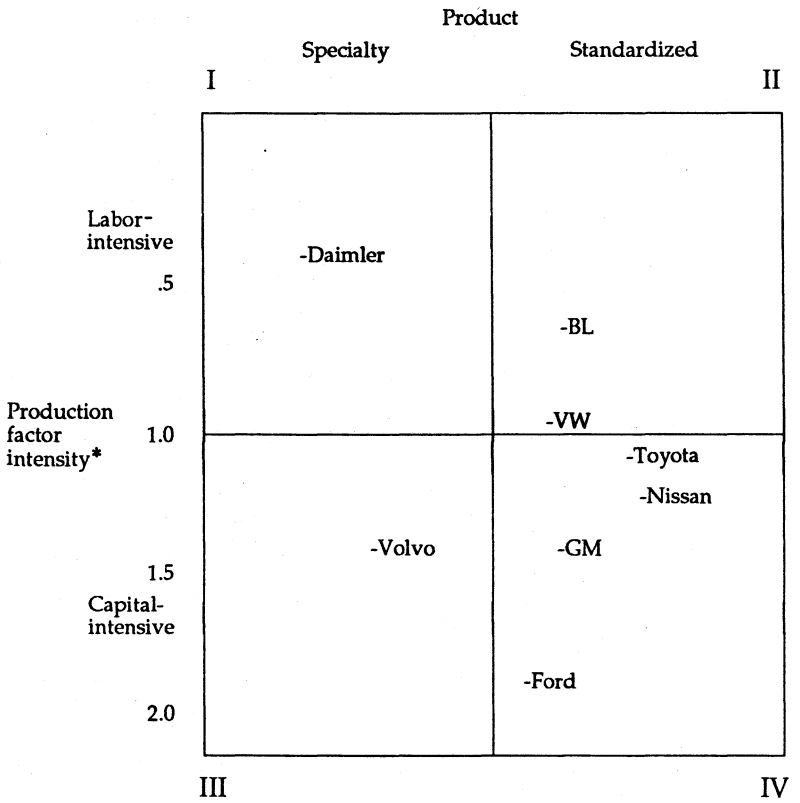
Figures 4 and 5 speak to the question of converging firm strategies, and production and product attributes. Comparing the data from 1975 to the data from 1985, we find a movement toward quadrant III. That is, firms are increasing the capital intensity of production and simultaneously increasing the value-added of the product. This strategy is consistent with an attempt to avoid the forecasted price competition (by moving toward the specialty market) and with increasing technological innovation in the production process. The data do not allow inference whether or not firms are employing technology in a fashion consistent with rationalization of work or with amplification of work. I should also note that Volkswagen's position in the matrix has changed little regarding labor/capital intensity, though their product line does show evidence of an up-market movement.

TABLE 3
RELATIVE PRICE / EARNING RATIOS FOR FIRMS

	P/E ratio	P/E % market	P/E % industry
US COMPANIES			
Chrysler, 1986	4.00	28.17	36.36
Chrysler, 1987	6.40	37.65	52.46
Ford, 1986	5.60	39.44	50.91
Ford, 1987	5.90	34.71	48.36
General Motors, 1986	6.60	46.48	60.00
General Motors, 1987*	12.30	72.35	100.82
EUROPEAN COMPANIES			
Daimler, 1986	24.20	136.72	220.00
Daimler, 1987	14.70	107.30	120.49
Volkswagen, 1986	14.10	79.66	128.18
Volkswagen, 1987	5.20	37.96	42.62
BMW, 1986	13.80	77.97	125.45
BMW, 1987	13.90	22.35	113.93
Peugeot, 1986	LOSS	0.00	0.00
Peugeot, 1987	45.00	213.27	368.85
Fiat, 1986	42.50	116.12	386.36
Fiat, 1987	14.40	65.16	118.03
JAPANESE COMPANIES			
Nissan, 1986	15.00	47.77	136.36
Nissan, 1987	45.70	73.47	374.59
Toyota, 1986	10.90	34.71	99.09
Toyota, 1987	13.00	20.90	106.56
Honda, 1986	7.70	24.52	70.00
Honda, 1987	13.70	22.03	112.30
Isuzu, 1986	17.20	54.78	156.36
Isuzu, 1987	LOSS	0.00	0.00
Mazda, 1986	9.60	30.57	87.27
Mazda, 1987	24.20	38.91	198.36
Mitsubishi, 1986	28.30	90.13	257.27
Mitsubishi, 1987	76.90	123.63	630.33

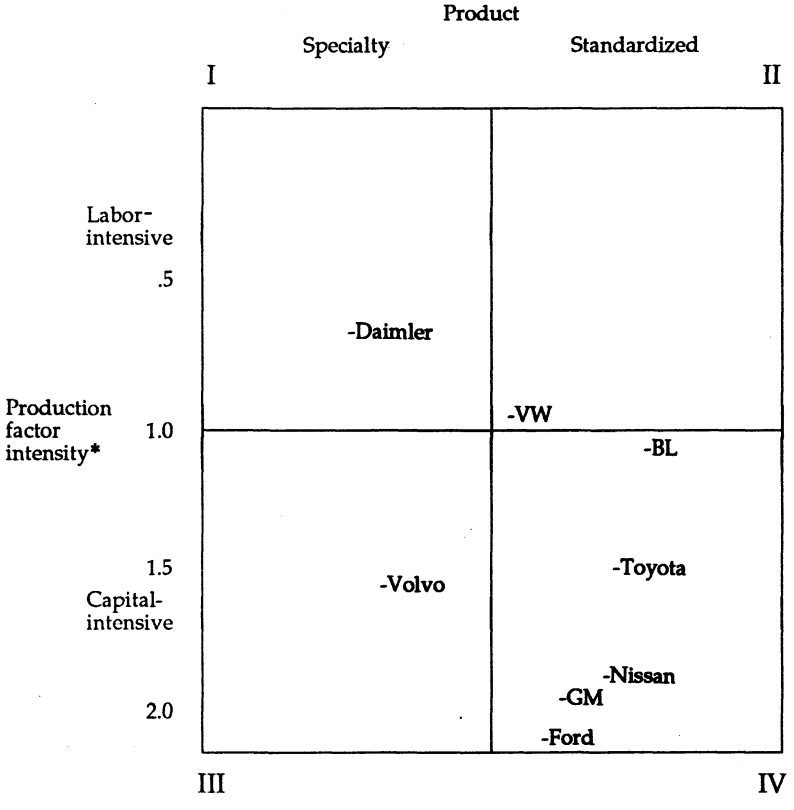
* GM's 1987 stock value was affected by its buyback of shares from the market.

FIGURE 4
PRODUCT ATTRIBUTES, CIRCA 1975-77



* Fixed assets as a proportion of labor costs.

FIGURE 5
PRODUCT ATTRIBUTES, CIRCA 1985

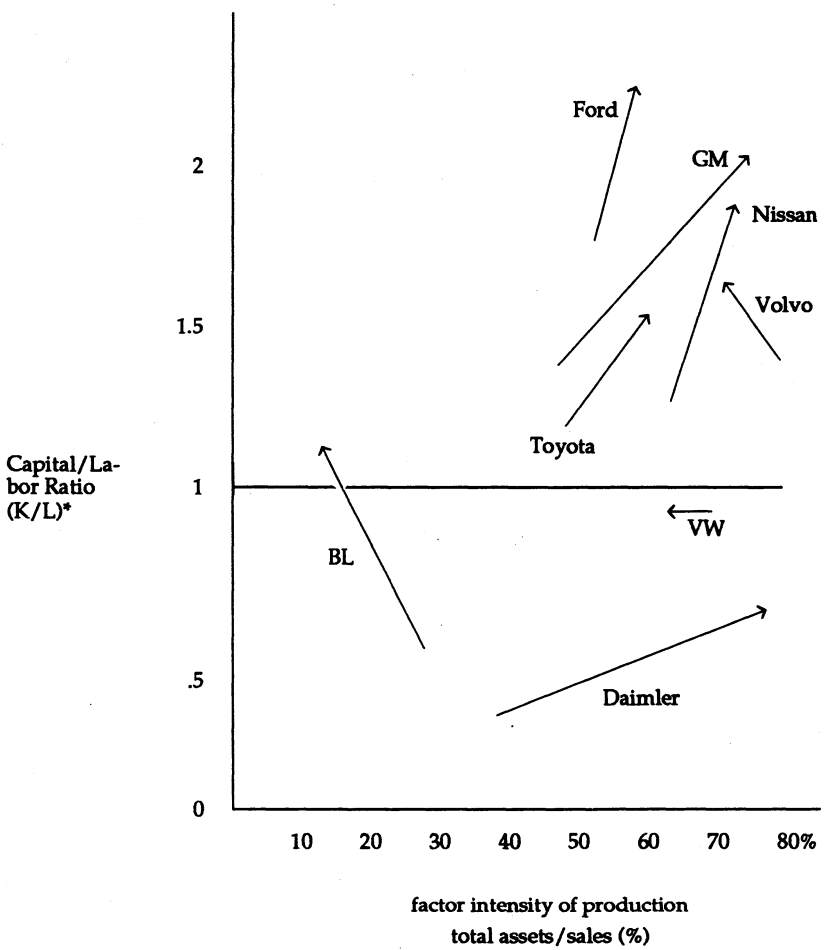


* Fixed assets as a proportion of labor costs.

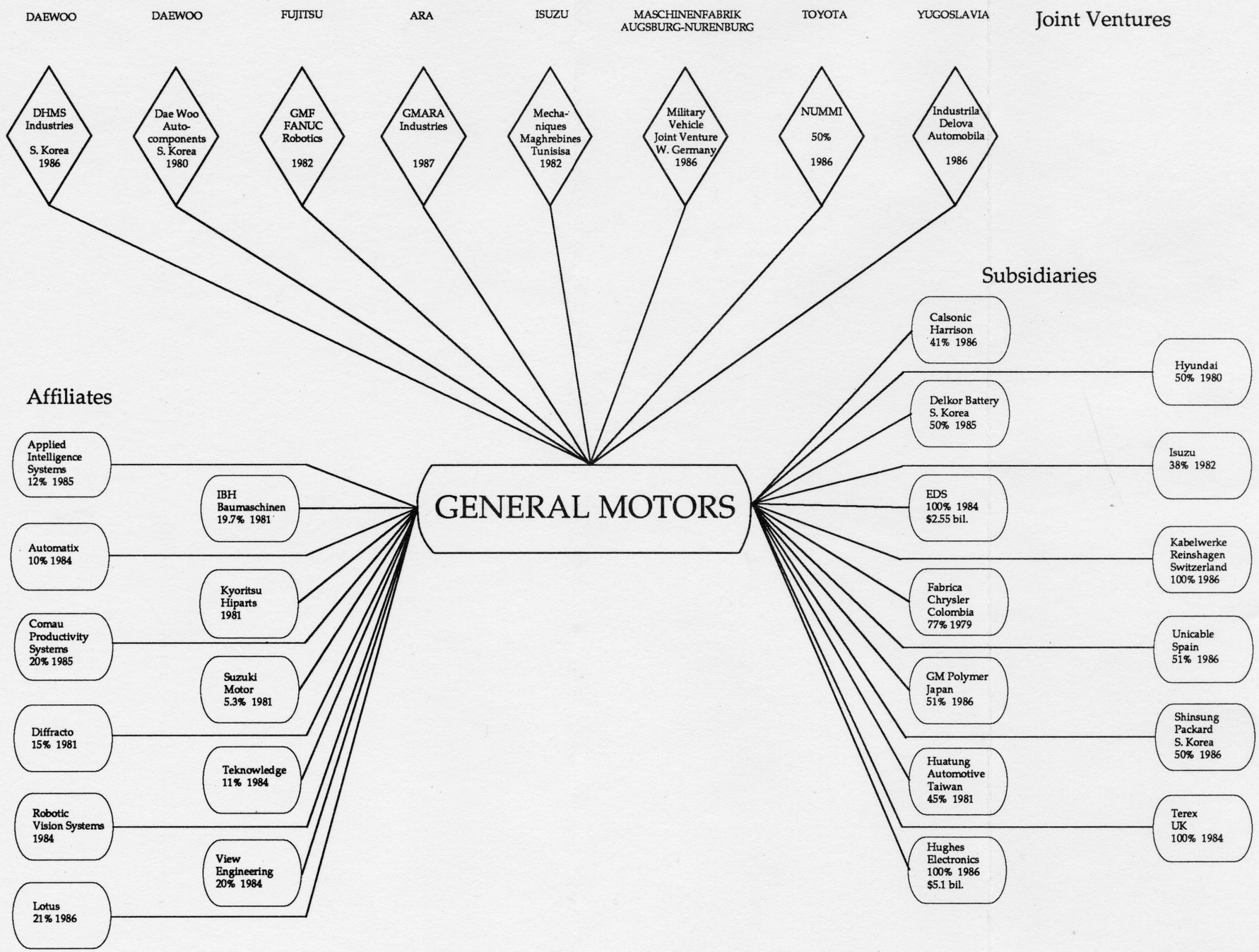
Figure 6 examines the asset intensity of production, that is, the range of institutional skills, expertise, and other institutional assets required to achieve current levels of sales, relative to the capital intensity of production. Excepting the two state-owned firms (VW & BL) and Volvo, the slope of the line is positive, strong evidence of an increasing asset intensity of production. (In the case of Volvo, the asset intensity of production was high already in 1975; Volvo remains clustered with GM and Nissan.) This implies that firms are internalizing the high-valued added components of production, a finding consistent with Monteverde and Teece's 1982 study of Ford and GM. BL, despite an increasing capital intensity of production, is evidently now little more than an assembler of cars, producing little of the value-added of an automobile. Volkswagen's organization of production has apparently changed little, though VW, as with Volvo, began the period with a high degree of internally produced value-added.

Figures 7 and 8 show the organization structure of General Motors and Toyota regarding the linkages and international affiliations of the number one and number three automotive producers. Examining the charts, we can see that range of affiliations and joint ventures upon which these firms have embarked is in some ways similar in terms of numbers and types of ventures. But, the timing of these affiliations differs. Toyota's organizational structure of alliances and sub-contracting dates in many cases to the 1940s. Only the international ventures show a modern date. General Motors, on the other hand, demonstrates a relative paucity of postwar organizational spinoffs and linkages until the 1980s, when GM actively began its current organizational mutation. This suggests that the organizational form of alliances and partial disintegration followed by partial "high value-added" integration is a way in which the American companies are moving closer to the Japanese model. In only the location of production does Toyota follow GM's example, a pattern, we may safely conclude, that results from increasing political constraints on exports.

FIGURE 6
PRODUCTION STRATEGIES, 1975, 1985



* Fixed assets as a proportion of labor costs.


DAEWOO
DAEWOO
FUJITSU
ARA
ISUZU
MASCHINENFABRIK AUGSBURG-NURENBURG
TOYOTA
YUGOSLAVIA
Joint Ventures
DHMS Industries S. Korea 1986
Dae Woo Auto-components S. Korea 1980
GMF FANUC Robotics 1982
GMARA Industries 1987
Mecha-niques Maghrebines Tunisisa 1982
Military Vehicle Joint Venture W. Germany 1986
NUMMI 50% 1986
Industrila Delova Automobila 1986
Subsidiaries
Affiliates
GENERAL MOTORS
Applied Intelligence Systems 12% 1985
Automatix 10% 1984
Comau Productivity Systems 20% 1985
Diffracto 15% 1981
Robotic Vision Systems 1984
Lotus 21% 1986
IBH Baumaschinen 19.7% 1981
Kyoritsu Hiparts 1981
Suzuki Motor 5.3% 1981
Teknowledge 11% 1984
View Engineering 20% 1984
Calsonic Harrison 41% 1986
Delkor Battery S. Korea 50% 1985
EDS 100% 1984 $2.55 bil.
Fabrica Chrysler Colombia 77% 1979
GM Polymer Japan 51% 1986
Huatung Automotive Taiwan 45% 1981
Hughes Electronics 100% 1986 $5.1 bil.
Hyundai 50% 1980
Isuzu 38% 1982
Kabelwerke Reinshagen Switzerland 100% 1986
Unicable Spain 51% 1986
Shinsung Packard S. Korea 50% 1986
Terex UK 100% 1984

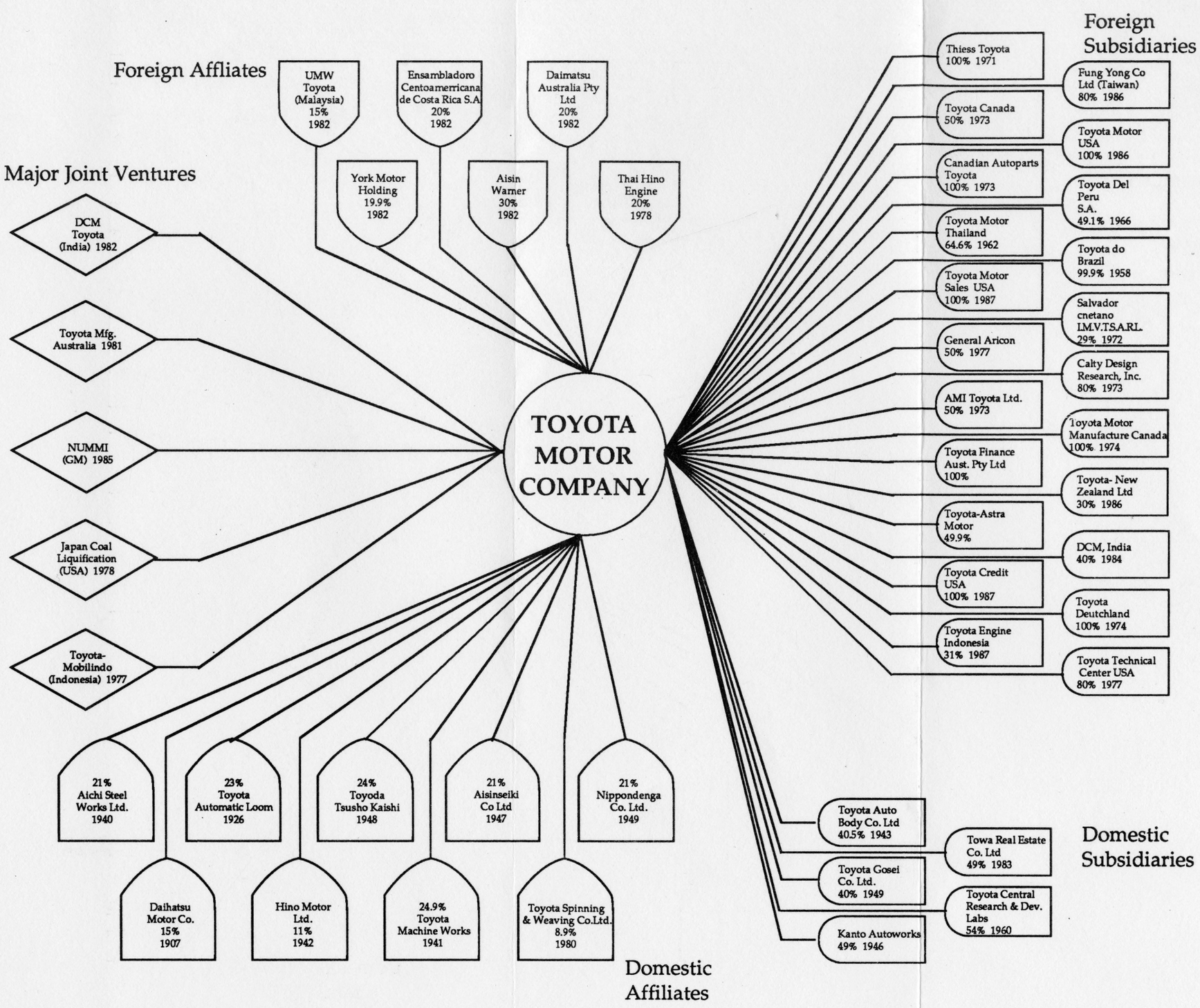

Foreign Affliates
UMW Toyota (Malaysia) 15% 1982
Ensambladoro Centoamerricana de Costa Rica S.A 20% 1982
Daimatsu Australia Pty Ltd 20% 1982
York Motor Holding 19.9% 1982
Aisin Warner 30% 1982
Thai Hino Engine 20% 1978
Major Joint Ventures
DCM Toyota (India) 1982
Toyota Mfg. Australia 1981
NUMMI (GM) 1985
Japan Coal Liquification (USA) 1978
Toyota-Mobilindo (Indonesia) 1977
TOYOTA MOTOR COMPANY
Foreign Subsidiaries
Thiess Toyota 100% 1971
Fung Yong Co Ltd (Taiwan) 80% 1986
Toyota Canada 50% 1973
Toyota Motor USA 100% 1986
Canadian Autoparts Toyota 100% 1973
Toyota Del Peru S.A. 49.1% 1966
Toyota Motor Thailand 64.6% 1962
Toyota do Brazil 99.9% 1958
Toyota Motor Sales USA 100% 1987
Salvador cnetano I.M.V.T.S.A.R.L. 29% 1972
General Aricon 50% 1977
Calty Design Research, Inc. 80% 1973
AMI Toyota Ltd. 50% 1973
Toyota Motor Manufacture Canada 100% 1974
Toyota Finance Aust. Pty Ltd 100%
Toyota- New Zealand Ltd 30% 1986
Toyota-Astra Motor 49.9%
DCM, India 40% 1984
Toyota Credit USA 100% 1987
Toyota Deutchland 100% 1974
Toyota Engine Indonesia 31% 1987
Toyota Technical Center USA 80% 1977
21% Aichi Steel Works Ltd. 1940
23% Toyota Automatic Loom 1926
24% Toyoda Tsusho Kaishi 1948
21% Aisinseiki Co Ltd 1947
21% Nippondenga Co. Ltd. 1949
Daihatsu Motor Co. 15% 1907
Hino Motor Ltd. 11% 1942
24.9% Toyota Machine Works 1941
Toyota Spinning & Weaving Co.Ltd. 8.9% 1980
Domestic Affiliates
Toyota Auto Body Co. Ltd 40.5% 1943
Towa Real Estate Co. Ltd 49% 1983
Toyota Gosei Co. Ltd. 40% 1949
Toyota Central Research & Dev. Labs 54% 1960
Kanto Autoworks 49% 1946
Domestic Subsidiaries

Table 4 measures one aspect each of vertical integration and the organization of work: vehicles produced per employee. VW again excepted, the employee per car ratio of the Japanese firms is slowly decreasing, largely owing, one suspects, to the increasingly international nature of Toyota and Nissan's production, while GM, Ford, and Volvo each show an increasing car per employee ratio, an indication that the increase in capital intensity of production seen in Figures 4-6 is translating into effective rationalization of production. This is occurring despite the fact the both GM and Ford have decreased the internal sourcing of parts. GM is now said to be planning to acquire externally 40% of the components of its cars by 1990 (vs. 20% currently) and Ford already acquires 50% outside the company: value-added increases by internalizing scarcity and by externalizing plenty. British Leyland (now called Rover) shows the clearest evidence of an increasing rationalizing of work, though, for an assembler of cars, its cars per employee figure remains very low. VW again shows evidence that it will retain its existing organization of production.

Tables 5-8 are summary tables of organizational changes among the major automotive firms. Table 5 shows the overall number of changes among all the firms. The most notable point is that the sheer number of organizational changes has increased three and a half times in the 1981-86 period over the 1976-80 period. Despite the increasing changes, and contrary to my original expectations, the changes between 1976-80 and 1981-86 are not significantly different in terms of the trends; organizational transformation in 1981-86 is an acceleration of the pattern found in 1976-80. Each category (as a proportion of the total changes) remained roughly constant. The patterns are: disintegration in standardized component products, international integration and affiliations in assembly, and linkages and integration in the high-tech, high value-added parts of automotive production.

Tables 6-8 are breakdowns by countries. By and large, the overall patterns found in Table 5 is repeated for each country's firms. Several differences, however, are worth highlighting. The trend among Japanese companies (as a proportion of total transaction) toward international assembly in production is more pronounced than for American and European firms. This trend is not surprising given that the American and European

TABLE 4
WORKER PRODUCTIVITY AS A MEASURE OF VERTICAL INTEGRATION

	Motor Vehicles* Produced	Number of Employees**	Vehicles per Employee
1981			
Toyota	3,254,942	48,757	66.76
Nissan	2,617,899	56,284	46.51
Ford	4,402,462	411,202	10.17
Volkswagen	2,279,000	247,000	9.23
General Motors	6,762,000	741,000	9.13
Volvo	227,700	36,945	6.18
British Leyland	525,000	126,000	4.17
1985			
Toyota	3,535,495	61,665	57.33
Nissan	2,463,982	58,925	41.82
Ford	5,634,348	369,314	15.26
Volvo	397,100	32,950	12.05
General Motors	9,305,000	811,000	11.47
Volkswagen	2,398,000	259,000	9.25
British Leyland	542,000	78,000	6.95

* includes trucks and vans as well as automobiles.
** worldwide employees in all cases.

Sources: Annual Reports, various companies, various years.

TABLE 5
ORGANIZATIONAL CHANGES AMONG AUTOMOTIVE FIRMS: INTEGRATIVE / DISINTEGRATIVE CHANGES IN HIGH-TECH / NON-HIGH-TECH FIRMS

ALL COMPANIES

	INTEGRATIVE				DISINTEGRATIVE			
	High-Tech		Non-High-Tech		High-Tech		Non-High-Tech	
1976-1980								
Total of 177 firms								
International	8	(5)	90	(51)	0		5	(14)
Domestic	16	(9)	25	(14)	0		13	(7)
Subtotal	24	(14)	115	(65)	0		38	(21)
1981-1987								
Total of 600 firms								
International	44	(7)	274	(46)	2		8	(10)
Domestic	83	(14)	92	(15)	6	(1)	41	(7)
Subtotal	127	(21)	366	(61)	8	(1)	99	(17)
ALL YEARS								
Total of 777 firms								
International	52	(7)	364	(47)	2		83	(11)
Domestic	99	(13)	117	(15)	6	(1)	54	(7)
Total	151	(19)	481	(62)	8	(1)	137	(18)

Figures in parenthesis are rounded percentages of total number of firms.

TABLE 6
ORGANIZATIONAL CHANGES AMONG AUTOMOTIVE FIRMS: INTEGRATIVE / DISINTEGRATIVE CHANGES IN HIGH-TECH / NON-HIGH-TECH FIRMS

US COMPANIES ONLY

	INTEGRATIVE				DISINTEGRATIVE			
	High-Tech		Non-High-Tech		High-Tech		Non-High-Tech	
1976-1980								
Total of 75 firms (99)								
International	4	(5)	22	(29)	0		18	(24)
Domestic	6	(8)	12	(16)	0		13	(17)
Subtotal	10	(13)	34	(45)	0		31	(41)
1981-1987								
Total of 313 firms								
International	18	(6)	112	(36)	1		39	(12)
Domestic	46	(15)	54	(17)	6	(2)	37	(12)
Subtotal	64	(20)	166	(53)	7	(2)	76	(24)
ALL YEARS								
Total of 388 firms (101)								
International	22	(6)	134	(35)	1		57	(15)
Domestic	52	(13)	66	(17)	6	(2)	50	(13)
Total	74	(19)	200	(52)	7	(2)	107	(28)

Figures in parenthesis are rounded percentages of total number of firms.

TABLE 7
ORGANIZATIONAL CHANGES AMONG AUTOMOTIVE FIRMS: INTEGRATIVE / DISINTEGRATIVE CHANGES IN HIGH-TECH / NON-HIGH-TECH FIRMS

JAPANESE COMPANIES ONLY

	INTEGRATIVE				DISINTEGRATIVE			
	High-Tech		Non-High-Tech		High-Tech		Non-High-Tech	
1976-1980								
Total of 51 firms								
International	1	(2)	36	(71)	0		4	(8)
Domestic	7	(14)	3	(6)	0		0	
Subtotal	8	(16)	39	(76)	0		4	(8)
1981-1987								
Total of 115 firms								
International	16	(14)	76	(66)	0		10	(9)
Domestic	9	(8)	4	(3)	0		0	
Subtotal	25	(22)	80	(70)	0		10	(9)
ALL YEARS								
Total of 166 firms								
International	17	(10)	112	(67)	0		14	(8)
Domestic	16	(10)	7	(4)	0		0	
Total	33	(20)	119	(72)	0		14	(8)

Figures in parenthesis are rounded percentages of total number of firms.

TABLE 8
ORGANIZATIONAL CHANGES AMONG AUTOMOTIVE FIRMS: INTEGRATIVE / DISINTEGRATIVE CHANGES IN HIGH-TECH / NON-HIGH-TECH FIRMS

EUROPEAN COMPANIES ONLY

	INTEGRATIVE				DISINTEGRATIVE			
	High-Tech		Non-High-Tech		High-Tech		Non-High-Tech	
1976-1980								
Total of 51 firms								
International	3	(6)	32	(63)	0		3	(6)
Domestic	3	(6)	10	(20)	0		0	
Subtotal	6	(12)	42	(82)	0		3	(6)
1981-1987								
Total of 172 firms								
International	10	(6)	86	(50)	1		9	(5)
Domestic	28	(16)	34	(20)	0		4	(2)
Subtotal	38	(22)	120	(70)	1		13	(8)
ALL YEARS								
Total of 223 firms								
International	13	(6)	118	(53)	1		12	(5)
Domestic	31	(14)	44	(20)	0		4	(2)
Total	44	(20)	162	(73)	1		16	(7)

Figures in parenthesis are rounded percentages of total number of firms.

producers generally have had international production arrangements whereas Japanese firms have not. Another pronounced difference in Japanese firm behavior concerns the relative absence of domestic production arrangements. Competition among Japanese car companies within the Japanese markets is notoriously fierce, and supplier firms are usually tightly linked to core firms, so few domestic inter-firm assembly linkages beyond those already existing develop. The American pattern differs from the Japanese and European in another category, low-tech disintegration. The American producers were substantially integrated prior to 1975; the evidence indicates a substantial volume of disintegration, as we would expect. Japanese and European firms were less vertically integrated than were American firms, so, as with Japanese internationalization of production, the American firms are joining a global pattern. We might also note that no Japanese domestic disintegrations occurred, and only 4 such transactions were recorded for European companies. This is consistent with an argument that Japanese and European firms tend to see their work forces as essentially fixed-cost.

As with the overall data, the 1976-80 and 1981-86 periods for each region contain similar trends, with the trends accelerating in the later period.[1]

1. A data appendix is available from the author.

CONCLUSION

The original arguments made in the beginning of the paper were that firms were adopting converging strategies, though the convergence would be limited by nationally-specific labor relations and work organization, which will have a strong influence on how firms organize production.

Regarding the converging strategies of automotive producers, I have presented a range of statistical data that show broad patterns of convergence among firms. What emerges is an intermediate form, between the American model of vertical integration and geographic dispersion, and the Japanese model of concentrated domestic production with high levels of supplier outsourcing. Firms appear to be incorporating high-value assets, and increasing the capital intensity of production, while diversifying product range. Firms are also responding to political pressure by locating production in central markets, even if at the expense of optimal production efficiency. Given the earlier discussion of firm response to market uncertainty and risk, these strategies are rational responses to market and political constraints.

The one firm that consistently does not fit the argument I presented here is Volkswagen. One could hypothesize that VW's position as a partially state-owned firm has influenced management to adopt tactics that differ from those of profit-maximizing firms.

Another piece of evidence that does not fully fit with the original argument is that Japanese and European firms rarely eliminate domestic parts of the firm, even in the relatively less profitable low-tech assembly and components production sector. American firms have increasingly done exactly that.

This fact recalls the arguments concerning labor and work organization. While much less evidence has been available for this group of arguments, we may draw several inferences from the evidence gathered here and from what we already know about labor traditions in these countries.

We know that Japanese, German, and Swedish firms practice internal labor markets, and rarely involuntarily discharge

employees. We also know that American firms do so as a matter of course. We further know that American firms rely on external markets to acquire labor and organizations that possess needed skills. Hence, the different patterns of domestic disintegrations between the U.S. on one hand, and Japan and Europe on the other, are likely the by-product of management's view of labor as either a fixed cost or a variable cost. When labor is seen as a variable cost, externalizing standardized products and the labor used to make them is a rational action—as American firms have done.

We also see some evidence that American and British firms have adopted microelectronic innovations in order to rationalize production, whereas we see no such evidence for Nissan, Toyota, and Volvo. Since the capital intensity of production has increased for each company, we might safely infer that machines were being used in different ways on the shop floor.[1]

Given the organizational changes we see in American firms, and the resulting consequences for unionized workers, we might also infer that firms that practice production rationalization and extensive worker redundancies have little common interest with the workforce's union. One truism among scholars who study automobile production is that worker commitment is a crucial concomitant for a high quality product. Can unions and firms find a common interest given the organizational mutations occurring within American firms? The arguments made by Streeck, and by Willman and Winch, that flexible systems of production are possible only with high levels of trust between management and labor, are consistent with the aggregate data presented here. Perhaps only once a firm has reduced employment to the core workforce will cooperation and incorporation be possible. We do see that less integrated firms (e.g., Toyota, Nissan, Chrysler) do not reduce employment beyond its core assembly workers.

The developments within the automotive industry affect the public welfare diversely. The increased price competition means that American consumers will pay less (in real terms) than they now do for cars; product competition will increase the range of

1. See Susumu Watanabe, "Labor-Saving versus Work-Amplifying Effects of Microelectronics" on this point. No direct evidence for this is presented here; it is clearly an area for further study.

choice for consumers: public welfare gains. The changes in organization and location of production will be far less beneficial to American public welfare, however. Falling wages, falling employment, the closing of plants, and increasing imports, all imply negative externalities. To some extent, we cannot expect firms to do other than to respond to the economic incentives they find; overcoming negative social externalities is not the usual business of corporate managers. Neither can we expect that extraordinary profits and high wages of the post-war era to return to the industry: markets change.

Nonetheless, the public welfare might benefit more from a production system of the German sort described by Streeck (i.e., production with highly skilled, highly educated workers) than from the production system now developing—fragmented, internationalized, limited skill, conflictual, with lower employment, and vulnerable to import competition from low-wage countries. But, as is true with externalities generally, market participants (here, GM, Ford, Chrysler, and the UAW) have no necessary incentive to achieve the public good of high skill and education levels. Instead, the economic incentives confronting automotive firms are unlikely to allow American firms to adopt production systems that protect current levels of employment or that allow for a systematic upgrading of skills of the workforce or both. Fierce price and product competition among automotive firms, existing traditions of distrust between management and labor, and the difficulty of internalizing scarce labor skills all limit American firms' acceptance of labor as a fixed asset of competitive value.

If market forces will not induce social benefits, changing the rules under which market participants operate frequently will. For instance, one possible role for U.S. government policy in helping to promote a high wage, high skill, high profit automobile industry is to change its subsidization policies. Current government policies are aimed at increasing the rate of investment of firms on the theory that increased capital investment will be associated with higher levels of productivity and technological innovation.[2] The capital subsidies substantially exceed

2. For a discussion of this issue, see David G. Davies, *United States Taxes and Tax Policy*, (New York: Cambridge University Press, 1986). A short capsule survey of this literature is also found in Dennis P. Quinn, "Investment Incentives: A Five Country Test of the Lindblom Hypothesis," *Research in Corporate Social Performance*, Vol. 10 (1988).

the true cost of capital investment.[3] Firms, for instance, are able to deduct the costs of plant closing from their reported income. Subsidizing employee training, in lieu of or in addition to capital investment, would encourage firms to invest in the work skills of their employees independently of the short-term returns to firms of employee skill levels. Increasing the range and domain of employee skill levels is now widely regarded as a prerequisite of sustained economic growth in a competitive world economy, and subsidizing employee training may bring about the pool of well-educated workers crucial for manufacturing success. The evidence presented here suggests, however, that market forces in the automotive industry are such that firms have little incentive to invest substantially in their employees' skill and education levels.

Automotive firms have reconstituted themselves organizationally. Whereas firms in 1950 looked like the firms of 1930, today's firms share decreasing common elements of production and organization with the firms of 1950. This paper has argued that organizational changes in contemporary automotive firms are primarily responses to changing consumer demand and increased internationalization of the competitive market place. Organizational structures mutate toward accommodation of these market necessities, especially in the case of sellers to the mass markets. In this view, a "complete" adaptation to these necessities continues to be constrained by political requirements of the state, and by patterns of work and labor organization.

3. The OECD estimated that, in 1984, tax allowances exceeded "true" depreciation by $54 billion. OECD. *Economic Survey, 1985/1986: United States* (Paris: OECD, 1985), p. 118.

REFERENCES

Abernathy, William J., *The Productivity Dilemma: Roadblock to Innovation in the Automobile Industry.* Baltimore: Johns Hopkins University Press, 1978.

_____, Kim B. Clark, and Alan M. Kantrow, *Industrial Renaissance: Producing a Competitive Future for American.* New York: Basic Books, 1983.

Altschuler, Alan, Martin Anderson, Daniel Jones, Daniel Roos, and James Womack, *The Future of the Automobile.* Cambridge, MA: MIT Press, 1984.

Anderson, Martin, *Financial Restructuring of the World Auto Industry.* Cambridge, MA: MIT, Future of the Automobile Program, 1982.

Bennett, Douglas C. and Kenneth E. Sharpe, *Transnational Corporations Versus the State: the Political Economy of the Mexican Auto Industry.* Princeton: Princeton University Press, 1985.

Bhaskar, Krish, *The Future of the World Motor Industry.* London: Kogan, Page, 1980.

Blauner, Robert, *Alienation and Freedom.* Chicago: University of Chicago Press, 1966.

British Leyland, Limited [BL, Limited] [BL, Public Limited Company], *Annual Report.* [*Reports and Accounts.*] Various years.

Burawoy, Michael, *Manufacturing Consent.* Chicago: University of Chicago Press, 1979.

_____, *The Politics of Production: Factory Regimes under Capitalism and Socialism.* London: Verso, 1985.

Chandler, Alfred D., Jr., *The Visible Hand.* Cambridge, MA: Harvard University Press, 1977.

_____, ed., *Giant Enterprise.* New York: Harcourt, Brace, 1964.

Chang, C.S., *The Japanese Auto Industry and the U.S. Market.* New York: Praeger, 1981.

Chilton's Automotive Industries. Various issues.

Chinoy, E., *Automobile Workers and the American Dream.* New York: Doubleday, 1955.

Chrysler Corporation, *Annual Report.* Various years.

Cole, Robert E. and Taizo Yajusiji, eds., *The American and Japanese Auto Industries in Transition.* Ann Arbor: Center for Japanese Studies, 1984.

Crandall, Robert W., Howard Gruenspecht, Theodore E. Keeler and Lester B. Lave, *Regulating the Automobile.* Washington: Brookings Institution, 1986.

Cusumano, Michael A., *The Japanese Automobile Industry: Technology and Management and Nissan and Toyota.* Cambridge, MA: Harvard University Press, 1985.

Dore, Ronald, *British Factory, Japanese Factory.* Berkeley: University of California Press, 1973.

_____, *Flexible Rigidities: Industrial Policy and Structural Adjustment in the Japanese Economy, 1970-1980.* Stanford: Stanford University Press, 1986.

Dunnett, Peter J.S., *The Decline of the British Motor Industry.* London: Croom Helm, 1980.

The Economist. Various issues.

Economist Intelligence Unit, *The Motor Business; Quarterly Report.* London: EIU, various issues.

Ford Motor Company (U.K.), Limited, *Annual Report, 1982.*

Ford Motor Company, *Annual Report.* Various years.

Friedman, David, "Beyond the Age of Ford: The Strategic Basis of the Japanese Success in Automobiles," in John Zysman and Laura Tyson, eds., *American Industry in International Competition: Government Policies and*

Corporate Strategies. Ithaca, NY: Cornell University Press, 1983.

General Motors, Inc., *Annual Report.* Various years.

Ginsburg, Douglas and William Abernathy, eds., *Government, Technology, and the Future of the Automobile.* New York: McGraw Hill, 1980.

Guest, Robert H., "Quality of Work Life — Learning From Tarrytown," *Harvard Business Review*, Vol. 57, No. 4 (July/August 1979).

Great Britain, Central Policy Review Staff [CPRS], *The Future of the British Car Industry.* London: HMSO, 1975.

Harrigan, Kathryn R., "Formulating Vertical Integration Strategies," *Academy of Management Review*, Vol. 9, No. 4 (1984).

_____, "Matching Vertical Integration Strategies to Competitive Conditions," *Strategic Management Journal*, Vol. 7 (1986).

Hayes, Robert and William J. Abernathy, "Managing Our Way to Industrial Decline," *Harvard Business Review*, July-August 1980.

Hayes, Robert and D. Garvin, "Managing As If Tomorrow Mattered," *Harvard Business Review*, Vol. 60, No. 3 (May-June 1982).

Jones, Daniel T., "Technology and the U.K. Automotive Industry," *Lloyds Bank Review*, April 1983.

_____ and S.J. Prais, "Plant-size and Productivity in the Motor Industry," *Oxford Bulletin of Economics and Statistics*, May 1978.

Kamata, Satoshi, *Japan in the Passing Lane.* New York: Pantheon, 1982.

Katz, Harry C., *Collective Bargaining in the U.S. Auto Industry.* Cambridge, MA: MIT, Future of the Automobile Program, 1982.

_____, *Shifting Gears: Changing Labor Relations in the U.S. Automotive Industry*. Cambridge, MA: MIT Press, 1985.

_____, "The U.S. Automobile Collective Bargaining System in Transition," *British Journal of Industrial Relations* Vol. 22, No. 2 (July, 1984).

_____, Thomas A. Kochan, and Kenneth R. Gobeille, "Industrial Relations Performance, Economic Performance, and QWL Programs: An Interplant Analysis," *Industrial and Labor Relations Review*, Vol. 37, No. 1 (October 1983).

_____ and Charles F. Sabel, "Industrial Relations and Industrial Adjustment in the Car Industry," *Industrial Relations*, Vol. 24, No. 3 (Fall 1985).

Lall, Sanjaya, "Prospects for Automotive Transnationals in the Third World," *National Westminister Bank Quarterly Review*, February 1983.

_____, "The International Automotive Industry and the Developing World," *World Development*, October 1980.

Lenway, Stefanie Ann, *The Politics of International Trade*. Boston: Pitman, 1985.

Magaziner, Ira C., "Japanese Industrial Policy: Source of Strength for the Automobile Industry," in Robert E. Cole, ed., *The Japanese Automobile Industry*. Ann Arbor: Michigan Papers in Japanese Studies, No. 3 (1981).

Maxcy, George, *The Multinational Motor Industry*. London: Croom Helm, 1981.

Meade, James, *Alternative Systems of Business Organization and Worker's Remuneration*. London: George Allen & Unwin, 1986.

Monteverde, Kirk and David J. Teece, "Supplier Switching Costs and Vertical Integration in the Automobile Industry," *Bell Journal of Economics*, Vol. 12 (1982).

Motor Vehicle Manufacturers Association, *World Motor Vehicle Data*. Various years.

The New York Times. Various issues.

Norsworthy, J.R. and Craig A. Zabala, "Worker Attitudes, Worker Behavior, and Productivity in the U.S. Automobile Industry, 1959-1976," *Industrial and Labor Relations Review*, Vol. 38, No. 4 (July 1985).

Organization for Economic Cooperation and Development [OECD], *Long Term Outlook for the World Automobile Industry.* Paris: OECD, 1983.

Piore, Michael J. and Charles F. Sabel, *The Second Industrial Divide.* New York: Basic Books, 1984.

Prais, S. J., *Productivity and Industrial Structure: A Statistical Study of Manufacturing Industry in Britain, Germany and the United States.* Cambridge: Cambridge University Press, 1982.

_____ and Daniel T. Jones, "Plant-size and Productivity in the Motor Industry," *Oxford Bulletin of Economics and Statistics*, Vol. 40 (May 1978).

Quinn, Dennis P., *Restructuring the Automobile Industry: A Study of Firms and Governments in Modern Capitalism.* New York: Columbia University Press, 1987.

_____ and Robert Jacobson, "Industrial Policy Through the Restriction of Capital Flows," *American Journal of Political Science*, Vol. 33 (1989).

Rhys, D.G., *The Motor Industry: An Economic Survey.* London: Butterworths, 1972.

_____, "Economies of Scale in the Motor Industry," *Bulletin of Economic Research*, November 1977.

Sabel, Charles, *Work and Politics: The Division of Labor in Industry.* New York: Cambridge University Press, 1982.

Salter, Malcolm S., Alan M Webber, and Davis Dyer, "U.S. Competitiveness in Global Industries: Lessons from the Auto Industry," in Bruce Scott and George Lodge, eds. *U.S. Competitiveness in the World Economy.* Boston: Harvard Business School Press, 1984.

Scherer, F.M., *Industrial Market Structure and Economic Performance*, 2nd ed. Chicago: Rand McNally, 1980.

Schumpeter, Joseph A., *Capitalism, Socialism and Democracy*, 3rd Edition. New York: Harper & Row, 1950.

Shaiken, Harley, *Work Transformed: Automation and Labor in the Computer Age*. New York: Holt, Rinehart and Winston, 1984.

Society of Motor Manufacturers and Traders, (U.K.), *The Motor Industry of Great Britain*. London: SMMT, various years.

Solidarity. Various issues.

Streeck, Wolfgang, *Industrial Relations in West Germany: A Case Study of the Car Industry*. London: Heinemann, 1984.

_____, *Industrial Relations and Industrial Change in the Motor Industry: An International View*. Unpublished, 1985.

Teece, David J., "Economies of Scope and the Scope of the Enterprise," *Journal of Economic Behavior and Organization*, Vol. 1, No. 2 (1980).

_____, "Profiting from Technological Innovation: Implications for Integration," *Research Policy*, Vol. 15, No. 6 (December 1986).

Toyota Motor Company, *Annual Report*. Various years.

United Nations, Center on Transnational Corporations, *Transnational Corporations in the International Auto Industry*. New York: UN, 1983.

U.S. Department of Transportation, *The U.S. Automotive Industry, 1980*. Washington: GPO, 1981.

_____, *The U.S. Automotive Industry, 1981*. Washington: GPO, 1982.

U.S. Senate, Committee on Labor and Human Resources, *Employment and the American Automobile Industry, 1982*. Washington: GPO, 1982

Vernon, Raymond, "International Investment and International Trade in the Product Life Cycle," *Quarterly Journal of Economics*, Vol. 80 (May 1966).

_____ and Louis T. Wells, Jr., *Economic Environment of International Business*. Englewood Cliffs: Prentice-Hall, 1972.

Walker, Gordon and David Weber, "A Transaction Cost Approach to Make-or-Buy Decisions," *Administrative Science Quarterly*, Vol. 29 (September 1984).

Wall Street Journal. Various issues.

Ward's Automotive Yearbook. Various years.

Ward's Auto Report. Various issues.

Watanabe, Susumu, "Labor-Saving versus Work-Amplifying Effects of Micro-Electronics," *International Labor Review*, Vol. 125, No. 3 (May-June 1986).

Weitzman, Martin, *The Share Economy*. Cambridge, MA: Harvard University Press, 1984.

Wells, Louis T., Jr., "The International Product Life Cycle," in Douglas Ginsburg and William Abernathy, eds., *Government, Technology, and the Future of the Automobile*. New York: McGraw-Hill, 1980.

White, Lawrence, "Automobile Emissions Control Policy," in Douglas Ginsburg and William Abernathy, eds., *Government, Technology, and the Future of the Automobile*. New York: McGraw Hill, 1980.

_____, "The Motor Vehicle Industry," in Richard Nelson, ed., *Government and Technical Progress*. New York: Pergamon, 1982.

Wilks, Stephen, *Industrial Policy and the Motor Industry*. Manchester: Manchester University Press, 1984.

Williams, Karel, John Williams and Dennis Thomas, *Why Are the British So Bad at Manufacturing?* London: Routledge, 1983.

Willman, Paul and Graham Winch, *Innovation and Management Control.* Cambridge: Cambridge University Press, 1985.

Womack, James, *The Competitive Significance of National Financial Systems in the Auto Sector.* Cambridge, MA: MIT, Future of the Automobile Program, 1982.

Zysman, John, *Governments, Markets, and Growth.* Ithaca, NY: Cornell University Press, 1983.