4 Production in a Shortage Economy

This is the communist sector. If there's pig iron, then there's no scrap. If there's scrap, then there's no pig iron. If there happens to be both, then someone must have stolen something.

Furnaceman's joke

Are there features which distinguish production in state socialist societies from production in capitalist societies? Can one talk of a capitalist as opposed to a state socialist production process? At similar levels of the development of the forces of production, is the organization of work of industrial societies essentially similar, irrespective of differences in their political and economic systems? After undertaking case studies which compare advanced capitalism and state socialism, specifically the United States and Hungary, we have come to the provisional conclusion that the two types of economy do incline toward different forms of work organization. Specifically, Harry Braverman's now-classic thesis that the tendencies toward the separation of conception and execution shape the character of *capitalist* production finds indirect support from the reverse tendencies we observed in *state socialist* enterprises.

Criticisms of Braverman have often been misplaced since they focus on his failure to explain variations within capitalism rather than on his attempt to establish the "essence" of the capitalist labor process. His focus on domination at the expense of resistance, his mistaking ideology for reality, his recognition of only one strategy of control where a number are operative, his essentialist view of development without adequate analysis of social mechanisms, etc., are all important shortcomings when explaining *variations among and within capitalist economies.* But Braverman set himself the task of identifying features common to all forms of the *capitalist* labor process. So his claim that the tendency of the capitalist labor process is toward the separation of conception and execution can be properly evaluated only through a comparison between capitalist and noncapitalist labor processes. When such a comparison is made, new light is shed on the expropriation of control from the direct producer.

Braverman was primarily concerned with domination and exploitation, the vertical dimension of production, not with the horizontal conditions that make production possible. That is, Braverman took as unproblematic the supply of inputs to and the demand for products of enterprises. Neither supply nor demand can be taken for granted, and we follow János Kornai's distinction between two types of advanced industrial economies: one in which supply exceeds demand, the modern capitalist economy of overproduction, and one in which demand exceeds supply, the state socialist economy of shortage.[1] Contrary to Michael Piore and Charles Sabel, who argue that demand-side constraints generate tendencies toward the reunification of conception and execution, we argue that this is the result of supply-side constraints.[2] Our task will be to identify, on the one hand, pressures toward and compatibility between expropriation of control from the shop floor and overproduction under advanced capitalism and, on the other hand, pressures toward and compatibility between workshop autonomy and shortages under state socialism.

Theoretical Framework

We define a mode of production as composed of two sets of relations: relations *of* production through which goods and services are appropriated and redistributed, and relations *in* production which define the labor process, the production of those goods and services. Under capitalism, appropriation is private with a view to accumulating profit in a context of market competition. Here the pressure is to gain a competitive edge either by process innovation (including reducing wages, developing mass production, reducing inventories, and introducing new technology) or by product innovation. This has two consequences. First is the tendency toward overproduction, for supply to exceed demand. Capitalism is, therefore, characterized by demand constraints; following Sabel and Piore, one can plot the development of capitalism and its national variations in terms of changes in those constraints as well as the way enterprises and states respond to those constraints (fig. 1).

But there is a second consequence of the search for profit in a competitive market which Piore and Sabel overlook. That is, it leads to the insecurity of both capital and labor. Profit is realized in the market but generated in production. Since the market is beyond the capitalist's control and there is no way of measuring profit at the point of production, the resulting endemic uncertainty drives capital to extract an ever-expanding surplus from the productive process. The reproduction of the relations of production depends first and foremost on the relations in production, so the capitalist can afford the latter little autonomy, and all the less so the more intense the competition. Although management might subscribe to all sorts of ideologies defending greater participation by employees, these tend to obscure the realities of greater control over employees. The contemporary context of global competition has created pressures toward centralization within large enterprises, for example, through the elimination of middle managers.[3]

Since labor depends on capital, over which it has no control, its fate

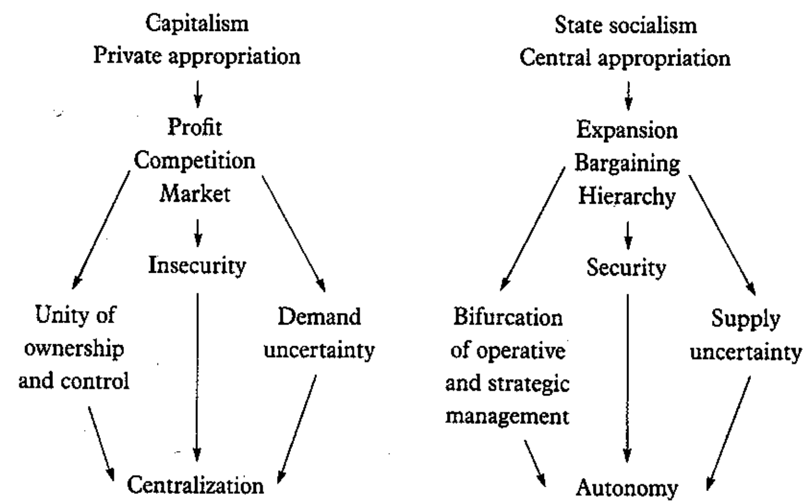

Figure 1. Ideal Type Models of Capitalist and State Socialist Enterprises

is doubly insecure. It has to cope with an arbitrary subordination to capital, itself subject to the caprice of the marketplace. Anxiety at this level concerning material livelihood is inimical to forms of self-organization that do not bring immediate economic gains or that may further endanger jobs.

In state socialism, central appropriation incorporates enterprises into a hierarchical bargaining structure.[4] The accumulation of resources whether of materials or investment depends on the enterprise's bargaining power with the center, which may depend upon its size, its profitability, the political influence of its director, plan fulfillment or other criteria. None of these is a "hard" criterion, but all are themselves subject to bargaining. The results are twofold. First, enterprises develop a seemingly inexhaustible appetite for investment resources, leading to shortages. The source of that appetite can be reduced to a universal urge for expansion, as Kornai argues, but more important in our view is the allocation of new resources which makes it impossible to effectively utilize existing resources. That is, supply constraints stem from the discrepancy between the logic of allocation and the logic of production.

Central appropriation and redistribution gives rise to a second set of consequences. The success of an enterprise is less dependent on the production process than on its bargaining power with the center. Insecurity lies in the competitive relations among enterprises for resources that are centrally allocated. The result is a split within management between *strategic* management, looking upward to reproduce and expand the relations *of* production, and *operative* management, concerned with relations *in* production, while *middle* management negotiates relations between the two. The independence of operative management creates the possibility of autonomous adaptation to supply constraints. As we shall see, this autonomy can become quite coercive when materials and machinery are so inadequate as to make adaptation less and less possible. At the same time, employees do not work in fear of losing their jobs—a security which conditions the possibility of their self-organization.

In other words, centralized appropriation—the separation of conception and execution at the level of relations *of* production—goes hand in hand with decentralized production—the unity of conception and execution at the level of relations *in* production. This is made possible by guarantees of employment and of enterprise survival, while it is made necessary by the need to adapt to shortages. In private appropriation, on the other hand, the mutual interdependence of the relations in production and relations of production leaves no space for autonomous

self-regulation of the former without corresponding regulation of the latter. Any attempts at self-organization of work are made more difficult by the insecurities facing both capital and labor, as well as by the centralizing pressures from demand-side constraints.

We will illustrate this theoretical framework by analyzing the Lenin Steel Works, one of Hungary's three integrated steel mills. We will examine, in particular, one section of the plant, where the steel is actually produced. Here the use of the most modern equipment, imported from advanced capitalist countries, allows us to control for the effects of technology in studying how political economy shapes work organization. Following the model outlined above, in the next section we focus on problems in the supply of both investment resources and material supplies, and how shortages are exacerbated by demand constraints. We then turn to the way a shortage economy structures management. At the enterprise level, "strategic" management negotiates external relations, in particular bargaining with the state over, for example, new investments, subsidies, prices, and production profiles. In the plant, "middle" management acts as a coordinating umbrella for "operative" management, the majority of whom are formally skilled workers. Middle management finds it influence restricted on the one side by strategic managers who hand down decisions arrived at through accommodations with the state and on the other side by operative managers who have to enjoy considerable autonomy if they are to adapt to the exigencies of shortages. We describe the forms of this self-organization on the shop floor and managerial attempts to undermine it. In particular, we study two cases of attempted centralization—the use of computers to regulate the system of production and the imposition of a centrally directed system of quality control—and a further case of the scrap yard, where shortages were too intense to permit meaningful self-organization. Finally, we draw some conclusions about the potentialities and tendencies of the socialist labor process.

Shortage Constraints at the Lenin Steel Works

The problem of shortages becomes more or less intense according to pressures from the demand side and from the character of the technology. We examine each factor in turn.

Demand Pressures

The Lenin Steel Works (LKM) produces steel for domestic and foreign industry, including quality carbon steel and alloy steel. Of LKM's total steel production in 1985, 63 percent was used domestically, 14 percent was exported to socialist countries, and 23 percent was exported to the West. The specific site of our study within LKM was the Combined Steel Works, completed in 1980 at the very height of the international steel crisis. Its purpose was to introduce "state of the art" technology into the production of quality and alloy steel at a world level. In the first place it was to supply the growing need of domestic manufacturing industry for specialized quality steels. Proudly boasting that it can produce any type of steel, LKM's management faces intense pressure from the state to accept orders for almost any type of alloy steel required by Hungarian industry. The relatively small scale of manufacturing ventures and a general unwillingness to use higher-quality steel in Hungary have given rise to lots of small-batch production with often narrow quality specifications.

Diverse and small-batch production is also the result of state economic policy. The construction of the Combined Steel Works was part of a larger government plan for the steel industry, namely that in addition to supplying domestic demand it should export finished products to the dollar markets while importing its raw materials from the ruble markets, complementing the opposite strategy of the machine- and vehicle-building industries, which import capital goods from the West and export to the Soviet bloc. The success of this venture has been substantially thwarted by the unanticipated international crisis in steel production, marked by world steel surpluses, competition from both advanced and industrializing countries with their new steel complexes, and falling prices for finished steel. LKM's strategic management has sought to enter into the world market by accepting orders which Western steel makers reject as uneconomic, namely small-batch production of high-quality steels at huge losses. Only by establishing its reputation in such steels can LKM begin to attract orders that might be profitable, but to achieve such a reliability is virtually impossible given the constraints on small-batch production posed by shortages in and/or poor quality of raw materials and investment goods. A further consequence is that the state has to make up the losses of the steel enterprise with subsidies, leaving no resources for the investments necessary to alleviate some of the problems responsible for the losses.

Uneven Development of Technology

Irrespective of demand-side pressures, the Combined Steel Works has to operate in a very unfavorable technological environment. The effectiveness of the new steel-making complex is undermined, on the one side by the backwardness of the technologies that produce the basic ingredients for steel production (the blast furnaces and scrap deliveries), and on the other side by the antiquated rolling mills, which are often poorly equipped to deal with processing high-quality steel. While this problem of uneven technology due to underinvestment can be found in capitalist countries, it is accentuated in the shortage economies of state socialism. Here the distribution of investment resources is based on bargaining with state organs, that is, on political as well as economic criteria. Rather than concentrate all new investment at a single steel enterprise, it becomes politically imperative to distribute resources among all three enterprises, thereby leading to the development of uneven technology.

To understand some of the problems of installing capitalist technology in a socialist economy we have to look more carefully at the character of that technology. The new steel-producing complex gradually replaced the eight old Siemens-Martin open-hearth furnaces with an eighty-ton basic oxygen converter from West Germany, known in the shop as the "LD." Like the Martin furnaces before it, the LD reduces pig iron to steel by combining it with scrap (roughly in a ratio of four to one) under high temperatures. But whereas the Siemens-Martin furnaces used gas to maintain the necessary high temperatures, the LD accomplishes this some eight times as quickly through an infusion of high-pressure oxygen. Here operators face a number of typical supply problems. For example, the amount of oxygen "blown" has to be carefully controlled to produce high-quality steel. The computer assumes that the oxygen is 97 percent pure, whereas in fact its purity fluctuates between 87 percent and 94 percent, so that operators have to blow more oxygen in than prescribed by the computer. Exactly how much depends on the quality of the oxygen, which is often unknown. In addition to the LD, the Combined Steel Works contains an eighty-ton electric arc furnace from Japan, the "UHP," which operates in conjunction with a Swedish vacuum degasser, the "ASEA," to provide the highest quality steel.

Within the same complex are casting facilities. There is a five-strand continuous caster from Japan, the "FAM," which accepts steel mainly from the converter. Money did not permit the two continuous casters, originally planned, to process the bulk of the steel produced. Even at the best continuous casters, casting sensitive alloy steel is a difficult operation usually confined to one or two qualities and not the wide range that would have to be cast at LKM. So there remains a casting bay where ingots are cast and from there taken to the more primitive primary rolling mill via an ill-equipped "soaking pit" where they are reheated. Stoppages at either of these points affect the casting of ingots at the casting bay as well as the final quality of steel produced in the fine rolling mill. To facilitate continuity in production at the rolling mill, that is to avoid frequent change of the rollers, they try to maintain the same shape of steel for long periods of time, which results in frequent changes in the quality of steel, exacerbating problems in the steelmaking process.

Pig iron (hot metal) coming from the blast furnaces is teemed (poured) into a mixer which can hold up to 1,300 tons, enough for almost twenty heats ("vessels" or "ladles" of steel). As well as acting as a buffer, the mixer is designed to homogenize the content of the hot metal so that steel production in the converter can proceed more smoothly. It

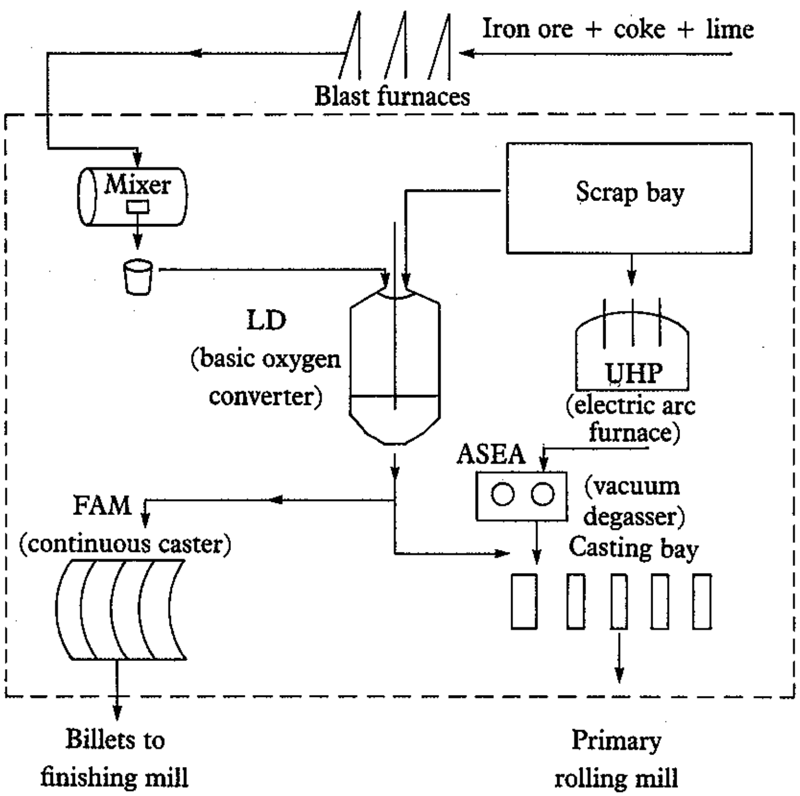

Figure 2. The Combined Steel Works at ~~Red Star~~ LKM

is important when the quality of the pig iron from the blast furnace varies considerably over time, as is the case due to the poor and variable quality of the iron ore, the ineffective sinter plant which processes the iron ore, and the now old-fashioned blast furnaces. In practice, due to the shortage of pig iron the mixer is often less than half full so that it does not homogenize the composition of the hot metal charged into the converter.

Finally, there is the scrap, the major ingredient of the electric arc furnace. The quality of scrap poses the critical barrier to the production of high-quality steel. Scrap is also used in the converter together with pig iron, and here too the variable quality means that it is more difficult to control the production process. In an advanced steel mill the scrap is divided up into several grades so that they can be selected according to the steel to be made. Here the scrap is not sorted but heaped onto a single pile. It is often of very poor quality and unprocessed—loose, light, and often mixed with slag. There is neither the space nor the equipment for effective processing. The best scrap comes from within the enterprise, but most of it is used at other electric arc furnaces.

Tightly Coupled Technology

We have seen how surrounding advanced technology with more backward technology intensifies the problems created by shortages. But the character of that advanced technology is itself a source of tension. The different parts of the Combined Steel Works are tightly interconnected and interdependent at the same time that they have their own cycles of production, so that the entire operation is very sensitive to mechanical breakdowns and to the availability and quality of raw materials. Take the relationship between the converter (LD) and the continuous caster (FAM). The cycle of production at the FAM dominates the production process at the LD, but only within limits defined by the LD's own cycle. Once the FAM begins to cast it must be continuously fed with heats from the converter about every forty-five minutes (the exact time depending on the size of the billets being cast and the number of strands working). To be efficient the FAM must be fed at least five consecutive heats. This requires advance planning. There must be enough hot metal and scrap for all five heats and the temperature of delivery (around sixteen hundred degrees) is important; otherwise the FAM will not work properly. It can happen that by the time the heat reaches the FAM it is too cold, or that it reaches the FAM too late, or that something happens at the FAM so that it malfunctions (the strands get clogged up with aluminum coating, steel can leak from the strands due to the presence of bits of slag, or it may have too low a viscosity due to low temperature before entering the strands); then the heat has to be sent to the casting bay where it can be cast at lower temperatures. But that is a complicated rerouting process, and whether there will be space at the casting bay depends on the availability of ingot molds. Such an elaborate coordination in time and space of tightly coupled technology is very susceptible to the types of supply problems that a socialist firm faces. What are the implications for the organization and direction of work?

The Squeeze on Middle Management

Based on the demarcation of three levels of management—strategic management, middle management (directing the plant and working on day shift), and operative or shop-floor management (distinguished by shift work)—our thesis is that the shortage economy tends de facto to polarize managerial direction at the lowest and the highest levels, leaving middle management dependent on both. This is a consequence of a shortage economy which requires strategic management to negotiate with the environment, particularly the state, at the same time that responsibility for dealing with shortages must lie in flexible organization on the shop floor. We shall show in later sections how attempts by middle management to appropriate control over the shop floor undermine effective adaptation to the exigencies of a tightly coupled technology in a context of supply uncertainty. This is not to say that middle management is superfluous. It does carry out important recognizable functions, to which we now turn.

Routine Functions

First, middle management performs certain routine functions. The highest levels create a buffer between the actual shop-floor practices and the attempts by the front offices to dictate alternative practices. Here the authority of the plant manager is critical—with both those above and those below. He has his agents on the shop floor, work site managers and foremen working permanently on day shift. They mediate dictates from above, as when some urgent order requires immediate production, an experiment is run, or preparations have to be made for the visit of a delegation. They are supposed to plan ahead, for example, for the supplies needed at the work points. They redistribute personnel on a temporary basis when there are shortages as well as controlling promotions and demotions. Foremen and work site managers are responsible for

coordinating relations among the parts of the plant. In their daily managerial meetings they are held accountable for failures at their work sites. At the same time, we shall argue, steel making in the context of shortages of materials and uneven, tightly coupled technology requires that immediate production decisions be made on the spot by skilled workers who are elevated to what we have called operative managers, specifically the steel makers at the LD, UHP, and ASEA, the casting bay master, and the process controller at the FAM.

Development Functions

Second, middle managers attempt to improve the efficiency and safety of the plant, and thus during the three years of our research we observed considerable increases in the output of the converter. When we began in 1985 the average number of heats was as low as six or seven per shift; when we left two and a half years later it was as high as nine or ten, with a maximum of fourteen. This was made possible by the greater availability of pig iron from the blast furnace and higher quality scrap steel. The crucial factors were the final closure of the remaining four Siemens-Martin furnaces in October 1986, so that all the pig iron could be directed to the converter, and an improvement in the supply of scrap. But who decided to close down the Martin furnaces? Confronted with the necessity of new investment there, strategic management decided to close them down altogether, exploiting the move as a sign of LKM's commitment to modernization. Once they were closed down, many of the advantages to the Combined Steel Works fell into place.

Another achievement of middle management is the increased rollability, that is, improvements in the quality of the steel coming from the Combined Steel Works, permitting more efficient production in the rolling mills. They attribute this to improved organization and a new incentive system. Further investigation shows that the improvement in the rollability can be attributed to the improved quality of the casting powder used in the casting of ingots—although here, middle management was involved in obtaining the new material. Finally, in the second quarter of 1987 middle management proudly announced a considerable increase in the number of heats per converter lining, from a record of 861 to 1,294. The major reason appears to have been the use of magnesium oxide, which reduces the corrosive effects of the slag. This is a textbook solution to the problem, raising the question of why it took so long to be adopted. It seems that the problem became particularly acute when, in a short period of time, the price of the new heat-proof bricks that make up the lining more than doubled from six million forints to fourteen million forints, to be paid in foreign exchange. Strategic management transmitted gradually increasing sensitivity to budget constraints by offering middle managers considerable bonuses for extendng the life of the lining. Such innovation bonuses are a major way for middle managers to increase their income, but not all innovations receive significant rewards. Here middle managers have to take their cue from strategic management, who set the system of rewards. Again, the initiative for development lies with top managers. There is a reluctance to take up small-scale changes on the shop floor which would advance production but offer few material rewards.

Regulatory Functions

The third and perhaps most important function for middle managers is to establish the incentive system for shop-floor operations. While all production workers in the Combined Steel Works receive bonuses according to the performance of their respective sectors, output is beyond the control of all but the key operators, such as the pivotal figure of the steel maker who directs production at the converter. Given a program of production of certain types of steel, the steel maker faces three problems. The first is to obtain hot metal and scrap, that is, backward cooperation. The second problem is to ensure effective production of steel at the converter, and the third is to deliver steel which is of appropriate quality and temperature that can be teemed at the FAM or casting bay.

The official incentive system corresponds to these three problems. Thus the steel maker tries first to minimize the percentage of hot metal per ton of steel. This minimizes the cost of inputs, since at LKM hot metal is more expensive than scrap. Second, he tries to minimize the number of kilograms of charge (hot metal and scrap) per ton of steel produced. This is a measure of the efficiency of the converter. Finally, he tries to maximize the ratio of steel teemed to steel cast. This involves producing steel that is of the right temperature, right quality, and right quantity so that it can be used at maximum efficiency at the FAM or casting bay. At the FAM any amount of steel can be cast, so the steel maker does not worry about the number of tons, but the temperature is critical. At the casting bay, on the other hand, only fourteen ingots of 5.8 tons each can be cast, that is, 81.2 tons. Anything over this will have to be scrapped, bringing down the steel maker's rate of teeming. Here the operative temperatures are lower, because the casting is quicker, giving more flexibility to the caster. As far as the steel maker is concerned, the quantity of steel cast is critical, and therefore the steel maker develops an interest not just in the provision of hot metal and scrap but also in what happens at the FAM and casting bay.

For those whose efforts affect production the official incentive system functions quite well. Sometimes, however, there are breakdowns, most frequently at the FAM, that are beyond the control of the operators but which can adversely affect their pay. On one occasion the personnel officer explained how the FAM had not been working well and workers' wages were being threatened. Extra premiums were introduced to create an effective bottom to their pay—absent in the official pay incentive system. If the official system had operated by itself, then the FAM wouldn't work as efficiently as it does, there would be continual turnover of workers, and their spontaneous cooperation would be lost. A bargain has to be struck on the shop floor between workers and managers outside of and, indeed, in opposition to the official incentive system.

If the incentive system is the carrot, there is also the stick, a punishment system that hung heavily in the minds of operators, arousing fear and fury. In a system so sensitive to shortages, there were ample cases of breakdowns and failures, whether these took the form of production stoppages or production losses or production of scrap. Here the punishment system took its toll. If operators failed to deliver the expected number of heats, then irrespective of the problems they had faced, they were subject to reprimand and verbal harassment. A more serious failure, such as the production of scrap, elicited threats of fines, some of which were actually carried out, for those declared negligent. Any failure to meet expectations, any malfunctioning, has its culprit who must be punished. The punishment system is ritualized in the morning meeting that the plant managers hold with night-shift operators, known to all as "Who knows how to [defend himself]?" after the TV talent show. Each operator has to give a persuasive account of any production failures. Later on there is a meeting of the day-shift managers where fines and reprimands are sometimes distributed. Those who run the meeting are not particularly interested in excuses or explanations but are concerned with allocating the blame to some irresponsible action.

Managers responsible for implementing this punishment system say it is necessary because the steelworks is such a dangerous place. This is less than an adequate response since danger is often the stimulus to self-organization and autonomy. Another explanation lies in the seemingly crucial role the Combined Steel Works plays in the overall profitability of LKM, but in a system of such tight interdependence the roles of the blast furnaces and the rolling mills are no less crucial. More likely is the view that strategic management is no more interested in the complaints and excuses of plant management than the latter is in those of its operative managers. The punitive system is passed down from above. Further, the unwillingness of plant managers to examine the causes of failures lies in their lack of control over the crucial factors of production (supplies and machinery) and their dependence on shop-floor operators to deal with breakdowns, disruptions, and crises as they spontaneously develop on the shop floor. The punitive system represents a frustration with their own powerlessness. What then is the response to this system of positive and negative sanctions on the shop floor?

Self-Organization on the Shop Floor

Given the constraints under which LKM has to operate, it is perhaps remarkable that its productive system is as effective as it is. As we will argue, its success can be largely attributed to the adaptive responses of operators on the shop floor. What are the elements of their autonomy?

Lateral Cooperation

On the basis of criteria established from above, shop-floor management's attention is directed laterally toward cooperation with other units in the Combined Steel Works. Take the steel maker at the LD, like most of the other operators always a male. Since he is dependent on the cooperation of others, he must command the confidence of his fellow operative managers at the other work sites. We observed the strivings of a recently promoted and inexperienced steel maker to establish himself among his peers, his furnacemen, and middle managers. Whenever he made a mistake, for example, they would say how young he was, how much he had to learn, and how in the old days the steel makers were really experienced. The steel maker who does not command respect may find himself waiting for the teeming ladles, for the "pots" into which the slag is poured, for hot metal from the mixer, for scrap from the scrap bay, for space and ingots to be prepared in the casting bay. Cooperation is particularly crucial when steel is being made for the FAM since its operation requires an uninterrupted flow of heats from the converter. The steel maker's adrenalin begins to run and tempers can flare. If operators at the other work sites are not keen to cooperate, he has to somehow persuade them that it is in their interest to do so.

But the steel maker seeks more than simple cooperation from others. In order to protect himself against unforeseen adversity, such as breakdowns at other units, poor service from the overhead cranes, which

often need repair, inferior quality or inadequate supply of materials, and arbitrary interference by higher managers, he asks them to undertake two types of manipulations: routine manipulations that make his production record look good and exceptional manipulations to cover up mistakes. First, the amount of scrap and hot metal registered as charged into the converter can be made less than that actually charged, so that at the FAM the amount of steel produced gives a better charging rate—ratio of scrap and hot metal to steel produced. At the casting bay the extra steel gives the leeway necessary to guarantee minimum production of 81.2 tons, and if the casting bay master cooperates there will not be too much officially recorded excess. Such manipulations require the cooperation of crane drivers with the supervisors at the casting bay, scrap yard, mixer, and FAM.[5]

The second set of manipulations takes place when there is a failure at the converter. For example, if the chemical composition of the heat is outside the limits stipulated for the steel being made, it is possible to change the steel being produced to a different type. This requires the cooperation of the "dispatcher"—another operative manager—who plans production of steel from blast furnace to rolling mill during the shift. The steel maker may ask the FAM to accept a heat that is slightly cooler than prescribed. Or he may ask the casting bay master to discount the scrap that was produced from a heat, or ask the FAM to submit a sample from a good piece of steel rather than from the bad one actually produced. In his turn the steel maker can extend favors to those upon whom he depends. He can record lost time due to shortage of scrap, for example (which otherwise would be blamed on the scrap master) as time lost due to shortage of hot metal, for which no one is blamed if there is less than six hundred tons in the mixer because officially this is the minimum. In practice there usually is less than six hundred tons, so that such a doctoring of the record is easy. In short, a system of reciprocal favors develops around the objective of producing steel on the one side and the protection of operative management from the punitive sanctions of middle management on the other.

Any attempt by management to eliminate such manipulations would lead to narrow self-protection on the part of each work site, involving continual and heated arguments as to whose responsibility was a given failure, e.g., in teeming. As it is, the manipulations are the basis of joint cooperation. The steel maker accepts the risk involved, for example, that his teeming ratio (amount teemed to amount of steel produced) may be adversely affected by what happens at the casting bay or the

FAM, but in return he expects his counterparts to undertake compensating manipulations that will make his production record look good and cover up his mistakes. Instead of interfering directly, the plant manager allocates fines to those held responsible for lapses. Operators and steel makers don't forget their punishments in a hurry—not only because the fines are considerable but also because of the public humiliation. In this way middle management defines what is acceptable and what is not. Out of this emerges the norms that govern relations and practices on the shop floor in conditions of uncertain production.

Shop-Floor Culture

This shop-floor culture is further elaborated through a network of social ties. While drinking groups forge solidarity between operators and their teams of workers, football competitions and outings, all of which are organized on a plantwide but shift-specific basis, establish ties between the different work points. Although workers and operators may move around from workplace to workplace, they rarely change shifts. That is to say, their mobility facilitates the development of social ties and a common set of norms. It is interesting to note therefore that the majority of complaints are made against those who are outside the control of this system of cooperation, that is, against the laboratory and the maintenance workers. Both groups are outside the moral order of steel production and their cooperation is more difficult to extract.

Shifts compete with each other to teem the greatest number of heats and to avoid breakdowns. This leads to antagonisms as each shift tries to push problems onto the next shift. So one shift may postpone repairing the taphole which has become too large or spraying the inner wall of the converter that has worn thin. Rules about the relative composition between hot metal and scrap may be flouted to get out a last heat, thereby emptying the mixer of hot metal and so leaving the next shift stranded. At the casting bay there might be no ingot molds or the place left in a mess; at the scrap yard the new crane drivers must begin afresh with empty boxes, or there may not be any preheated ladles or slag dishes. Any of these can lead to considerable time loss at the beginning of a shift. Moreover, the quarterly production conferences are held separately for the different shifts. All of this cements solidarity within a shift across work points while building up distance between workers at the same work points but on different shifts. While middle management complains about "shift chauvinism," at the same time its own punitive order encourages lateral cooperation among work sites at the expense of cooperation between successive shifts.

Obstacles to Centralization

So far we have argued that adaptation to supply constraints is most effectively accomplished through granting autonomy to operative managers on the shop floor. This becomes even clearer when we examine attempts at centralization.

Computer Control

Let us return to the steel maker at the LD and his assistant, who control production at the converter. So far we have talked about how they negotiate relations with other work sites, but what happens at the LD itself? They have to decide first how much hot metal and scrap, and then how much fluorspar and lime have to be charged into the converter, and finally the quantity of different alloys to be charged into the ladle prior to or during the tapping. They are also responsible for the length of the oxygen blow, i.e., the volume and the number of blows of oxygen. The converter, like all the other work points in the Combined Steel Works, is equipped with computer-directed operations, so that for any steel on the program there are instructions as to how the steel should be made.

Given a specific steel to be produced, the computer calculates how much scrap and hot metal have to be put into the converter, and basing its calculations on the average composition (in terms of carbon, silicon, and manganese) of the last ten heats of hot metal, gives up a prescription for the volume of oxygen to be blown in. Where indeed the average composition of the last ten heats of hot metal would predict the composition of the eleventh, and where other factors are held constant, the prescription would be an accurate one. In practice this is almost never the case. Often the mixer is nearly empty and so does not perform its homogenizing role, and the hot metal from the blast furnace can be of very uneven quality. This is the first major variation which the computer cannot take into account. The scrap itself is not sorted, so it can vary in content. Then there are a wide range of miscellaneous problems that affect the length of the oxygen blow, e.g., the purity of the oxygen, the temperature of the ladle into which the steel is tapped, whether the steel is going to the FAM or to the casting bay, the temperature of the hot metal (pig iron), the size of the taphole, whether the argon equipment that circulates the steel once it is made is working. The computer cannot take these and other imponderables into account, so they have to be assessed by the operator.

The computer is not only unreliable but, in roughly 40 percent of the heats, fails to give any prescription at all for the oxygen blow. This is usually because the acceptable limits of silicon or of manganese in the hot metal are exceeded, so that their oxidation generates either too much or too little heat. In practice the steel maker has no such option—not to make a heat when the conditions are not within prescribed limits—so he figures out an appropriate oxygen blow. On one occasion, however, we heard that the production manager had halted the delivery of hot metal from the blast furnace because the silicon was considerably above the prescribed level. Only the top echelons of middle management can intervene in such a manner beyond each plant.

That these problems are largely distinctive to a shortage economy was illustrated when the Japanese who installed the computer were recalled because it was not living up to its promise. The program couldn't take into account the long stoppages due to malfunctioning of equipment or shortages. At first the Japanese were quite baffled by the problems encountered in the plant. They then tried to reprogram the system to meet the specific needs of a shortage economy. But it still does not dictate operations and so its use is confined to information processing.

It is not simply a source of information but actually saves a great deal of time by recording the processes of steel production. But even here it is not always accurate. The shortage economy and the incentive system lead to manipulations that the computer does not register, and so many of the data are misleading. When one of us asked one of the managers if we could examine the computer readings on the amount of hot metal in the mixer, he told us we shouldn't bother since they are hopelessly wrong, registering some minus two thousand tons! The computer system was originally set up so that operators could not change any of the data on the screen. But this proved incompatible with the exigencies of a shortage economy, so that now there is a woman in the production department who is responsible for "correcting" the data in the computer in accordance with shop-floor manipulations. But anyone who wants to make any change has to first register that request in a special logbook.

The following incident highlights the conflicts that can arise over the proper use of the computer. One Saturday morning, the chief metallurgist came in to inspect the production of a very special steel. He was there because of the high cost of the alloys and the importance of the quality of the product. The problem with this steel is that it requires very low phosphorus and sulfur content at the same time as high carbon content. This is difficult to accomplish because the conditions for getting rid of phosphorus and sulfur also bring down the level of carbon.

There is a special desulfurizer, but sometimes this still leaves the sulfur content too high. To further reduce the amount of sulfur requires a very high temperature, but if it is too high the phosphorus that has been eliminated through oxidation and passed into the slag is deoxidized and returns to the steel. The operation is a delicate one in which rather than a single blow of oxygen it is necessary to give two blows, keeping the temperature relatively low and pouring in lime and fluorspar to help oxidize the sulfur and phosphorus, removing them to the slag. Seeing the operator working to keep the temperature relatively low, the chief metallurgist told him he was doing it all wrong and that he should work according to the program, which stipulated a long single oxygen blow. The operator knew that this would not work and took no notice even as the chief metallurgist stood there.

The conclusions are twofold. First, any attempt to use the computer system as a means of control is doomed to failure because of the uncertainties, mainly from the supply side. Second, any attempt at the centralization of control in the hands of those who are not attuned to the day-to-day realities of the Combined Steel Works easily leads to the production of scrap. Although middle management does make such attempts at expropriation of control, for the most part it accepts the necessity of workshop autonomy.

Quality Control

We have shown how shop-floor autonomy helps adjustment to shortages, particularly in the context of tightly coupled work processes. But it cannot be forgotten that shortages exist only relative to demand constraints, so that as the latter become more severe the former also intensify. This can be seen in the case of quality control.

The second half of the 1970s saw government economic policy for the steel industry turn toward the provision of Hungary's developing manufacturing industry and the expansion of the export of steel to the West. In line with this strategy LKM proposed the Combined Steel Works to increase and improve the production of its quality and alloy steels. In 1983, two years after the completion of the new complex, it exported 1,500 tons of alloy steel; in 1984 about 50,000, and in 1985 62,000. Most of these steels were produced in the Combined Steel Works, but at great costs in scrapping. Scrap rates have varied from 5 percent to 40 percent according to the type of steel. In 1986, for every 1,000 tons of finished steel, 1,400 tons of liquid steel had to be produced.

The difficulties of making quality steels underline the dilemmas of production in a shortage economy. Here the diagnosis and solutions of American experts, brought in to advise LKM management but accustomed to problems of a demand-constrained economy, illuminate the distinctive dilemmas of socialist production.[6] The experts attributed increasing rates of scrap to declining effort and diminishing sense of responsibility. As a solution they proposed the creation of an independent and centralized system of quality control which through computerization would trace each heat of steel through its various production processes, pinpointing the source of defective quality, making it possible to correct the problem, and immediately halting the continued processing of substandard steel. In theory their proposal was admirable, but it did not come to grips with the underlying realities of the uncertain conditions of production, whether unreliable machinery or inadequate or even absent materials. It was never implemented.

Frustrated by their apparent powerlessness to affect the quality of production, middle managers in quality control have attempted to follow these plans for centralization.[7] But instead of using surveillance to identify sources of scrap production, they have used it to punish those they find culpable of mistakes. This has the unintended effect that inspectors on the shop floor often turn a blind eye to the attempts of operators to push defective steel onto the next work point. They naturally sympathize with the operators' attempts to escape responsibility for what is not of their own doing, whether it be that steel arrives at their workplace already defective or that working conditions make substandard steel unavoidable if it is to be produced at all. The inspectors don't want to be party to punishing workers for mistakes they either did not make or had to make. In short, rather than solving the problem, the punitive system exacerbates it.

For example, there is a continual struggle between the primary rolling mill and the Combined Steel Works as to who is responsible for steel that cannot be rolled. The rolling mill blames the steel producers for not turning out steel according to specifications or for uneven surface on the ingots, while the Combined Steel Works blames the rolling mill for mistakes in reheating the ingots or poor rolling practices. Because of antiquated reheating equipment and poor measuring devices, and because of the sensitivity of quality steel to rolling practices, it is hard to distribute responsibility fairly. The difficulty of discovering the source of the problem is only exacerbated by the application of punitive sanctions, leading each side to cover up its own mistakes and spy on the other. Although the root cause of quality failures lies outside the control of operators, the correction of that which does lie within their control

requires immediate cooperation between inspectors and producers. This will only take place in the absence of punitive and arbitrary interventions by middle managers. Centralization of quality control is another exception which proves the rule, that is, that technically efficient production depends on autonomous organization at the workplace.

Scrap Bay

Unaccustomed to the problem of shortages, the American experts had nothing to say about attempting to change critical supply conditions, in particular the situation at the scrap yard. Here supply uncertainties are so extreme that no amount of shop-floor autonomy can facilitate adjustment. The history of the scrap bay illustrates well the character and sources of shortage in a socialist economy.

When the Combined Steel Works was being planned, the government told LKM management that it would provide no more than ten billion forints to finance the project. The original estimate was twelve billion forints, so top management had to decide on cuts. The essential technology had to remain, they argued, and instead reductions should be at the expense of some peripheral part of the plant. Accordingly, in order to reduce the size and therefore the cost of the scrap bay, management inflated figures for the density of scrap they would be receiving. They estimated that the scrap density would be between 1.4 and 1.8 tons per cubic meter, whereas the real figure should have been between 0.6 and 0.8 tons per cubic meter. In this way they pushed the responsibility for higher-density scrap onto the enterprise which collects and distributes the scrap. This, they knew, would only be possible if there would be capital investment in scrap-processing equipment—a very unlikely event. So the scrap bay was built much too small for the voluminous loose scrap, and as a result it is impossible to sort the scrap into different grades, as is done in many capitalist steel plants. Instead it is simply dumped into one huge disorganized mound. From there the scrap master has to organize deliveries to the UHP and the converter. Both sets of demands are usually urgent, but the cranes are slow in collecting the scrap because they were designed to gather much heavier types. Moreover, when quality steel is being produced it is critical to know the alloy content of the scrap, but with only a small electronic device at their disposal such a sorting operation is beyond the capability of the work crew.

The consequences are obvious. The scrap master and his work crew have a great deal of autonomy but little control over their work. They are cynical and frustrated and feel the hopelessness of their task. Here autonomy is antithetical to efficient production because the shortages are simply too great in relation to production needs. The original attempt to save on what appeared to be a peripheral operation becomes a major obstacle to the production of quality steel, for which the Combined Steel Works was explicitly designed.

Conclusion

We have opposed the common argument that modern technology requires the return of control to the shop floor. Technology by itself is not determinant: Its condition of effective deployment, in particular the most effective work organization, depends on the form of the wider political economy. We highlighted the link between a centralized economy and the character of work organization in a state socialist enterprise using the most up-to-date capitalist technology. More important, we took issue with another variant of the reskilling argument: the prognosis of Piore and Sabel that the future of capitalist society heralds increased worker control over production through flexible specialization. They do not argue from technological determinism, but give precedence to market factors: the need to cater to a multifaceted consumer demand. On the basis of what we know about the mini-mills and integrated steel plants in the United States, demand pressures lead to centralization and coercive managerial strategies rather than, as Piore and Sabel claim, the resurrection of the craft paradigm.[8]

Our own case study suggests that it is in state socialism, where supply constraints are the more significant force shaping development, that some form of shop-floor self-organization holds the greatest potential. Fluctuations in the quality and availability of raw materials, machinery, and labor power require some form of autonomous and flexible workshop organization for technical efficiency.[9] We have seen how, on the one hand, there developed dual systems of management and of incentives. In order to adapt to supply constraints in the context of tightly interdependent work sites, shop-floor management had to be given the room to make decisions spontaneously and elaborate a set of plant norms that governed lateral coordination. The centrally controlled computer system was mainly useful as a source of information, not as a means of prescription, for which it was originally intended. On the other hand, when middle management sought to interfere in the direction of day-to-day operations, crises and work stoppages were the frequent result.

Shop-floor autonomy need not necessarily revolve around a few key figures who direct production. In some situations, such as the machine

shop we studied at Bánki (chapters 2 and 3), workers themselves became the central figures in organizing work. Managers were fewer and acted as the emissaries or agents of workers. At LKM, on the other hand, the character of the technology and tightly coupled production involved key leaders at the different work sites, who work out deals among themselves, developing social ties and a sense of joint responsibility. The workers under them undertake a multiplicity of tasks, and in this sense they engage in a form of flexible specialization, but they don't exercise any guiding control over the process of production. Instead they are its agents.[10]

In its strongest form the claim of this chapter is that the promotion of technical efficiency, that is, the realization of a firm's production possibilities, requires centralization in advanced capitalism and shop-floor autonomy in state socialism. How then do we explain cases of shop-floor autonomy in advanced capitalism and centralization in state socialism?

National economies are constrained not solely by demand or by supply but also by some combination of the two. First, and most simply, within capitalism, shop-floor autonomy springs up precisely where factors of production cannot be controlled—for example, in the construction industry or coal mining—just as, within state socialism, pressures for centralization are most intense where there are stringent demand constraints—for example, in military production. Second, supply constraints may become more critical in capitalist societies as profitability becomes less salient. Within a large corporation, divisions may be bound into a political center much as socialist enterprises are bound to the state, leading to insatiable investment demands and shortages. On the other hand, market competition may develop among divisions within a socialist enterprise so that demand rather than supply becomes the salient constraint.

Third, and even more generally, we argue that too categorical a distinction between supply-constrained economies and demand-constrained economies tends to overlook the mutual determination of supply and demand. That is to say, the more specific and variable the demand, the more significant becomes any variation in the quality and availability of factors of production. Inasmuch as the intensification of demand constraints leads to supply problems, so shop-floor autonomy may emerge under capitalism. Equally under socialism, shortages may so adversely affect the quality of the product that the enterprise will find difficulty selling the product and thereby invite centralization.

We can also explain countertendencies to our model in terms of class struggle. Namely, in advanced capitalism workers have sometimes successfully resisted the expropriation of skill or centralization of control, just as in state socialism shop-floor operators and workers are often defenseless against the concerted efforts of trade union, party, and management to control production. While such economic and social factors explain variations both over time and between places within advanced capitalism and within state socialism, in no way do such variations refute the contention of this chapter that for the survival of these societies, the tendencies must be stronger than the countertendencies.

Finally, we don't want our conclusion to be misunderstood. We are not saying that autonomy on the shop floor will by itself resolve the dilemmas of socialist economies. Their fate hangs elsewhere, namely in the hierarchical relations between state and enterprises—relations which create the very problems to which self-organization is one adaptive response.

5 Painting Socialism

"New Evolutionism" is based on faith in the power of the working class, which, with a steady and unyielding stand, has on several occasions forced the government to make spectacular concessions. It is difficult to foresee developments in the working class, but there is no question that the power elite fears this social group most. Pressure from the working classes is a necessary condition for the evolution of public life toward democracy.

Adam Michnik, 1976

Following Marx, classical Marxism retained a boundless faith in the working class as deliverer of revolutionary promise. By virtue of its objective position in capitalist production, the working class bears the chains of all oppressed classes. Its revolutionary mission is to burst those chains by overthrowing capitalism and inaugurating the classless society of communism. In emancipating itself, the proletariat emancipates the entire human race. This mythology of an inevitable, teleological movement from class in itself to class for itself rides on two theses.

The first is the *polarization* thesis. Capitalism combines private ownership of the means of production with socialized organization of work. While capitalists dispose of their capital, workers—with only their la-