Giving and Getting the Wrong Signals: Institutions, Technical Change, and the Decline of British Productivity since 1850

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The recognition that labor contracts imperfectly specify the rate at which labor time is converted into labor effort has necessitated a reevaluation of standard microeconomic models [30, 31, 61]. A great deal of this work has stressed the role of institutional arrangements other than markets in the conversion of time into effort. This has led to a renaissance in economic interest regarding the origin of institutions and their role in the process of economic development [5, 25, 43, 52, 54]. Central to much of this new institutional analysis is the power struggle between buyers and sellers of labor time over the conversion of time into effort at the economic, political, and ideological levels. This brief paper will suggest how we might incorporate the effort bargain into models of technical change and how this might afford an alternative interpretation of the relative decline of the British economy.

The work of numerous economic and social historians over the past decade leaves little doubt that there has been bargaining over the conversion of time into effort and that the rate at which time is converted into effort varies between countries and time periods [8, 9, 32]. In what follows, labor time is the central focus of the analysis; other factors of production enter indirectly through their impact on labor productivity. We make a distinction between realized and potential labor productivity. Potential labor productivity depends on the ratio of capital to labor time and the organizational capacity of the institutions employed. Realized labor productivity depends on the level of potential productivity and the effectiveness of converting labor time into effort.

Technical change can fall into one of four categories:

1) Input Substitution Innovations
2) Productivity-Enhancing Innovations
3) Effort-Insulating Innovations
4) Effort-Bargain Innovations

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Input Substitution Innovations are motivated by the desire to minimize the total cost of factor inputs such as capital and labor time They are strongly influenced by relative factor prices.

Productivity-Enhancing Innovations increase the potential output from a fixed amount of labor time. Such changes include an increase in the quantity of capital per hour of labor time, an improvement in the quality of capital, improvements in human capital, or changes in the organizational capacity of the production unit. The incentive to make such changes, especially those involving increases in the capital labor ratio will depend on the ability of buyers to convert labor time into effort. Here, the standard partial equilibrium results of the factor price models--that firms will have an incentive to employ more of a factor of production the higher its marginal productivity--are misleading. In cases where labor is very productive (by which we mean that the rate at which time is converted into effort is high), the incentive to invest in capital equipment will be high because the firm will realize much of the potential output made possible by the new investment. In cases where labor time is less productive because the effort is not realized, the maximizing firm may actually adopt labor intensive methods of production because investment in capital equipment cannot be justified.

Effort-Insulating Innovations make the level of output less sensitive to failures to convert time into effort. Holding constant the rate at which time is converted into effort, the ratio between realized and potential labor output will vary from technique to technique. The more integrated is production or the more dependent each stage of a process is on previous stages, the more serious will be failures to convert time into effort. Effort-insulating changes can be viewed as defensive technical change. They may take the form of deskilling and reduced dependence on key skilled workers, shifts away from highly integrated flow processes, or even team work where workers cover for each other. Such changes will likely, but not necessarily, involve changes in the institutional framework.

Effort-Bargain Innovations shift the rate at which labor time is converted into effort. Interest in effort bargain changes will increase with increases in the capital/labor ratio and the accompanying rise in potential labour productivity. Both buyers and sellers of labor time can be expected to engage in this type of technical change. While they may take the form of changes in physical capital, such as the moving assembly line, these changes are more likely to result in alterations in the institutional framework, such as new payment systems, new norms or conventions, etc. [4, 17, 18, 37].

Institutions play an important function in each of the categories listed above. In some cases they are the subject of change, while in others they are important factors that shape change. At one level, institutions take the form of formal and informal structures and procedures such as payment systems, labor relations procedures, shop floor bargaining arrangements, and formal trade unions, which either coordinate factor inputs or facilitate, monitor, and enforce exchanges between economic agents. At a second level, institutions take the form of less tangible rules of behavior and include social norms and conventions [58]. Expectations regarding the extent to which other agents will

be cooperative or engage in opportunistic behavior may have dramatic effects on choices made and the willingness to innovate.

The challenge is to explain the origin of institutions, like social norms, and how they change over time [28]. One approach relies heavily on the past and the process of learning and path dependency [14, 15, 16]. Elster argues that norms are not necessarily outcome-oriented and hence may not be generated by rational calculations about the direct impact of actions. Instead, actions become socially sanctioned; once so declared, they may be repeated for emotive reasons, "feelings of embarrassment, anxiety, guilt and shame that a person suffers at the prospect of violating them" [19, pp. 98-99]. Once sanctioned by society, norms may be difficult to displace, especially in older stable societies like Britain where interactions between agents follow regular patterns and where the cost of deviant behavior, in the form of social opprobrium, will be higher than in a less stable but more fluid society, such as the United States in the nineteenth century.

An alternative school of thought has explored the possibility that norms are endogenous to the economic process and in part the product of purposeful actions by economic agents [58]. The transaction cost approach to institutions would fall into this camp. Stark has suggested that employers and employees will try to shape and signal their own preferences in order to generate advantageous conventions, norms, and patterns of behavior [55]. In this literature the formation of trust between economic agents is seen as critical [1, 2, 7, 9, 11, 23, 34, 53, 62]. In general, it is assumed that economic agents have some control over norm creation and the resulting patterns of trust and loyalty.

Our crude framework for examining technical change yields a wealth of ideas that may be useful in explaining the history of Britain and the United States. We would argue that the ability and desire to control effort norms are central to decisions about which types of technologies to adopt and develop. Institutions and especially social norms have two functions in this approach. They influence the innovative climate and bias the type of innovation agents view as desirable. They are also the product of innovation as agents attempt to shift the institutional context in their own favor. The perceptions that agents hold about the norms of other actors are critical inputs to the innovation process. Giving or getting the wrong signals about effort or the expected strategies of agents in general could have disastrous effects on the course of economic development. These propositions can be tested by looking at the relative failure of the British economy to match American improvements in realized labor productivity since 1850.

For most of the period since 1850, British labor productivity growth has lagged seriously behind that of the United States [22]. Britain has moved from being the most productive of industrialized nations to being among the least productive [36]. McCloskey has long argued that the British economy did not fail; rather, it did the best it could given its factor endowments [39]. Recently, Crafts and Thomas have given a new twist to this story by suggesting that the slower rate of factor productivity growth in Britain reflects the persistence of investment in "unskilled-labour-intensive, capital-neutral, and human-capital-scarce" industries. These were industries in which labor

productivity growth was slow compared to the industries in which the United States had a comparative advantage [12, 13]. Crafts and Thomas leave unanswered the most critical question: why was labor productivity growth low in industries in which Britain had a comparative advantage?

By looking at the motor vehicle industry, and in particular the revolution in production methods implemented by Henry Ford, we can get a clearer picture of how one American industry was able to dramatically increase labor productivity while the same industry in Britain failed to keep pace. At the heart of our analysis lies the inability of British buyers and sellers of labor time to transform production institutions that exploit the potential of American style production techniques compared with the ability of American buyers of labor time to transform social norms and conventions.

Until about 1905, nearly all American manufacturers of motor vehicles used production methods that mirrored the practices of European metal working shops. Within the span of a few years firms such as Ford, pushed existing techniques to their technical and social limits. At first, the technical problems associated with coordinating a rapidly growing factory played a leading role in forcing change. The early stages of the shift to mass production can be characterized as productivity-enhancing, motivated largely by the desire to increase supply to match demand and improve the organizational capacity of the firm. Assembly tasks were divided up into smaller units, and workers moved along the rows of assembly stations doing their specialized tasks. Average task duration fell from 518 minutes in 1908 to 2.3 minutes in 1913. In manufacturing areas, general purpose machines were replaced by single purpose and special purpose machines organized sequentially according to the component they were working on, signaling the first tentative moves toward flow production.[2]

These changes created the conditions for effort-bargain and effort-insulating innovations. As more capital was invested in machinery and these machines were integrated into flow processes they became more vulnerable to isolated labor slowdowns. Consequently, control of the pace of work became a greater managerial concern. Between 1906 and 1913, Ford groped for a new set of institutions to ensure a favorable conversion of time into effort. The initial strategy was to allocate control over labor supervision and enforcement of effort standards to low-level supervisors who were given responsibility for hiring, firing, and setting wage rates in their departments. In 1907, the first crude time studies were performed. In 1906, Ford hired the first of his infamous labor spies whose report left little doubt about the limitations of managerial authority on the shop floor. In 1908, profit sharing was introduced to overcome the growing social tension between labor and management as foremen resorted to hire-and-fire techniques to discipline

[2]Some of the more useful archival sources on Ford include Wollering, Ford Archives, *Reminiscences*, pp. 6-13; Dickett, Ford Archives, *Reminiscences*, pp. 11-14; Wibel, Ford Archives, *Reminiscences*, p. 58; Rockelman, Ford Archives, *Reminiscences*, p. 9; G. Heliker, *Detroit Labor: 1900-1916*, (Detroit Archives).

labor when labor resisted the increased pace of work and the growing monotony of Ford jobs.

Throughout this period, Ford was substituting less skilled labor for skilled labor. Between 1910 and the eve of the introduction of the first assembly line, the share of skilled labor in the work force fell from 54% to 26% [40, pp. 48-51]. This represented more than a shift to less costly labor time. It also had implications for the conversion of time into effort and made possible the revolution in technology that came to be known as the Ford system.

The continuing increase in output and employment put further strains on both coordination systems within the plant and the bargain over effort levels. The deskilling of labor during this period, combined with the tight Detroit labor market, gave workers a degree of mobility and hence leverage in the bargain over effort levels. This advantage was enhanced by rising capital labor time ratios and the spread of integrated machine processes. The situation was aggravated by autocratic foremen whose attempt to use fear of job loss as a mechanism for converting time into effort was simply inconsistent with an economy in which workers could easily find alternative employment.

The final stage of technological change at Ford, beginning in mid-1913, enhanced potential labor productivity and ensured that more of this output would be realized through controlling effort norms. Responding to the failure of the foreman's regime, Ford centralized the responsibility for hiring, firing and setting wage rates within a new employment office.

The next step in resolving this production crisis was taken with the introduction of the assembly line in late 1913. Between December of 1913 and March of 1914, the labor time needed to produce a Model T chassis fell from 134 to 67 hours, and the time needed to produce an engine fell from 36.6 to 23.07 hours.[3] These increases in productivity came from two sources. First, the line enhanced labor productivity as it reduced the amount of labor needed to move components around the plant. Second, the line acted as a mechanical pace setter, thereby becoming a classic example of a production technique that shifted the effort bargain.

Despite the line's potential to convert time into effort, it alone could not guarantee the necessary levels of effort. In early 1914, Ford, who preferred paying workers on a fixed-day wage system, doubled wages to five dollars a day for male workers. The Ford Sociology Department was introduced to guide workers toward a style of home life that would improve their shop floor efficiency and would encourage changes in consumption patterns such as home ownership and the elimination of borders, making Ford workers more dependent on Ford employment and the high wages being offered. Ford Sociology also helped to give Ford employment a distinct male quality, the kind of work a caring and successful head of household might engage in. The gender-engineering aspect of this stage of Fordism should not be underestimated and deserves further attention. Much of the work on the sociology department has been focused on its attempt to Americanize Ford

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[3]Ford Archive, Acc. 125, Model T Cost Books.

workers and give them middle-class values. Work by feminist social historians alerts us to the fact that many of these values were also male values [10, 45]. The sociology department's success in giving Ford work an image attractive to males was likely a critical factor in securing higher effort norms.

The ability of Ford to shift effort levels, through both the carrot and the stick should be viewed as one of the critical components of the entire system. It marked the final chapter in the reform of time discipline that had begun in Britain in the late eighteenth century with the rise of the first factories [56, 59]. Here more than anywhere else, the role of history, social norms, and conventions looms large. The balance of power between capital and labor, attitudes toward mechanization and centralization of authority, labor's sympathy to economism, Ford's ability to spread middle-class consumer values among his workers, immigration, the low level of work-group solidarity, and the definition of factory work as male work contributed to the success of Fordism.

Ford quickly transferred many components of the his system to his British branch plants. Starting in 1910, employees were hired as handymen and were expected to perform any task that management felt was necessary. The first British mechanized assembly line began operations in September of 1914, less than a year after it was adopted in Detroit. British producers were quick to respond to the American invasion. New models appeared and a strong interest was shown in the skill displacing metal-working production techniques used in the United States. By 1914, many of the machine advances adopted in Detroit were in use by leading British producers. In that year, a management consultant argued that, "In the motor trade . . . a large portion of the workers were either turret hands who do not do much more than pull certain handles, or milling machine hands who only put work in a fixture and let it go, having the speed and fed set for them, and jig drillers" [33, 47]. As had happened in the United States, these changes made British employers less dependent on skilled labor.

Despite the advances in machine techniques and a substantial reduction in the demand for skilled labor, critical innovations in production institutions and social norms did not receive widespread support in Britain [48]. Pullinger, manager of the Arrol Johnston plant, which was built in 1913 and modeled after Packard in the United States, argued against American labor practices and rigid managerial control of labor and in favor of "kindly and sympathetic" treatment of labor [46, p. 432; 3]. Bayley, argued before the British Institute of Automobile Engineers:

> In America, I understand, the labour available is much more amenable to systematised working. In England there is difficulty in getting a man to do exactly what he is told, because he is apt to think a great deal more for himself than do his fellows in America. Therefore, a system in this country has to be more

> elastic and less precise than many American systems are said to be.[4]

Perry Keene, from Austin had the following observation on American labor management methods:

> In America you have to employ methods which a crowd can carry out, but the British individual will not have that. . . the Britisher will not have 'herd' methods. He has the individualistic tendency, and it is a British tendency that you have to allow for [29, p. 31].

These statements support the thesis that direct control of labor effort on the model of Henry Ford was rejected not because the price of labor was wrong, but rather because of perceived differences in social norms and conventions. It was argued that the British workers did not trust British managers and that they had learned how to protect themselves from managerial control of the effort bargain [26]. British managers also held views about the role of workers in factories and their relationship to management that were inconsistent with the type of authority centralization that characterized Fordism. Again, the gender dimension of British work warrants further research. We can only speculate that in Britain the right to participate in decisions was the mark of male work, which contrasts with the ability of Ford to sell subservience and high-effort norms. Growing concerns regarding the conversion of time into effort led British innovators to abandon the route of investment in productivity enhancing innovations and a growing interest in innovations which would control effort levels and insulate output from variations in effort.

The irony here is that while British labor clearly was unsympathetic to a new regime that raised effort norms while keeping wages constant, it is less clear that they were unsympathetic to a system that raised effort norms and wages. Reminiscences of former workers and the lack of organized labor agitation in the Ford plants for thirty years suggests that shop floor British labor was at least sympathetic to the high wage/high effort deal that Ford offered. This was certainly true of their leaders.[5] In 1919, Brownlie, the leader of the Amalgamated Society of Engineers, the strongest union in the vehicle industry, advocated the modernization of British industry on the American model. He argued, "The individual or the organization that stands in the way of utilizing the improvement of the machine tool, or the improvements brought into being by the application of science to industry, is standing in its own light."[6] In 1921, the Trades Union Congress condemned

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[4]Comments on a paper titled, "Works Organisation", *Proceedings Institute of Automobile Engineers*, 11, (1916/17), p. 396.

[5]EEF Archives, Special Conference, 1 May 1925.

[6]EEF Archives, *Conference EEF and ASE*, 24 July 1919, p. 29.

British factory organization and pointed to American factories as a model.[7]

Many British employers, especially those in the motor vehicle industry, turned to a variety of incentive payment systems with large bonus rates. This system of indirect control of effort norms left sellers of labor time greater control over level of effort but insulated profits from variation in effort by automatically adjusting wage payments. These techniques had been pioneered in British steel plants and in the coal mining sector [60]. Similar strategies were used in many American firms; however, the extent to which British management relied on British labor to coordinate shop floor activity and self-enforce effort norms under incentive payment systems seems extraordinary [51].

The justification for making incentive payment systems such an important component of postwar managerial strategies was based in part on managerial perceptions of British labor preferences, norms, and conventions. Howe, chair of the Higher Productivity Council, wrote in 1919, "The whole point is that workmen now say that they want a share of the control of business and this scheme [payment by results] gives them the share that they want."[8] In an extensive examination of "What the British Worker is Thinking," another author argued that the Fordist system of direct control was incompatible with trends in labor thinking: "He [labor] wants to be admitted into the management of industry. . . What he is really resenting therein is the exercise of almost unbridled power which modern industry associates with management" [44, p. 96].

The managerial view of British labor intentions was reinforced by the greater social cohesion of the British working class that had translated into work-place solidarity and political activity. Managerial dependence on highly skilled workers in the nineteenth century allowed these workers to build class links and economic and political organizations. A set of management and labor norms and conventions regarding how work was to be done, how much was to be done, the roles of labor and management, and probably attitudes toward workers who broke social customs to "get ahead" emerged from this early experience. As the potential of the American system was recognized by buyers and sellers of labor time, neither could find a way to break with the institutions and social norms of the nineteenth century. The more cohesive British working class, less affected by waves of immigration, was a less-willing participant in the type of social engineering that played such a role at Ford's Detroit plant and redefined Ford work as American, middle-class, and male.

The reluctance to Americanize British production institutions is clearly evident in the postwar strategy of the Austin Motor Company [6]. What impressed Austin about the Ford factories was that "everybody in the

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[7]TUC Archives, *Comments on the Present Economic Position of the Engineering and Allied Industries*, pp. 23-24. See also, "Payment by Results," (*Machinery*, 11 March 1926); "The Correlation Between Wages and Profits," (*Engineering and Industrial Management*, 4 September 1919), p. 2.

[8]EEF Archive, P(13)5, Letter from Howe to EEF, 29 Oct. 1919.

establishment seemed to be trying to do their best."[9] This led him to argue that if Britain was to compete with the United States it needed an improved spirit among labor, not new machine methods. During the twenties, Austin made changes in the production process and moved the firm some way toward flow production [20]. Assembly lines were installed after 1924, but they remained relatively simple and unmechanized until the late twenties. More important, Austin's system of labor control was vastly different from Ford's. The Austin workers were placed on piecework and allowed to earn bonuses often exceeding 100%.

The shaping of the Austin strategy was influenced by managerial perceptions of relations between British labor and management in the early 1920s.[10] Statements by Austin managers indicate that they saw their system as an alternative to the Ford system. They argued:

> There are still a few employers who object to piecework on principle. Their stand-point is that an efficient management ought to be able to get the same results at an agreed rate of wage without having to pay more money to encourage the men to work harder. . . The daily task system at fixed wages may, perhaps, be workable in American, or even Continental factories, but the necessary . . . driving works policy would not be acceptable either to English Labour or Management.[11]

The extent to which many British employers had become dependent upon labor self-regulation rather than direct managerial control is revealed in their attitude toward the experiments at Associated Equipment (AEC) in the late twenties. AEC was the first British vehicle maker to adopt a mechanized moving assembly line in 1915; by the 1920s it had adopted a system that looked very similar to Fordism, including the payment of high wages on a fixed-day rate scheme. The London Engineering Employers Federation threatened to expel the firm from the association unless it changed its wage policy. The EEF was concerned that wages were being paid in anticipation of output, a strategy that they argued was too risky in the British context.[12] The inability of British management to enhance its authority in the shops by investing in production institutions was evident to the sixty-six teams examining American practice after World War II as part of the Anglo-American Council on Productivity. In their report they claimed, "[In

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[9]Third Annual Meeting IAE as reported in (*Proceedings Institute of Automobile Engineers*, (1924/25), p. 7.

[10]For statements by Engelbach and Keene, see Ward Papers, MRG1, *Organisation Section*, w/8/29-34/13/476, pp. 2-14, housed at the Business History Unit, London School of Economics.

[11]EEF Archives, W(3)129, *Piece Work in the Toolroom*, 1 February 1934, pp. 26-28.

[12]EEF Archives, Membership Files AEC, *Failure to Obey Rules*, p. 4.

America] the function, scope and authority of management are more widely recognized and asserted to inside the firm" [27].

We have argued that differences in the rate of growth of labor productivity in Britain and the United States since the 1850s can be explained in part by differences in the paths the economies followed and the types of technical change these differences generated. In the United States, the ability of American buyers of labor time to introduce new production institutions and gain control of effort levels encouraged investment in productivity-enhancing technology prior to World War I. Favorable conditions for further productivity-enhancing technical change was insured by using some of the earlier gains to buy labor cooperation through higher wages. The Second Industrial Revolution did not just happen in the United States, nor was it mainly a product of factor prices. It was made to happen by economic agents who were engaged in a constant struggle to control the effort bargain. It was the relative success of American managers in this regard that allowed rapid development of mass production and labor productivity after World War I.

In Britain the pattern of technical change was very different. The institutions, norms, and conventions created during the First Industrial Revolution were not easily displaced. Buyers of labor time had limited control of effort norms, and sellers had little confidence that cooperation would improve their standard of living given their nineteenth-century experiences with rate cutting and rising effort expectations. The social and institutional preconditions for investment in capital intensive flow production techniques did not exist in twentieth-century Britain. Again, it was the struggle over effort rather than the ratio of factor prices that largely dictated the pattern of British technical change. In Britain, systems were adopted that protected profits by tying wages directly to effort levels but leaving control of effort in the hands of labor. The inability to gain control of effort norms made British managers reluctant to adopt the capital intensive flow systems pioneered by Ford.

By the 1970s, British workers found themselves employing too little machinery that was often of an antiquated nature and rarely well organized by employers. In a cruel turn of the tables, British sellers of labor time who had successfully defended themselves from the worst excesses of the Fordist years of labor speedup in the early part of the century were facing the prospect of working much harder and for lower wages than their European and North American counterparts who were benefiting from productivity-enhancing and effort-saving technical change [42]. The widespread social and political unrest in Britain in the 1970s and 1980s represented the final and painful disintegration of nineteenth-century British production institutions. Whether the future will see better times for British workers is unclear. There is no reason to assume that British buyers and sellers of labor time have found a new set of institutions consistent with productivity-enhancing technical change.

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