MISSION CONTROL? THE DEVELOPMENT OF PERSONNEL SYSTEMS IN U.S. INDUSTRY*

JAMES N. BARON
Stanford University

P. DEVEREAUX JENNINGS
University of British Columbia

FRANK R. DOBBIN
Indiana University

This paper examines historical differences in personnel practices among U.S. industries to explore the roots of modern "bureaucratic" work control. We report multivariate analyses of data describing organizational personnel practices, collected by the National Industrial Conference Board between 1935 and 1946. We find evidence of three early strands of bureaucratic labor control in different industrial sectors: worker allocation and job-evaluation techniques, which evolved from scientific management in modern assembly-line industries; internal labor-market mechanisms in white-collar nonmanufacturing; and practices related to seniority and the formalization of rules in unionized and skilled industries. Our analyses suggest that the institutional environment and the historical period of an industry's founding were among the central contingencies shaping labor control in a particular sector, as were several factors that past research has emphasized more, such as technology and skills, labor market conditions, and unionization. Our analyses thus corroborate some previous accounts of industrial differences in "bureaucratic control," while also suggesting some revisions concerning where, when, and why employment relations first became bureaucratized.

INTRODUCTION

With the onset of industrialization, the scale of employment in workplaces grew dramatically. Marx and Engels ([1848] 1968, pp. 69–70) vividly characterized the organization of early factories:

> Modern industry has converted the little workshop of the patriarchal master into the great factory of the industrial capitalist. Masses of labourers, crowded into the factory, are organized like soldiers. As privates of the industrial army they are placed under the command of a perfect hierarchy of officers and sergeants.

In practice, however, hierarchical command was far from perfect in most firms, and controlling workers became a central problem for the "officers and sergeants" of industry. Early factories depended on close and sometimes harsh supervision and on threats of layoffs to control workers. By World War I, this system had proved costly and unmanageable. New regimes of workplace control emerged that rationalized the production process (through scientific management and kindred practices) and/or the employment relation (through internal labor markets and kindred arrangements) (Burawoy 1979; Edwards 1979; Gordon, Edwards, and Reich 1982; Jacoby 1985). Different industries adopted these innovations to varying degrees, but by the end of World War II, they were widespread among large core-sector firms (see Baron, Dobbin, and Jennings 1986).

What organizational practices comprised these modern systems of workplace control? When and why did they appear in certain industries? This paper examines some descriptive evidence concerning these questions. We analyze industry-level data on the prevalence of various employment practices in the U.S. economy in the 1930s and '40s, concentrating on the roots and the spread of modern

* Direct all correspondence to James N. Baron, Graduate School of Business, Stanford University, Stanford CA 94305–5015.

The authors gratefully acknowledge generous research support from the Stanford Graduate School of Business; assistance from A. Bucher, T. Bush, and J. Fukuhara in preparing the manuscript; and very helpful suggestions by R. Althauser, R. Bagozzi, P. DiMaggio, T. DiPrete, M. Hannan, R. Hodson, S. Jacoby, T. Kochan, D. Palmer, J. Pfeffer, G. Salancik, V. Srinivasan, and the *ASR* reviewers.

"bureaucratic controls"—including internal labor market arrangements.

Our data focus on changes in employment practices between the early years of the New Deal and the end of World War II, a critical period of transformation in U.S. industry and labor relations (Hawley 1960; Bernstein 1970). To be sure, large organizations had already made substantial progress in bureaucratizing and rationalizing employment before the New Deal, particularly in the government, military, and educational sectors (e.g., Tolbert and Zucker 1983; DiPrete, forthcoming, chap. 5).[1] In certain respects, our findings capture the spread of these practices to other sectors; for instance, our results point to the early adoption of key bureaucratic controls over white-collar employment in nonmanufacturing organizations, reflecting the diffusion of early governmental reforms (civil service rules, employment testing, etc.) to private white-collar bureaucracies. Our analyses suggest that three rather distinct forms of workplace control in evidence by the mid-1930s later coalesced and diffused to produce modern-day "bureaucratic control." First, centralized personnel functions, formal job analysis, and employment record-keeping extended the scientific management principle of rationalizing production to the workforce in assembly-line industries. Second, seniority provisions and formal rule systems flourished in industries characterized by union strife, continuous processing technology, and/or public-sector ties (e.g., utilities and petroleum). Third, internal labor market systems, combining centralized personnel functions with the formalization of jobs, salaries, and promotions, appeared in industries relying extensively on white-collar personnel (e.g., banking and insurance). The roots of modern bureaucratic control thus appear to be more complex and diverse than prior analysts have implied (e.g., Edwards 1979). The concluding section highlights the importance of technology and skills, industry founding period, unionization, and the institutional environment in determining which control mechanisms various industries adopted.

[1] These sectors were not a key focus of the personnel surveys we analyze (described below), which may therefore understate the prevalence of modern bureaucratic models for employment relations during this period.

WORK CONTROL IN HISTORICAL CONTEXT

Recent studies of the labor process have identified three main systems of workplace control, often tracing their roots to particular historical periods. We begin by describing these three ideal-types of workplace control and how their elements are operationalized for this study. We then briefly review debates about the development and diffusion of the modern bureaucratic form of control.

Historically, worker control was primarily the task of foremen, who contracted for and oversaw labor. Under traditional or "simple" labor control, foremen and managers determined wages, hiring, work conditions, and firing (Edwards 1979, p. 19). They used physical force and verbal abuse, threats of unemployment or wage reductions, and personal obligations and favoritism to control workers. Work behavior and performance were personally monitored by the foreman, rather than by machine-pacing, scientific analyses of work, or bureaucratic rules and procedures. Slichter called this the "drive system" of labor control, the "dominating note of [which] is to inspire the worker with awe and fear of the management, and having developed fear among them, to take advantage of it" (1919, p. 202). For our purposes, we operationalize reliance on simple control within an industry by the *absence* of personnel practices that sought to rationalize employment relations (e.g., personnel rule books; rating and testing systems; centralized personnel offices responsible for hiring, firing, and promotion) and of scientific management techniques that sought to rationalize production (e.g., time and motion studies).

Scientific-management practices pioneered in the late 1800s by Frederick Taylor and others were used in new assembly-line industries after the turn of the century to rationalize production processes and coordinate complex manufacturing flows. New mechanized production processes vested labor control in technology; "machinery itself (now) directed the labor process and set the pace". (Edwards 1979, p. 20). The mainstream literature on technology notes the consequences of the shift from craft production to mechanization: "machine technology generally reduces the control of the employee over his work process . . . [because] decisions have been incorporated into the ma-

chine's very design and functioning . . . [Operatives] simply respond to the rhythms and exigencies of the technical system instead of initiating activity and exerting control" (Blauner 1964, p. 170). Foremen were thereby relieved of the task of constant supervision, since supervision was built into the production technology. The scientific-management movement advocated various personnel practices as adjuncts to machine pacing to rationalize production and engineer the worker-machine interface, including time and motion studies of work, work-simplification programs, job analysis, and systematic records of employment and turnover. We operationalize reliance on scientific management by the prevalence of these personnel practices in each industry. Unfortunately, we lack specific data on the extent of machine pacing of work which, according to Edwards (1979), was the linchpin of "technical control."

Bureaucratic personnel practices sought to rationalize employment procedures as scientific management had sought to rationalize production procedures. These new policies aimed to find the "right person for the job" through testing and evaluation and to discourage costly turnover by offering stable employment and promotion opportunities. Bureaucratic employment techniques also controlled workers, inducing them to comply with commands by offering the carrot of steady employment and promotions. Sumner Slichter argued that "the fear of unemployment is one of the greatest fears the average workman has and he is slow to leave a shop in which he feels assured of steady work" (1919, p. 269). Likewise, job ladders provided incentives for workers to remain with the firm and to perform well: "when many small gradations in status exist, the employee can more often experience the illusion of 'being somebody' and of ascending the scale" (Mills 1956, p. 211). Firms subjected the employment relation to bureaucratic control through the "elaboration of job titles, rules, procedures, rights, and responsibilities" (Edwards 1979, p. 145), including tests for hiring and promotion; scheduled performance ratings; incentives for long-term employment, such as seniority provisions and systematic promotion schemes; and the introduction or extension of personnel departments that took hiring, firing, and promotion out of foremen's hands. Job classification and job-bidding systems were also elements of the emerging bureaucratic control system (Burawoy 1979, chap. 6), as were the development of formalized layoff procedures, codified rule books, and the introduction (or extension) of job analysis and evaluation. We use the prevalence of these personnel practices in each industry to indicate the extent of "bureaucratic" control over employment relations there.

Recent studies of the labor process have fueled debates about when, where, and why employment became rationalized and bureaucratized. Various theorists have stressed the efficiencies associated with bureaucratic rules and procedures, particularly the internal labor market (ILM). Doeringer and Piore (1971), for instance, trace ILMs to management's need to retain skilled workers in an economy that has become increasingly sophisticated technologically. Similarly, some attribute the spread of bureaucratic arrangements in organizations to the rationalization and increasing scale of economic activity (e.g., Weber [1922] 1947; Bendix 1956).

In contrast, neo-Marxists (Stone 1974; Marglin 1974; Edwards 1979; Gordon et al. 1982) argue that both scientific-management and bureaucratic personnel practices developed because they enabled owners and managers to control and coopt workers more completely and less visibly. According to these authors, scientific management and other "technical" controls, which extended the logic of the assembly line to work routines and employment policies, were adopted in modernizing mass-production industries in the first three decades of this century. Violent union opposition in the 1930s then prompted capitalists to create less obtrusive controls. Consequently, beginning in the 1950s, a new regime of bureaucratic control was consolidated in large "core" manufacturing concerns, after many years of casual exploration with modern personnel reforms. This new system involved formalized personnel rules and procedures designed to limit the power of organized labor in the unionized sector and to forestall unionization elsewhere:

> In retrospect, the speed and comprehensiveness of unions' postwar accommodation with management in the new system of labor management appear quite remarkable. . . . [M]any union leaders may not have appreciated the significance of their ceding so much managerial authority over the organization of work. By the

> early 1950s, large corporations had succeeded in shaping and applying an essentially new structure of labor management. Nonunion employers in both manufacturing and nonmanufacturing industries followed similar patterns, led by the coherence of management theory and the similarity of production work in many blue-collar and white-collar settings (Gordon et al. 1982, pp. 188–89).

Jacoby (1985) challenged this neo-Marxian view. Focusing on developments in manufacturing, he demonstrates the existence of ILMs as early as 1900 and argues that there were two periods of rapid diffusion for modern bureaucratic controls: World War I and immediately following passage of the Wagner Act (in 1935). According to Jacoby, in the wake of the Wagner Act, labor was able to pressure managements to adopt personnel practices that benefited union members by limiting managerial discretion and ensuring greater voice, equity, employment, security, and promotion chances. These practices included seniority provisions, job-evaluation systems, pension plans, grievance procedures, and formalized compensation practices. Jacoby concludes that unions were key forces behind modern personnel reforms, rather than unwitting victims of them (also see Kahn 1976; Rubery 1978).

Others trace the spread of modern organizational forms, including bureaucratic employment systems, to normative and coercive forces that have favored their institutionalization. Meyer and Rowan (1977) and DiMaggio and Powell (1983) suggest that the professionalization of management and state involvement in economic affairs are two key forces favoring the diffusion of modern bureaucratic organizational forms. Institutionalization approaches also claim that the bureaucratic form has become increasingly legitimated over time, particularly in sectors where organizations must be judged on the basis of their *procedures* because their outputs are difficult to measure or evaluate (e.g., schools). Since organizational arrangements are often inert (Stinchcombe 1965; Hannan and Freeman 1984), these innovations in workplace control should be less prevalent among firms in older industries, even those whose specific characteristics otherwise make them likely candidates for adoption (e.g., large tobacco firms). Conversely, this view implies that modern personnel innovations should be most prevalent in newer industries and in those where outputs are difficult for constituents to evaluate, even within enterprises lacking the specific characteristics (such as large size or firm-specific skills) that ostensibly make such innovations "efficient." Meyer and Brown (1977), Tolbert and Zucker (1983), and Baron et al. (1986) have presented empirical evidence consistent with these predictions.

These different theoretical perspectives offer rather disparate accounts of when, where, and why organizations rationalized and bureaucratized employment matters. Below, we examine how personnel practices varied across industries historically to identify the different facets of workplace control present in the U.S. economy between 1935 and 1946. Our principal aim is to sketch a more representative portrait than previous studies of how the employment relationship was administered in different parts of the economy. Then, we discuss causes of industry differences in workplace control systems, noting where the evidence corroborates or contradicts the different theoretical perspectives reviewed above.

DATA AND METHODS

The Sample

To describe the configuration of personnel practices, we analyze data gathered by the National Industrial Conference Board (NICB) in 1935, 1939, and 1946 surveys (NICB 1936, 1940, 1947). NICB publications based on these surveys tabulated specific personnel practices by industry. The NICB attempted to survey the entire population of work organizations in all industries using New York Stock Exchange listings, Dun and Bradstreet publications, and other firm registers as sampling frames. The 1935 sample included 2,452 firms that employed 4.5 million workers, 15.5 percent of the national labor force in these industry classifications at the time (NICB 1936, p. 5). The 1939 survey covered 2,700 firms with 5 million employees, and the 1946 survey covered 3,498 firms with an unspecified number of workers. The industries studied in 1935, 1939, and 1946 are listed in Tables 2, 4, and 6, respectively.[2]

[2] We eliminated one or two ambiguous industrial categories in which the NICB samples contained a very small number of cases.

The NICB apparently achieved considerable continuity and comparability in their surveys (see Baron et al. 1986). The mix of industries remained fairly constant in the surveys, although some new industries (e.g., aircraft, shipbuilding) were added in 1946, which reflected wartime expansion. Larger firms clearly dominated the NICB sample, but a sizable group of smaller enterprises was also included: 33 percent of the firms studied in 1935 had fewer than 250 employees, as did 32 percent and 25 percent in 1939 and 1946, respectively. The NICB targeted many of its own member organizations as survey respondents; therefore, the same organizations often participated in the various surveys over the years. Thus, the NICB studies provide data for a relatively stable group of firms over time.

Our industry-level analyses of labor-control regimes no doubt obscure some important firm-level differences in personnel practice (see Denk 1988). Moreover, the reported usage of personnel practices by firms in the NICB surveys may not reflect the actual working conditions, advancement opportunities, or employment security that workers *experienced* in particular sectors. Nor is it likely that all workers in a firm were affected equally by these personnel innovations.

It is also difficult to determine the exact representativeness of these data, since population-level statistics on firms by industry are scarce during this period. Other surveys of personnel practices conducted during this era generally report more widespread use of many relevant practices, such as time and motion studies (Peirce School 1935; Parks 1936). However, they typically sampled larger firms, fewer industries, and fewer time points than the NICB. One historian of this period has called the NICB data "excellent in every respect" (Brandes 1976, p. 193), and several authors have recently relied on them to chart trends in the employment relationship during this century (Kochan and Cappelli 1984; Jacoby 1985).[3]

[3] Form (1987, p. 40) suggests that scientific management, including time and motion studies, was less widespread than some scholars have claimed. In our sample, 31 percent of manufacturing firms employed time and motion studies in 1935, and 51 percent reported "time studies" in 1946 (NICB 1936, p. 62; NICB 1947, p. 29). If these percentages overstate the true prevalence of such techniques, this illustrates the potential biases associated with the NICB surveys, which no doubt focused disproportionately on larger corporations employing "state-of-the-art" personnel practices. On the other hand, as we have indicated, such biases are more severe in other surveys from this period.

Methods of Analysis

To identify labor-control systems and examine how they varied across industries and over time, we use principal-components factor analysis to examine patterns of covariation among personnel practices. Control systems are defined operationally by clusters of personnel practices that tended to co-occur in each period. Industries are then classified (i.e., assigned factor scores) according to the extent to which they relied on the employment procedures that define each dimension. Thus, we use factor analyses simply as a descriptive shorthand for grouping kindred personnel practices and for differentiating industries by their workplace controls.

We included in our analysis those personnel practices that previous researchers have identified as integral to scientific management and the rationalization of employment relations (see "Work Control in Historical Context" above). The specific items available in the NICB surveys varied somewhat across years; Tables 1, 3, and 5 list the personnel activities analyzed for 1935, 1939, and 1946, respectively.[4] For each personnel practice, the NICB surveys reported the percentage of firms in each industry using it. We analyzed covariances rather than correlations among these percentages for two reasons: all measures are in the same percentage metric; and in identifying control regimes and differentiating industries, we wished to give greatest weight to those personnel practices that varied most in their rates of use across industries.[5] We relied on principal-components

[4] We also conducted supplemental factor analyses for 1935, 1939, and 1946, based on a subset of industries and practices that were roughly comparable across the three surveys. Nineteen industries and eight personnel practices were studied, including time and motion studies, centralized employment, centralized personnel department, rating systems, job evaluation, job analysis, and employment testing. Principal component analyses on this subset of industries and practices yielded results similar to those reported below for the full set of practices and industries.

[5] When factoring a covariance matrix, one could define a loading as the weight of each variable on

Table 1. Principal-components Analysis of Industrial Personnel Practices, 1935: Factor Loadings after Varimax Rotation

	All Industries ($N=24$)[a] Factor			Manufacturing ($N=19$)[a] Factor		
Personnel Practice	(1)	(2)	(3)	(1)	(2)	(3)
Centralized discharge	.88	.36	−.10	.94	.24	.05
Centralized transfer	.90	.38	.06	.93	.30	.09
Centralized employment	.88	.43	.00	.90	.34	.14
Personnel department	.83	.31	.41	.73	.39	.52
Rating system	.92	.10	.16	.69	−.04	.65
Salary classification	.80	−.08	.36	.22	−.10	.93
Employment tests	.78	−.11	.26	.42	.20	.46
Job analysis	.75	.46	.08	.70	.34	.57
Systematized promotion	.66	−.17	.59	−.05	.42	.49
Job specifications	.69	.49	.14	.67	.15	.66
Length-of-service bonuses	.23	.00	.01	.11	.14	−.04
Time and motion study	.05	.73	−.63	.97	−.16	−.04
Layoff procedure	−.06	.92	.01	.70	.49	.45
Employment records	.53	.70	.41	.73	.46	.43
Turnover records	.54	.70	−.08	.77	.46	.18
Rule book	.28	.20	.92	.29	.91	.19
Maximum hiring age	.02	−.05	.75	−.02	.01	.11
Eigenvalue						
Before rotation	1729.59	679.80	276.29	1454.35	226.86	112.60
After rotation	1354.89	675.67	655.13	1218.03	306.23	269.55
Variance explained						
Before rotation	56.89%	22.34%	9.09%	73.89%	11.53%	5.72%
After rotation	44.57%	22.22%	21.55%	61.88%	15.56%	13.69%

[a] See Table 2 for a listing of the industry categories included in the analyses.

analysis because it imposes less rigid statistical assumptions on the data than other techniques (Kim and Mueller 1978), although analyses using other factor-analytic and nonparametric techniques yielded similar results (details available from authors on request). Given the nature of these historical data and the small number of industries relative to personnel practices analyzed, these factor analyses are intended merely to be suggestive, and, accordingly, we supplement these results with other historical material in portraying how the employment relation evolved during this period.

RESULTS

1935

Table 1 reports loadings for three principal components (after orthogonal rotation) extracted from the 1935 covariance matrix of personnel practices.[6] The table reports one factor analysis for all industries and another for manufacturing industries only. The industry categories used are listed in Table 2, which shows the factor scores derived from Table 1.

Factor (1) for all industries shows that a number of bureaucratic personnel practices clustered together as early as 1935, including centralized employment, transfer, and discharge; job classification, specification, and evaluation; rating and testing systems; systematic promotion ladders; the keeping of detailed personnel records; and the use of personnel departments. These activities were all associated with the rationalization of employment and the development of ILMs. These practices prevailed most in the banking, insurance, and trade enterprises studied

the factor, so that the sum of the squared loadings equals the eigenvalue for that factor (Green 1976, pp. 274–75). However, we employ the more conventional definition of loadings, dividing each weight by the standard deviation of the corresponding observable to obtain correlations between personnel practices and factors.

[6] In all three survey years, principal components after the third one invariably were harder to interpret and much weaker statistically. Oblique rotations did not appreciably alter the pattern of results reported here.

Table 2. Factor Scores for Industries, 1935

Industries	All Industries Factor (1)	(2)	(3)	Manufacturing Factor (1)	(2)	(3)
A. Manufacturing						
Agricultural implements	−.04	1.40	−.15	.96	1.21	−.83
Automobiles and parts	.57	1.97	−.40	1.71	.88	.06
Chemicals	.03	−.35	−.28	−.10	.21	−.13
Clothing	−.00	.17	−1.04	.56	−.81	−.23
Electrical mfg.	.44	1.42	−.57	1.32	−.14	.77
Food products	−.26	−.07	−.35	−.11	.15	−.23
Iron and steel	−.43	.46	−.11	−.05	1.15	−.71
Leather	−.91	−.49	−.57	−.64	−.88	−.17
Lumber	−.78	−1.48	−.80	−.94	−1.12	−.85
Machines and tools	−.39	.41	−.57	.35	−.64	−.14
Other metal products	−.28	−.22	−.79	.13	−.76	−.47
Mining	−1.11	.02	1.01	−1.27	2.75	−1.21
Paper	−.01	−.23	−.26	−.19	.15	.36
Petroleum	−.12	.06	1.05	−1.23	.86	3.50
Printing and publishing	−.79	−1.27	−.35	−1.27	−.60	.14
Rubber	.57	2.36	−.60	2.02	−.07	.93
Stone, clay, and glass	−.85	−1.38	−.44	−1.34	−.60	−.06
Textiles	−.40	−.26	−.87	.00	−.68	−.57
Miscellaneous mfg.	−.13	−.49	−.92	.08	−1.07	−.16
B. Nonmanufacturing						
Banking	2.21	−.87	.26			
Insurance	2.99	−1.26	.52			
Gas and electricity	−.06	.25	2.45			
Transportation and communication	−1.47	.28	2.73			
Wholesale and retail trade	1.23	−.44	1.02			

by the NICB (see factor [1] in Table 2).[7] In manufacturing, only the automobile, electrical manufacturing, and rubber industries score positively on this dimension. Some accounts of the origins of bureaucratic control claim that nonmanufacturing companies followed the trend of manufacturing innovators in personnel reform (e.g., Edwards 1979, p. 131). The fact that banking, insurance, and trade enterprises availed themselves of these personnel practices more than other industries in 1935 is intriguing, since it implies that these personnel innovations diffused more rapidly in the nonmanufacturing sector. We return to this point below.

The practices clustering on factor (2) for all industries include core scientific-management techniques (time and motion studies) and several kindred personnel practices—such as employment and turnover records and formal layoff procedures—that assisted in rationalizing production processes. These practices were most common in rubber, automobiles, electrical manufacturing, and agricultural implements, and least prevalent in craft or process manufacturing and in nonmanufacturing (except utilities). Like time and motion studies, employment and turnover records were part and parcel of management efforts to routinize and systematize production in the former industries, since these practices extended the logic of "inventory control" to workers. Firms using them relied extensively on formal layoff procedures for similar reasons: production was often seasonal and layoff procedures aided management in production scheduling (Jacoby 1985). Moreover, industrial unionism, which championed formalized layoff procedures, had proceeded furthest in these industries by 1935.

The third factor for all industries is a bit more ambiguous (and weaker statistically).

[7] The NICB samples apparently included a disproportionate number of large trade establishments. Consequently, this industrial sector may appear more bureaucratized than was the case in the majority of smaller trade companies. Nonetheless, Carter and Carter (1985) have documented the prevalence of ILM arrangements in retailing before the Depression, even in trade enterprises with fewer employees than the average of those surveyed by the NICB.

This dimension of labor control is defined primarily by the use of rule books and maximum hiring ages. (In results restricted to manufacturing, factor [2] is quite similar, although it is dominated almost entirely by the rule book variable.) Rule books were used during this period to codify company employment policies. They were usually written either to handle union demands for formalized agreements or to forestall employee criticism about the absence of recognized procedures, sometimes in conjunction with the creation of a company union that followed guidelines offered in the rule book (Wolman 1936, p. 229). This was particularly true in mining, which was highly unionized by 1935 and which loads positively on the factor (Table 2, column 3).

The use of maximum hiring ages, which was widespread in utilities and particularly in transportation and communication, has been traced to a slightly different source: the use of pension plans to attract skilled workers needed in these industries. Age cutoffs in hiring were developed to limit the number of workers who would actually become eligible for pensions in these industries (Bernstein 1960, p. 57). Pensions and age cutoffs in hiring, combined with rationalization and deskilling of work, made it more difficult for older workers to find new skilled jobs, encouraging long-term employment and making workers increasingly concerned with securing seniority provisions. The practices defining factor (3) anticipate the emergence of union-based seniority systems and work rules in employment that flourished after passage of the Wagner Act (Jacoby 1985).

Analyses limited to manufacturing reveal that in 1935, employers were already experimenting with some bureaucratic controls as adjuncts to scientific management in modern mass-production industries (Table 1, factor [1] for manufacturing). Centralized employment, personnel departments, job analysis and evaluation, and rating systems were used in conjunction with efforts to control workers through the rationalization of production processes in rubber, auto, electrical manufacturing, and (to a lesser extent) agricultural implements companies (see Table 2). Petroleum, in contrast to these industries, did not use time and motion studies extensively but *did* bureaucratize the employment relationship early on, relying on salary and job classification, promotion ladders, rating systems, and the like (see factor [3] for manufacturing). Compared to auto, rubber, and electrical manufacturing firms, petroleum companies thus appear to have relied more on ILM mechanisms (salary classification and systematized promotion). This pattern is consistent with propositions about the links between technology, bureaucratization, and labor control posited by Blauner (1964, chap. 6) and others, who argue that decentralized, capital-intensive, continuous-process production in such industries as oil and gas favors greater job security, promotion from within, and decentralization of employment matters. Moreover, as Blauner noted, these process industries are also younger and relied on larger proportions of white-collar personnel, factors that presumably favored greater adoption of new bureaucratic employment innovations (cf. Stinchcombe 1965), while their nonroutine and highly interdependent technologies limited the implementation of scientific management.

Several industries exhibit relatively low scores on all three dimensions of work control (see factors [1]–[3] for all industries in Table 1). These industries tend to be of two types: those that relied on craft traditions and often had AFL unions, such as printing and publishing and leather; and those that relied on a great deal of unskilled labor, such as food products,[8] textiles, lumber, and miscellaneous manufacturing. In the former group, strong AFL unions resisted the imposition of scientific management and bureaucratic controls, viewing them as managerial attempts to encroach on craftworker discretion (see Bernstein 1970; Stone 1974; Edwards 1979). In contrast, the latter group of industries, which score low on all three factors, seemed to rely on employer paternalism or simple control techniques. These industries also display vestiges of "welfare work" reforms, which various authors have identified as early

[8] Notwithstanding Edwards' (1979) description of meat slaughtering as an archetype of "technical control," the food products industry does not exhibit a particularly high score on factors denoting reliance on scientific-management techniques (see Tables 2, 4, and 6). Chandler (1977, pp. 256, 293, 295) describes how many large food-products corporations had implemented continuous-process technologies early in their histories, prior to the scientific management movement, which may explain our results.

Table 3. Principal-components Analysis of Industrial Personnel Practices, 1939: Factor Loadings after Varimax Rotation

	All Industries ($N=25$)[a] Factor			Manufacturing ($N=19$)[a] Factor		
Personnel Practice	(1)	(2)	(3)	(1)	(2)	(3)
All-salaried workforce	.79	−.45	−.36	−.55	.27	.05
Performance evaluations[b]	.94	−.27	−.12	.11	.87	.36
Full-time personnel director	.89	−.12	.35	.29	.79	.43
Centralized employment	.93	.10	.15	.37	.55	.70
Tests: employment/promotion[c]	.75	−.39	−.12	.23	.20	.55
Information to employees: company organization and operations	.66	−.39	.42	.02	.78	.36
Job evaluation	.78	.02	.09	.30	.65	.25
Length-of-service bonuses	.62	.26	.16	.54	.45	.05
Time studies	−.02	.96	.20	.97	.06	.23
Rule book	.42	−.72	.28	−.24	.52	.21
Motion studies	.15	.88	.25	.83	.15	.44
Employment stabilization plan	−.16	.65	.29	.55	.32	.11
Seniority provisions	.53	.23	.61	.32	.85	−.39
Community wage surveys	.37	.22	.70	.20	.81	.30
Information to employees: industrial relations policies	.24	.06	.72	.02	.86	.38
Job rates set by general comparison	.04	.24	.59	.01	.75	−.00
Standardized job descriptions	.53	.23	.61	.50	.69	.19
Eigenvalue						
Before rotation	1643.53	747.58	557.28	933.98	416.71	152.79
After rotation	1262.47	995.41	690.52	641.03	638.42	224.03
Variance explained						
Before rotation	48.70%	22.15%	16.51%	54.47%	24.31%	8.91%
After rotation	37.41%	29.50%	20.46%	37.39%	37.23%	13.07%

[a] See Table 4 for a listing of the industry categories included in the analyses.

[b] The maximum of: percentage of firms in the industry using evaluations for hourly workers; and percentage using evaluations for salaried workers.

[c] The maximum of: percentage of firms in the industry with employment or promotion tests for clerical ability; mechanical ability; sales ability; or general characteristics.

attempts at social control by employers in traditional sectors, especially "geographically isolated industries like mining, lumbering and textiles" (Jacoby 1985, p. 54; also see Edwards 1979, ch. 6).

1939

Tables 3 and 4 reveal continuity between 1935 and 1939 in systems of work control. Factor (1) for all industries still clusters personnel practices aimed primarily at instituting ILMs and rationalizing employment relations, and factor (2) groups practices associated with the rationalization of production (particularly scientific-management techniques). Sectors using bureaucratic controls and eschewing scientific management—nonmanufacturing industries and petroleum—are still distinguished from manufacturing industries that primarily used time and motion studies and kindred personnel practices (e.g., clothing, textiles, leather, and agricultural implements) and from the younger, mass-production industries that blended the two regimes (autos, rubber, and electrical manufacturing).

The results do, however, reflect one major change between 1935 and 1939: the increased development and diffusion of seniority-related provisions, stimulated by the Wagner Act (1935) and the boost it gave to union organizing efforts. The increasing importance of these provisions and collective bargaining is shown by factor (3) for all industries and factor (2) within manufacturing.[9] These

[9] A weak third factor among manufacturing industries essentially distinguishes agricultural implements from rubber production (see Tables 3 and 4). The former relied extensively on seniority provisions, but not on many of the other

Table 4. Factor Scores for Industries, 1939

Industry	All Industries Factor (1)	(2)	(3)	Manufacturing Factor (1)	(2)	(3)
A. Manufacturing						
Agricultural implements	−.74	.56	.51	1.38	.14	−2.67
Automobiles, aircraft, parts	.85	1.18	1.77	1.19	1.52	.55
Chemicals	−.14	.09	−.13	−.80	.14	.94
Clothing	−.23	1.26	−.93	.81	−1.29	.67
Electrical equipment	.76	1.48	1.24	1.33	.99	.65
Food products	−.59	−.38	.08	−.72	.30	−.51
Iron and steel	−.40	.24	.00	−.09	.05	−.35
Leather	−.78	.64	−1.00	.30	−1.17	−.54
Lumber	−1.05	−.16	−.61	−.47	−.53	−1.01
Machines and tools	−.10	.72	−.27	.08	−.32	.75
Other metal products	.07	1.05	.01	.61	−.18	.62
Mining	−1.30	−.87	−1.43	−1.64	−1.32	.24
Paper	−.14	.07	.04	−.80	.28	.91
Petroleum	−.02	−1.16	1.91	−1.82	2.76	−.37
Printing and publishing	−.58	−.16	−1.04	−.99	−.78	.55
Rubber	.83	1.73	1.00	1.47	.60	1.24
Stone, clay, and glass	−1.09	−.43	−.17	−.49	−.05	−1.63
Textiles	−.32	.74	−.67	.03	−.70	.56
Miscellaneous mfg.	−.46	.60	−.15	.59	−.33	−.76
B. Nonmanufacturing						
Banking	2.33	−.80	−1.31			
Insurance	2.66	−.96	−1.27			
Gas and electricity	.55	−1.36	1.55			
Transportation and communication	−.99	−2.22	1.58			
Wholesale and retail trade	1.29	−.97	−.34			
Miscellaneous nonmanufacturing	−.41	−.89	−.39			

factors are defined primarily by the prevalence of seniority agreements, community wage surveys, and provision of information to employees about industrial relations policies. All of these practices were advocated by unions or negotiated under their influence. During this period, organized labor was keenly interested in systematizing rewards within and among firms on the basis of tenure and explicit job comparisons (Fine 1969; Bernstein 1970). By 1939, firms in agricultural implements, autos and aircraft, electrical manufacturing, and rubber were most likely to employ these union-based practices. These are the manufacturing settings in which industrial unions also made the greatest gains after 1935, fueled largely by worker resistance to employers' earlier experiments with scientific management and technical control (Baron et al. 1986, Table 4).

Modern unionized nonmanufacturing industries (gas and electricity, transportation and communication) also used these seniority-related bureaucratic practices extensively, as shown by their high scores on factor (3) in Table 4. Firms in those industries may have been subject not only to direct union pressure, but also to public-sector regulations that reflected labor demands, encouraging the rationalization of employment practices. However, these new seniority-related practices apparently did not spread quickly to more traditional craft industries, such as printing and publishing, leather, and glass, where craft tradition persisted as an alternative

bureaucratic practices that typically accompanied seniority arrangements. Although the average agricultural-implements firm in our sample was more than twice the size of the average rubber company, the legacy of "welfare work" by International Harvester and its competitors may have rendered formal bureaucratic arrangements less necessary to accomplish the same objectives than in industries without this tradition (Ozanne 1967). In contrast, rubber companies, which relied extensively on scientific management and various bureaucratic labor controls, apparently routinized and rationalized tasks to the point that workers were fairly interchangeable, since firms placed less emphasis on seniority.

Table 5. Principal-components Analysis of Industrial Personnel Practices, 1946: Factor Loadings after Varimax Rotation

	All Industries ($N=29$)[a] Factor			Manufacturing ($N=21$)[a] Factor		
Personnel Practice	(1)	(2)	(3)	(1)	(2)	(3)
Personnel section: wage and salary administration	.91	.28	−.04	.91	.28	.23
Personnel section: benefits	.91	.02	.15	.91	.11	−.03
Personnel section: training	.89	.05	.23	.85	.16	.41
Personnel section: employment	.74	.51	.24	.74	.38	.45
Employee handbook	.94	.06	.04	.91	.22	.13
Rating plan[b]	.69	.32	−.42	.74	.31	.16
Policy and procedure manual	.85	−.12	−.15	.90	.14	−.20
Employment tests	.73	−.19	−.03	.78	.22	−.33
Exit interviews	.69	.32	−.42	.66	.54	.30
Personnel section: personnel research	.89	−.02	−.09	.90	−.01	.12
Personnel section: employee information	.81	.28	.10	.78	.30	.41
Organization manual	.71	−.07	.13	.80	.14	.05
Time studies	−.15	.91	.34	.03	.92	.33
Job evaluation	.46	.78	−.00	.56	.74	−.01
Motion studies	.02	.91	.24	.27	.86	.27
Work simplification	.10	.85	.16	.19	.82	.16
Employment guarantee	.02	−.23	−.03	.08	−.19	−.50
Seniority provisions	−.13	.17	.96	.29	.15	.65
Personnel section: labor relations	.32	.31	.85	.59	.16	.74
Employment stabilization plan	−.04	−.11	−.30	.07	−.12	−.63
Eigenvalue						
Before rotation	1773.09	1261.60	519.51	1931.28	562.66	169.87
After rotation	1534.21	1143.82	876.18	1437.15	882.69	343.97
Variance explained						
Before rotation	42.27%	30.07%	12.39%	63.10%	18.38%	5.55%
After rotation	36.58%	27.27%	20.89%	46.96%	28.84%	11.24%

[a] See Table 6 for a listing of the industry categories included in the analyses.

[b] The maximum of: percentage of firms in the industry with rating plans (performance appraisals) for clerical employees; factory workers; for supervisors; for executives; and for sales workers.

control system.[10] Nor did these reforms penetrate industries that relied disproportionately on unskilled labor, such as lumber and textiles, where simple control and the legacy of paternalistic "welfare work" practices apparently remained in effect.

1946

Tables 5 and 6 report results for 1946. The first factor for all industries still differentiates industries in terms of their reliance on a cluster of formal bureaucratic employment procedures underpinning ILMs. Factor (2) still distinguishes industries relying on time and motion studies and work simplification, and factor (3) captures industries using seniority-related personnel policies. Reliance on craft traditions or simple control is still evident in various industries that have low scores on all three factors, including coal and coke mining, glass, printing, building materi-

[10] Within manufacturing, supplemental analyses revealed strong *negative* rank-order correlations between the percentage of firms in an industry having AFL contracts on the one hand and factor scores characterizing the rationalization of employment relations and application of scientific-management approaches on the other hand. Conversely, the correlations were strongly positive between the percentage of firms in each industry having CIO contracts and reliance on those clusters of personnel practices. This was particularly true by 1946, no doubt because industrial (CIO) unions were more "accommodating" to management during the War than their craft (AFL) counterparts (Bernstein 1970; Gordon et al. 1982, pp. 183–84).

Table 6. Factor Scores for Industries, 1946

Industry	All Industries Factor (1)	All Industries Factor (2)	All Industries Factor (3)	Manufacturing Factor (1)	Manufacturing Factor (2)	Manufacturing Factor (3)
A. Manufacturing						
Aircraft, parts	2.43	1.16	.99	2.73	.42	.82
Autos, parts	.06	1.63	.51	−.01	1.32	.97
Building materials, supplies	−1.36	−.49	.15	−1.05	−.76	−.27
Chemicals, drugs, dyes	.35	−.13	−.06	.85	−.43	−1.16
Coal and coke	−1.65	−.78	−.02	−1.34	−1.01	−.46
Electrical equipment, appliances, supplies	−.09	1.53	.14	.01	1.43	−.15
Foods, beverages, dairy	−.20	−.17	.35	.19	−.42	−.56
Glass	−1.13	−.24	.13	−.86	−.34	−.53
Instruments and scientific apparatus	.22	1.38	.06	.39	1.04	−.02
Leather	−1.29	.31	.35	−1.21	.28	.12
Machinery and accessories	.03	.70	.22	.28	.40	−.23
Metals and metal products	−.50	.78	.34	−.40	.49	.37
Paints, pigments, varnishes	−1.06	−.82	.05	−.60	−1.06	−.91
Paper and paper products	−.35	−.01	.44	−.07	−.44	.16
Petroleum and petroleum products	1.40	−1.25	1.01	2.08	−1.84	−.46
Printing and publishing	−.58	−.70	−.01	−.20	−.99	−.70
Rubber	−.41	1.62	.65	−.53	1.30	1.33
Shipbuilding	.02	−.27	1.04	−.04	−1.71	3.22
Soap and toilet preparations	.45	1.33	−.41	.83	1.24	−1.37
Textiles and textile products	−.56	.81	.21	−.50	.60	.34
Miscellaneous mfg.	−.75	.58	−.06	−.55	.48	−.49
B. Nonmanufacturing						
Banks and trust companies	.70	.03	−2.84			
Communications and broadcasting	1.76	−1.19	.92			
Finance companies, investment counsellors, investment trust, and stock exchange houses	−.35	−.82	−1.91			
Insurance	1.65	.01	−2.49			
Public utilities	1.06	−1.40	.84			
Transportation	.19	−1.97	1.36			
Wholesale and retail trade	.93	−.53	−.71			
Miscellaneous nonmanufacturing	−.95	−1.11	−1.25			

als, paints, and small finance and "miscellaneous nonmanufacturing" concerns.

Perhaps the most significant aspect of the 1946 results is that the pattern of factors and factor scores for all industries is now so similar to the results for manufacturing only. A tremendous rationalization and diffusion of bureaucratic employment practices occurred within and across industries during World War II. By war's end, many personnel practices were centrally administered through specialized personnel subunits, as reflected by the uniformally high loadings of the "personnel section" variables on factor (1) in Table 5. The rationalization of personnel matters spread particularly to newer manufacturing industries and those of strategic importance to the war effort, such as aircraft, petroleum, chemicals, and scientific instruments (Baron et al. 1986). This closed the gap between manufacturing and nonmanufacturing in the prevalence of ILMs and other facets of "bureaucratic control," so much so that the aircraft-parts sector, a new mass production industry central to the war, had a higher score than *any* other industry in 1946 on factor (1) in Tables 5 and 6. Various manufacturing industries also demonstrated increased reliance during the war years on union-negotiated seniority systems including leather, lumber, machinery, and glass (see factor [3], Table 6). Time and motion studies and kindred techniques also became somewhat more prevalent, including in banking and insurance (see factor [2], Table 6), further blurring the distinction between the

control systems used in manufacturing and nonmanufacturing.

The statistical results in Table 5 document the continued presence of a separate (third) factor in 1946 capturing reliance on union-oriented employment practices, which is distinct from the two other factors characterizing clusters of personnel practices aimed at (1) bureaucratizing employment relations and extending ILMs; and (2) rationalizing production via scientific-management approaches. However, supplemental oblique factor analyses within manufacturing reveal that by 1946 this union-oriented set of personnel practices was actually more intertwined (i.e., correlated) with the other dimensions of labor control than in the earlier NICB surveys. Furthermore, there is evidence that personnel specialists or their departments were attempting to integrate union-related activities into their functions, as witnessed by the prevalence of specialized personnel department subunits in 1946 to handle labor relations (also see Kochan and Cappelli 1984). Thus, by the end of World War II, ILMs and related personnel practices, scientific-management techniques, and union-oriented employment regimes had all become more interconnected through union-management accommodation and the rationalization and diffusion of modern personnel administration.[11]

DISCUSSION

What do these analyses suggest about the nature and sources of different work-control regimes—particularly, bureaucratic control—in industry? Based on comprehensive evidence concerning personnel activities throughout the U.S. economy in the 1930s and 1940s, our analyses document several regimes of modern labor control, which became increasingly interconnected over time and helped form separate strands of what has been termed modern "bureaucratic control." First, banking, insurance, and trade firms combined centralized personnel functions with the formalization of jobs, salaries, and promotions to facilitate control via long-term employment and internal labor markets. Second, modern mass-production industries used centralized personnel functions, job analysis, and employment record-keeping as adjuncts to scientific management, helping to rationalize the deployment of human resources along the same lines that engineers had streamlined production processes. We found increasing evidence of a third control system involving seniority-related personnel practices, accompanied by efforts to systematize employment rules, and this system was especially evident in industries subject to unionization pressures and in advanced sectors (e.g., petroleum, utilities) where turnover costs were high and the nature of technology made scientific management problematic. "Bureaucratic controls" thus developed in various forms, in various sections of the economy, and for various reasons, underscoring the inadequacy of monocausal arguments about the evolution of the modern employment relationship.

Our analyses suggest that by 1946, there was an increased melding within manufacturing among these three different strands of bureaucratic control. As Edwards (1979) and others have argued, bureaucratic personnel practices were already serving as adjuncts to scientific management in modern manufacturing industries in 1935 and 1939. These innovations in personnel practice continued to spread within those industries and to other sectors as well, due in large measure to governmental pressures and labor-market intervention during World War II (see Baron et al. 1986). Our analyses also indicate that by war's end, union-negotiated employment reforms were ceding to a logic of bureaucratic control, coming under the purview of personnel specialists. While Gordon et al. (1982, pp. 185–92) argue that technical, bureaucratic, and union control became "consolidated" within "core" manufacturing firms after World War II, our results suggest that process was already underway by 1946, fueled by the war. Carroll, Delacroix, and Goodstein (1988) have recently proposed that state mobilization for war favors more elaborate, rationalized organizational forms; their proposition is certainly consistent with our evidence, which suggests that different strands of personnel reform blended and spread during the war years, producing the

[11] Supplemental analyses, based on the subset of personnel practices and industries that are comparable in 1935, 1939, and 1946, provide additional evidence of a melding by 1946 between control systems based on scientific management and those based on the rationalization of employment relations and extension of ILMs (details available from authors.)

comprehensive modern-day system of organizational practices that scholars have labelled "bureaucratic control."

Many accounts of the origins of ILMs and bureaucratic control have studied specific firms or industrial sectors. In contrast, our findings reflect the evolution of personnel practices across diverse industries, and therefore our results question the generality of some previous accounts. For instance, our analyses indicate that ILMs and related personnel practices were first prevalent in white-collar nonmanufacturing organizations, even as early as 1935. Some analysts, focusing on developments in manufacturing, have traced modern employment practices to the failure of scientific management (Edwards 1979) or the growing power of unions during and after the New Deal (Jacoby 1985). Our results suggest that "bureaucratic control" was already flourishing by 1935 in nonmanufacturing industries, where scientific management was hardly commonplace and unionization was never a serious threat. For instance, 73 percent of banks, 72 percent of insurance firms, and 59 percent of trade establishments in the NICB sample had personnel departments by 1935, while the mean for manufacturing companies was 29 percent. Similarly, 20 percent of banks had formal promotion and transfer systems by 1935, as did 33 percent of trade firms and 41 percent of insurance companies, compared to 11 percent of manufacturing enterprises (NICB 1936).

Why were these modern employment innovations more prevalent in service industries? Increasing firm size has often been cited as the main cause of personnel rationalization (e.g., Bendix 1956, Oi 1983), but firms in these service industries were not significantly larger than companies in modern manufacturing industries, where personnel offices and formal promotion mechanisms spread less quickly. For instance, in the 1935 NICB sample, the average firm in the modern mass-production industries—automobiles, electrical equipment, and rubber—had 40 percent more employees than the average firm in the banking, insurance, and trade sector. Yet centralized employment systems were just as prevalent in service organizations (66 percent) as in modern manufacturing firms (64 percent), and personnel departments were even more common in the service industries (66 percent of firms versus 50 percent) (NICB 1936).

Other theorists have traced internal promotion systems and other bureaucratic controls to the high turnover costs associated with extensive firm-specific skills (Doeringer and Piore 1971). One indicator of large fixed hiring costs in banking and insurance during this period is that firms sometimes required that female prospective employees promise to delay marriage (Goldin 1986). Yet skills were apparently transferred rather easily to other companies in these nonmanufacturing industries, since many banking, insurance, and trade firms developed career ladders to curb the pirating of skilled employees by competitors (Carter and Carter 1985).

However, firms in these service industries did face another important turnover cost associated with their service orientation and dependence on employee-client relationships, which was probably more significant in molding employment practices (see Bimson 1932). In fact, those industries had long depended on informal within-firm hiring practices to promote stable employment (Washington 1921; Bimson 1932; Carter and Carter 1985). Managers in these settings recognized that losing employees often meant losing clients: "a bank differs from other types of business. The right kind of employees are far more important to a bank . . . [because] half of our employees have daily contact with the public. These men and women produce new business and sell our service to the old customers" (Bimson 1932, p. 618). Although these service industries are highly institutionalized today and may depend less on personal relationships, one should not lose sight of the earlier need for employment stability to sustain a clientele. Here more than elsewhere, companies needed to be able to trust employees who were literally handling the company profits, and managers were motivated to recruit "trustworthy" white-collar personnel, which they did by hiring from their own social and ethnic group and by adopting personnel polices aimed at ensuring loyalty from these employees (Kocka 1980; Jacoby 1986). Thus, if "firm-specific skill" is conceived broadly enough to embrace these aspects of service industries, then our findings are not inconsistent with arguments about the connections between specific human capital and the rise of ILMs.

Institutional perspectives on organizations similarly suggest that service industries, which depend heavily on process (rather than

outcome) measures of performance, may formalize operating procedures to increase their own perceived legitimacy (Meyer and Rowan 1977; DiMaggio and Powell 1983). In the early 1930s, financial-service organizations faced the added pressure of a crisis of confidence occasioned by the Depression. In the finance sector, new federal regulations required expanded formalization and accountability to the Federal Reserve Board and S.E.C. (Schlesinger 1958). Efforts to formalize, rationalize, and regulate other aspects of financial services during this period no doubt spilled over to the employment relationship as well. In short, in terms of their skills, technologies, demographic composition, and institutional environments, organizations in banking, insurance, trade, and related nonmanufacturing industries had much in common with governmental bureaucracies, which had already experimented extensively with modern personnel innovations through civil service reform and which provided readily accessible organizational models (Tolbert and Zucker 1983; DiPrete, forthcoming).

In addition to this strand of bureaucratic control originating in white-collar nonmanufacturing settings, our analyses uncovered a cluster of personnel practices related to scientific management and efforts to rationalize production. Modern mass-production industries combined aspects of scientific management (e.g., time and motion studies, work simplification programs) with several personnel reforms that became key components of "bureaucratic control," particularly centralized personnel functions, job analysis and specification, and extensive employment and turnover record-keeping. Those practices extended the principle of rationalizing production tasks to problems of allocating and retaining personnel. This cluster of personnel practices—and the industries in which they flourished—corresponds closely to Edwards' (1979) portrait of "technical control."

Our data furnish some clues concerning why these innovations flourished in these particular industries, even if they permit no definitive answer. As previous studies have suggested, the capacity to control labor through scientific management and machine pacing clearly depended on the nature of the product (Blauner 1964; Edwards 1979). Newer mass-production industries, such as agricultural implements, automobiles, rubber, and electrical equipment, involved sequential production and simpler, more repetitive tasks, and were thus better suited to efforts at "engineering" work and employment. However, our results suggest that technology interacted with industry age in determining where and when scientific management flourished. These innovations diffused less quickly to older industries whose products were amenable to these techniques—such as leather, textiles, and printing—despite active management efforts to homogenize labor there (Gordon, Richards, and Reich 1982; Griffin, Wallace, and Rubin 1986). The fact that industry modernity favored the diffusion of scientific management and related personnel reforms appears consistent with Stinchcombe's (1965) claim that organizational arrangements are contingent on an industry's founding period. Indeed, those manufacturing industries that Stinchcombe classifies as "modern" exhibited the most widespread use of time and motion studies and kindred practices in our sample.

As early as 1935, we also found some evidence of a third cluster of personnel reforms, involving seniority provisions and rules and procedures apparently aimed at containing turnover and unionization among skilled workers. In utilities, transportation and communication, mining, petroleum, and (to some extent) trade, seniority incentives to reward long-term employment and formal rule books to reduce capricious dismissals by supervisors were increasingly common. In these industries, increasingly active "industrial" unions, high-skill requirements, nonrepetitive and discretionary work, and/or the decentralized nature of production made technical control less feasible, while simultaneously heightening the need for employment mechanisms that retained skilled workers and ensured their loyalty to the enterprise (Brandes 1976, p. 56; Gordon, Richards, and Reich 1982, p. 159; Mater 1940).

Thus, a combination of union pressure and labor market uncertainty apparently led these specific industries to experiment with this third strand of bureaucratic control based on seniority and rule systems. Standard Oil, for instance, issued employee rule books in the late 1910s with two express purposes: preventing unionization by offering unionlike protections; and halting the loss of skilled workers due to capricious firings by foremen (NACS 1918; Feldman 1925). In contrast, modern assembly-line industries characterized by sea-

sonal production cycles, such as automobiles, avoided early use of seniority rules, presumably because scientific management had made training and turnover less costly there. It appears that in dealing with labor market uncertainty, the seniority provisions and employment rules used in such industries as mining and petroleum were a functional alternative to the scientific management techniques and technical controls used in newer mass-production firms.

A number of industries seem not to have depended much during this period on ILM mechanisms, scientific management, *or* the seniority-based personnel reforms associated with industrial unionism in controlling labor. Older, less mechanized, lower-skill industries, such as food and lumber, apparently still used "simple control" extensively. Nor did modern personnel innovations diffuse as extensively in industries with strong AFL unions during this period, where scientific management and ILMs would have been possible only if "the power of the craft union, with its rules pertaining to work organization, technology, hiring, evaluation, and pay, was broken" (Griffin, Wallace, and Rubin 1986, p. 150). Our data suggest that even during World War II, in the face of significant federal involvement in the labor market, craft unions maintained substantial control over the labor process. In contrast, industrial unions displayed an increasing affinity for technical and bureaucratic controls (Piore 1982), often supporting the rationalization of production tasks and employment practices as a means of ensuring equity and career opportunities for their (less-skilled) members (Jacoby 1985; Baron et al. 1986).

The historical roots of bureaucratic control are complex and diverse. By focusing on certain manufacturing industries, past research may have been preoccupied with the causal role of unions, factory technology, and labor market conditions. Our analyses suggest that such forces, although very important, are only part of the story. We identified some factors—including historical founding conditions, the institutional environment (particularly the state), and characteristics of white-collar nonmanufacturing work—that are important elements of a richer organizational theory describing how and why employment relations evolve. Comparative organizational research, especially longitudinal and cross-national studies, would be invaluable in developing and testing such a theory. A recent study of labor relations in Japanese manufacturing during this same era, for instance, stresses many of the same technical, organizational, and institutional factors that we have emphasized in the U.S. context, including state wartime intervention, in accounting for the rapid bureaucratization of Japanese employment relations (Gordon 1985, especially ch. 7).

Finally, our analyses underscore the benefits of unraveling such shorthands as "bureaucratic control." We tried to give that term more precise empirical content by identifying particular clusters of personnel activities used by different kinds of organizations. However, we were limited by the data available. For instance, lacking detailed enterprise-level information on formal personnel policies and informal practices, we have not been able to examine the diversity of personnel systems *within* industries. Such micro-data would almost certainly reveal tremendous unexplained variations in personnel systems among firms within a given industry, even holding constant such "imperatives" as size, technology, and unionization (for contemporary evidence, see Osterman 1984; Pfeffer and Cohen 1984; Baron, Davis-Blake, and Bielby 1986). In other words, there appears to be a wide range of equally viable systems for structuring employment within a given organizational form. We need to know much more about how workers (and firms) react over time to these alternatives for organizing personnel. For instance, if firms using the drive system or "paternalism" flourished alongside otherwise comparable firms that adopted the various personnel innovations analyzed in this paper, then we must question the argument that those innovations were necessary to solve "crises of control" facing capitalists (see Doeringer 1984). As many contemporary organizations experiment with new variants of paternalism, the drive system, and technical control in managing their human resources, research along these lines may offer important insights not only into the past but also into the future.

REFERENCES

Baron, James N., Alison Davis-Blake, and William T. Bielby. 1986. "The Structure of Opportunity: How Promotion Ladders Vary within and among Organizations." *Administrative Science Quarterly* 31:248–73.

Baron, James N., Frank R. Dobbin, and P. Devereaux Jennings. 1986. "War and Peace: The Evolution of Modern Personnel Administration in U.S. Industry." *American Journal of Sociology* 92:350–83.

Bendix, Reinhard. 1956. *Work and Authority in Industry*. New York: Wiley.

Bernstein, Irving. 1960. *The Lean Years*. Boston: Houghton Mifflin.

_____. 1970. *The Turbulent Years*. Boston: Houghton Mifflin.

Bimson, Walter R. 1932. "Personnel and Relations with the Banking Public." *American Bankers' Association Journal* 7:618–20.

Blauner, Robert. 1964. *Alienation and Freedom*. Chicago: University of Chicago Press.

Brandes, Stuart D. 1976. *American Welfare Capitalism, 1880–1940,* 2nd ed. Chicago: University of Chicago Press.

Burawoy, Michael. 1979. *Manufacturing Consent: Changes in the Labor Process Under Monopoly Capitalism*. Chicago: University of Chicago Press.

Carroll, Glenn R., Jacques Delacroix, and Jerry Goodstein. 1988. "The Political Environment of Organizations: An Ecological View." Pp. 359–92 in *Research in Organizational Behavior,* vol. 10, edited by B.M. Staw and L.L. Cummings. Greenwich, CT: JAI Press.

Carter, Michael J. and Susan B. Carter. 1985. "Internal Labor Markets in Retailing: The Early Years." *Industrial and Labor Relations Review* 38:586–98.

Chandler, Alfred D., Jr. 1977. *The Visible Hand: The Managerial Revolution in American Business*. Cambridge, MA: Harvard University Press.

Denk, Charles. 1988. "Many Roads Lead to Rome: Implications of Heterogeneous Diffusion for Institutionalization and 'Internal Imperatives'." *American Journal of Sociology* 93:1224–31.

DiMaggio, Paul J. and Walter W. Powell. 1983. "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields." *American Sociological Review* 48:147–60.

DiPrete, Thomas A. Forthcoming. *The Bureaucratic Labor Market: The Development and Impact of a Tiered Personnel System in the Federal Civil Service*. New York: Plenum Press.

Doeringer, Peter B. 1984. "Internal Labor Markets and Paternalism in Rural Areas." Pp. 271–89 in *Internal Labor Markets,* edited by Paul Osterman. Cambridge, MA: MIT Press.

Doeringer, Peter B. and Michael J. Piore. 1971. *Internal Labor Markets and Manpower Analysis*. Lexington, MA: Lexington Books.

Edwards, Richard. 1979. *Contested Terrain*. New York: Basic Books.

Feldman, Herman. 1925. *The Regularization of Employment: A Study in the Prevention of Unemployment*. New York: Harper.

Fine, Sidney. 1969. *Sit-Down: The General Motors Strike of 1936–1937*. Ann Arbor: University of Michigan Press.

Form, William. 1987. "On the Degradation of Skills." *Annual Review of Sociology* 13:29–47.

Goldin, Claudia. 1986. "Monitoring Costs and Occupational Segregation by Sex: A Historical Analysis." *Journal of Labor Economics* 4:1–28.

Gordon, Andrew. 1985. *The Evolution of Labor Relations in Japan: Heavy Industry, 1853–1955*. Cambridge, MA: Harvard University Press.

Gordon, David M., Richard Edwards, and Michael Reich. 1982. *Segmented Work, Divided Workers*. London: Cambridge University Press.

Green, Paul E. 1976. *Mathematical Tools for Applied Multivariate Analysis*. New York: Academic.

Griffin, Larry J., Michael E. Wallace, and Beth A. Rubin. 1986. "Capitalist Resistance to the Organization of Labor Before the New Deal: Why? How? Success?" *American Sociological Review* 51:147–67.

Hannan, Michael T. and John H. Freeman. 1984. "Structural Inertia and Organizational Change." *American Sociological Review* 49:149–64.

Hawley, Ellis W. 1960. *The New Deal and the Problem of Monopoly*. Princeton, NJ: Princeton University Press.

Jacoby, Sanford. 1985. *Employing Bureaucracy: Managers, Unions, and the Transformation of Work in American Industry, 1900–1945*. New York: Columbia University Press.

_____. 1986. "Progressive Discipline in American Industry: Its Origins, Development, and Consequences." *Advances in Industrial and Labor Relations* 3:213–60.

Kahn, Lawrence M. 1976. "Internal Labor Markets: San Francisco Longshoremen." *Industrial Relations* 15:333–37.

Kim, Jae-On and Charles W. Mueller. 1978. *Factor Analysis*. Sage University Paper Series on Quantitative Applications in the Social Sciences, 07–014. Beverly Hills, CA: Sage.

Kochan, Thomas A. and Peter Cappelli. 1984. "The Transformation of the Industrial Relations and Personnel Function." Pp. 133–62 in *Internal Labor Markets,* edited by Paul Osterman. Cambridge, MA: MIT Press.

Kocka, Jurgen. 1980. *White Collar Workers in America, 1890–1940*. London and Beverly Hills: Sage.

Marglin, Stephen A. 1974. "What Do Bosses Do? The Origins and Functions of Hierarchy in Capitalist Production." *Review of Radical Political Economics* 6:60–92.

Marx, Karl and Friedrich Engels. [1848] 1968. *The Communist Manifesto*. New York: Washington Square Press.

Mater, Dan. 1940. "The Development and Opera-

tion of the Railroad Seniority System." *Journal of Business* 61:728–31.

Meyer, John W. and Brian Rowan. 1977. "Institutionalized Organizations: Formal Structure as Myth and Ceremony." *American Journal of Sociology* 83:340–63.

Meyer, Marshall W. and M. Craig Brown. 1977. "The Process of Bureaucratization." *American Journal of Sociology* 83:364–85.

Mills, C. Wright. 1956. *White Collar: The American Middle Classes*. New York: Oxford University Press.

National Association of Corporate Schools. 1918. "Standard Oil's New Labor Democracy." *NACS Bulletin* 5:207–9.

National Industrial Conference Board (NICB). 1936. *What Employers are Doing for Employees*. New York: NICB.

_____. 1939. *Studies in Enterprise and Social Progress*. New York: NICB.

_____. 1940. *Personnel Activities in American Business*. Studies in Personnel Policy #20. New York: NICB.

_____. 1947. *Personnel Practices in Factory and Office*. Studies in Personnel Policy #86. New York: NICB.

Oi, Walter Y. 1983. "Heterogeneous Firms and the Organization of Production." *Economic Inquiry* 21:147–71.

Osterman, Paul. 1984. "White-Collar Internal Labor Markets." Pp. 163–89 in *Internal Labor Markets*, edited by Paul Osterman. Cambridge, MA: MIT Press.

Ozanne, Robert. 1967. *A Century of Labor-Management Relations at McCormick and International Harvester*. Madison: University of Wisconsin Press.

Parks, Donald S. 1936. "1936 Personnel Trends." *Factory Management and Maintenance* 12:39.

Peirce School. 1935. *Current Personnel Practices*. Philadelphia: Peirce School of Business Administration.

Pfeffer, Jeffrey and Yinon Cohen. 1984. "Determinants of Internal Labor Markets in Organizations." *Administrative Science Quarterly* 29:550–72.

Piore, Michael J. 1982. "American Labor and the Industrial Crisis." *Challenge* 25:5–11.

Rubery, Jill. 1978. "Structured Labor Markets, Worker Organization, and Low Pay." *Cambridge Journal of Economics* 2:17–36.

Schlesinger, Arthur M., Jr. 1958. *The Coming of the New Deal*. Boston: Houghton Mifflin.

Slichter, Sumner. 1919. *The Turnover of Factory Labor*. New York: Appleton.

Stinchcombe, Arthur. 1965. "Social Structure and Organizations." Pp. 142–93 in *Handbook of Organizations*, edited by James G. March. Chicago: Rand McNally.

Stone, Kathryn. 1974. "The Origins of Job Structures in the Steel Industry." *Review of Radical Political and Economics* 6:113–73.

Tolbert, Pamela S. and Lynne G. Zucker. 1983. "Institutional Sources of Change in the Formal Structure of Organizations: The Diffusion of Civil Service Reform, 1880–1935." *Administrative Science Quarterly* 28:22–39.

Washington, Lawrence. 1921. "Personnel Management of the Metropolitan Life Insurance Company." *Industrial Management* 61:27–31.

Weber, Max. [1922] 1947. "Bureaucracy." Pp. 196–244 in *From Max Weber: Essays in Sociology*, edited by H.H. Gerth and C. Wright Mills. New York: Oxford University Press.

Wolman, Leo. 1936. *Ebb and Flow in Trade Unionism*. New York: National Bureau of Economic Research.