GEM | Generalized Exchange
Macroeconomics

Chapter Eight

ECONOMIC MODELING OF MANAGEMENT

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CHAPTER EIGHT

ECONOMIC MODELING OF MANAGEMENT

TVGE modeling provides a much more robust role for management than does its SVGE counterpart, in which markets do all the heavy lifting. The generalization of exchange is predicated on the existence of large bureaucratic corporations. From that platform, managerial input is further enhanced by the introduction of a broad range of information costs and imperfections, imposing discretion on firm decision-making with respect to an imposing set of tasks. Familiar examples include the design and implementation of human-resources systems, identifying and responding to the variety of hold-up problems associated with sunk-capital investment, and the use of advertising and other marketing techniques to differentiate products and generate pricing power.[1]

The analysis has already used inherently costly, asymmetric information about employee behavior to motivate management's construction of wage incentives and, more generally, a complex of workplace-exchange mechanisms. Convincing employees to adopt the firm's goals as their own is a task broadly recognized by practitioners, as a result of generations of learning-by-doing, to be crucial to profit-seeking. After introductory comments on the general role of costly, imperfect information in economic theory, this chapter will elaborate on the rational management of employer-employee exchange, where the meaning of "employer" will range from middle-management (who deal with production and nonsupervisory workers) to equity owners (who elect directors who, among other responsibilities, select and provide oversight of the CEO).

I. COSTLY IMPERFECT INFORMATION

Fundamental question. Why do firms exist? Ronald Coase (1937) famously forced that fundamental question on (initially) disinterested economist colleagues. Responding adequately opens up powerful avenues of research that inform our understanding of the nature and practice

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[1] For an introduction to the economics of advertising, which is not covered in this chapter, see Chamberlin (1963).

of management in highly specialized economies. The nature of firms is particularly consequential for mainstream SVGE modeling that has been investigated, in some detail, in this eBook. The organization of a substantial share of global economic activity into large firms fundamentally challenges the strong SVGE theorem that market prices are a Pareto-efficient measurement and information-transmission mechanism. (See, for example, Hayek (1945).) If market pricing is indeed always Pareto optimal, its spontaneous measurement and transmission of incentives cannot be rationally displaced by intentional information gathering and processing inside firms. The literature's answer to Coase's question is that spontaneous (market) and intentional (intra-establishment) information measurement/transmission systems are both inherently imperfect and costly. Circumstances, general and particular, determine the relative efficiency of each and, therefore, the rational boundaries between the firm and the marketplace.

While intentional information systems constructed and operating inside firms have no place in mainstream SVGE modeling, they have not been wholly ignored by economists. Relevant modern work appears to have been pioneered by Monsen and Downs (1965), who identified a large-corporation problem set rooted in information gathering and dissemination: separation of ownership and control, risk aversion, expense preference, information bias, and manager satisficing in place of optimizing. Somewhat later, Alchian and Demsetz (1972) influentially examined another part of the elephant, arguing that information and other inseparabilities inherent to team production require intentional, nonmarket measurement systems. Reinterpreting their message in the language of TVGE modeling, market pricing cannot cope with workplace information costs and asymmetries associated with employer-employee exchange in complex, specialized production environments.

Workplace exchange. The eBook has demonstrated, within the formal economic method, what practitioners have long understood: Voluntary workplace exchange, a global activity set that has increasingly acquired significance since the second half of the 19th century, is intentionally organized by management in order to deal with a broad class of labor pricing and allocation that, as a result of information-acquisition and job-routinization problems, is beyond the efficient reach of the marketplace. Richard Nelson (1995, 2003), working through the significance of such intra-firm transactions, insightfully separated technology into two classes. First is physical

technology, captured (frequently badly) by standard-form production functions. Second is social technology, which organizes cooperative behavior and includes the rule of law, the development and use of money, and joint-stock corporations.

The intentional configuration of workplace exchange requires explicit human designers. Early in the Second Industrial Revolution, management confronted a nonintuitive learning curve as firms became larger and more complex. Modern best-practice administration of workplace exchange developed via experimentation, an ongoing process motivated by simultaneous employer profit- and employee utility-seeking. Continuous-equilibrium workplace modeling has extended the formal economic method to modeling the LEV management function, helping to better integrate the uncomfortably inconsistent literatures of economics departments and business schools.[2]

So far in this manuscript, in order to simplify the presentation of an unfamiliar class of economic modeling, workplace-equilibrium theory has been restricted to the on-the-job behavior of nonsupervisory production workers. Exogenous formal workplace organization has been assumed, and the interests of the firm's leadership and shareholders are posited to be congruent. As a result, introductory TVGE modeling has arbitrarily restricted LEV employers' latitude to influence employee OJB, suppressing much that is interesting in management conduct.

The restriction, not surprisingly, was useful. Theories become unwieldy, and less productive, when attempting to capture too much detail. The simple workplace model, by augmenting market transactions with rudimentary optimizing intra-firm exchange, powerfully increases the explanatory and predictive capacities of formal economic modeling. In a nontrivial number of circumstances, however, explaining and predicting labor pricing and use is enhanced by a richer treatment of rational management behavior. Outlining such treatment is the task of this chapter.

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[2] That literature incompatibility is no less embarrassing than the micro-macro inconsistencies that have occupied economic theorists for generations. The reconciliation of management and economics modeling should rank high on research agendas in both branches of the academy.

In two-venue macroeconomics, as constructed so far, LEV management has been restricted to two interrelated classes of endogenous labor-related decision rules:

- The labor-capacity decision, i.e., maintain/increase employment, layoff workers (with or without recall rights) with the expectation that the job reduction is temporary, or permanently downsize jobs (including closing relevant facilities); and

- The labor-pricing decision, i.e., pay the established efficiency rate unless ongoing job destruction has convinced employees to rationally recalibrate their reference standards ($\mathbb{K}^{\acute{n}}_j$) and accept (with unchanged OJB) reduced wages.

This chapter's more detailed treatment of optimizing management expands the set of TVGE endogenous variables to include: (a) OJB monitoring, ($\acute{Z}^{m}_j(t)$); (b) management credibility, especially with respect to the likelihood of job destruction; (c) workplace organization, especially with respect to its implications for the rational calibration of $\mathbb{K}_j$; (d) nonpecuniary job benefits; (e) design of compensation packages; and (f) likelihood of promotion (incorporating tournament theory into two-venue modeling).

To anticipate the overall outcome, greater LEV management endogeneity does not reduce the central role of employee reference standards, does not compromise the simultaneous determination of labor pricing and worker OJB, does not return wage determination to the marketplace, does not eliminate meaningful wage rigidities, and does not microfound the fine-tuning of wage rents over the business cycle. The expanded analysis does make management modeling more intuitive and powerful, better delineating management's influence on macro efficiency while maintaining analytical roots in the bedrock formal economic method. Overall, the rigorous analysis of a broader range of management behavior reinforces the value of separating economic exchange into distinct large- and small-establishment venues, each with its own decision rules, constraints, and transaction mechanisms. Relative to mainstream SVGE modeling, TVGE provides a much more useful bridge between formal economic modeling and the huge literature on best-practices management.

The remainder of this chapter is divided into five parts. First, the trial-and-error development of the modern best-practices approach to the management of large-establishment worker OJB is

summarized. In the second section, management of employee behavior in the two heterogeneous venues is outlined from the perspective of the formal economic method. In the third section, LEV human resource practices are elaborated. The section is the chapter's longest, reflecting the inherent complexity of rational management in the circumstances of costly, asymmetric workplace information. Fourth, the relation of TVGE modeling to both modern organization theory, rooted in the innovations of Ronald Coase and Herbert Simon, and to "personnel economics", most closely associated with the extensive work of Edward Lazear, is acknowledged. The former closely links workplace equilibrium to the foundational literature on firm existence and rational boundaries while the latter provides a useful analytical benchmark for the formal economic modeling of management behavior. Finally, the key ideas are summarized.

II. EVOLUTION OF LARGE-ESTABLISHMENT OJB MANAGEMENT

Equation 2.3 identified, and then assumed away, an especially important function for management. Specialized, large departments, universally present in large firms, are tasked to sufficiently identify the establishment's various modal workplace-exchange relations (WERs) to enable payment of its unit-cost minimizing labor prices, i.e., the efficiency wage that maximizes $\acute{Z}_j/W_j$.

In the now familiar story, WER identification was greatly complicated by the Second Industrial Revolution, which required "new corporate forms" (Alfred Chandler's term). [3] In the new class of establishments, management is tasked with a variety of functions that SVGE analysis, in what turns out to be a most consequential simplification, assumes away. It is not surprising that making sense out of WERs, rooted in axiomatic worker preferences and manifested in collectively observable OJB, proceeded in fits and starts. Labor management passed through drive-system and scientific-management phases before arriving at the equity-based human-

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[3] Chapter 2 demonstrated that a necessary condition for the rational firm payment of a wage greater than employees' opportunity cost is lower unit labor costs, implying that optimal, firm-specific wage rent ($W_j > W^m$) exists iff $\acute{Z}_j/W_j > \acute{Z}^m_j/W^m$. The WER class (over the range of feasible labor pricing, $W_j \geq W^m$) that is consistent with the rational payment of nonmarket wage incentives is *unbundled* ($\acute{Z}_j/\acute{Z}^m_j > W_j/W^m$), while WERs mandating payment of market-opportunity costs are *bundled* ($W_j/W^m > \acute{Z}_j/\acute{Z}^m_j$). Recall that $\acute{Z}^m_j$ is the on-the-job cooperative input associated with cost-effective workplace monitoring and that W^m denotes market opportunity cost, i.e., the discounted expected best alternative wage upon separation from firm j.

resource paradigm (designed to elicit employee acceptance of employer goals) that now dominates large-scale, complex production throughout the world.

Drive System

The infamous "drive system" was most characteristic of large-firm labor management in the nineteenth century. At the onset of industrialization, it was typical for foremen to act as permanent subcontractors, hiring, supervising, and paying their work crews. Firm owners kept no employment records, dealing only with foremen. The approach featured close worker oversight, arbitrary treatment, bribery, abuse, and the absence of employee rights. From Sanford Jacoby (1994, p.343): "The fear that the drive system aroused ultimately was founded on the threat of dismissal. The foreman was free to utilize the discharge as he saw fit, and discharges were liberally meted out. The threat posed by dismissal depended on labor-market conditions…." The drive system is recognized to have much in common with the Shapiro-Stiglitz (1984) shirking theory, which has become SVGE theorists' default model of worker behavior. (See Chapter 9.)

As establishments became larger and work tasks more specialized and integrated, with much faster throughput time, the close supervision of the drive system increasingly became less effective. Moreover, the SVGE-consistent approach was sufficiently maligned to have become a national social-policy issue, motivating in the United States high-profile Congressional hearings. The drive system, as firms learned more about workers and specialized workplaces, was over time recognized to be rooted in a fundamental misperception of employee preferences and, as a result, to be ultimately inconsistent with firm profit-seeking.

Scientific Management

"Speedy" Taylor. Scientific management was famously developed by Frederick Taylor (1911) in order to facilitate the transition from the drive system. (The nickname "Speedy", while predating scientific management, is evocative of his life work.) Taylorism was a revolutionary approach to managing labor as tasks became increasingly specialized and workplaces more complex in the aftermath of the Second Industrial Revolution. Peter Drucker, perhaps exercising

some dramatic license, once suggested that Taylor's work is "… the most powerful as well as the most lasting contribution America has made to Western thought since the Federalist Papers."[4]

Scientific management applies systematic measurement to the firm's associated problems of how to better calibrate the Workplace-Exchange Relation and how to improve $\acute{Z}^{\mathrm{m}}$. Taylor conducted his experiments with a stopwatch, timing workers' movements and rest pauses. Selection criteria were established to place workers in jobs for which they are most suited. They were then instructed in the most efficient methods to use in their work tasks. He introduced time-and-motion studies into manual employment and helped design the devolution of complex labor processes into simple, repetitive tasks. Taylorism provided early blueprints for class-I jobs, which as described in Chapter 2 tend to be characterized by monotonous routinization. The innovation fits comfortably into both the SVGE and TVGE model classes.

Fair treatment. Unlike mainstream economic theorists, however, Taylor importantly recognized that labor management was not wholly a problem of efficient worker supervision ($\acute{Z}^{\mathrm{m}}$), opening the door to a deeper understanding of OJB. He argued that, even with optimal oversight, cost-efficient production requires worker cooperation. From Stessin (1960, p. 5): "Taylor called for a 'mental revolution' by management in its attitude towards the workforce. He argued that if employees were to be won over to scientific management, they must have the assurance of fair treatment by the employer. This meant that management must voluntarily adopt new concepts of boss-worker relationships. [For example] the supervisor must abandon his prerogative of 'instant dismissal' and substitute 'just cause' as the standard for separation from a job." The stopwatch-carrying developer of time-and-motion studies recognized, as a result of his experience in many different workplaces, that labor contracts are inherently incomplete and that employees ubiquitously, and strongly, prefer fair treatment from management. Through a lifetime of experience at the dawn of industrialization, Taylor eventually identified the essential key to many modern economic puzzles.

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[4] Quoted in Kanigel (1997), p.10.

<u>Equity-Based Human-Resource Management</u>

Chapters 1 and 2 cited the 1927-1932 study conducted at the Hawthorne plant of the Western Electric Company in the United States, which in retrospect can be understood as a turning point in large-establishment management's learning curve on employee behavior. The results showed that, with respect to WERs and the determination of $\acute{Z}_j$, attitudes of individual workers and the role of informal work groups are critical. The central question changed from the design of the work environment to how to induce employee cooperative effort.

As firms' understanding of the nature of employees and specialized workplaces continued to progress, Taylor's "mental revolution", not his stopwatch, carried the day. Experience had produced the ubiquitous management conclusion that employees strongly prefer fair treatment and that their preference for equity critically influences $\acute{Z}_j$ whenever direct OJB supervision is limited. Anticipating later findings of behavioral economists, the extensive literature documenting worker behavior has long indicated that interpersonal and intertemporal comparisons of wages and working conditions play a central role in employee satisfaction. As indicated by the evidence summarized in Chapter 10, LEV management have recognized the importance of reference wages and implicitly adopted the specification of instantaneous worker utility of Chapter 2:

$$(8.1) \qquad \max_{\acute{Z}} \acute{U}(C,L^o,W/W^n),$$
$$\text{such that} (\Delta\acute{U}/\Delta(W/W^n) \,|\, W \leq W^n) > 0.$$

The growing understanding of both worker preferences and the nature of large, specialized workplaces motivated the increasing reliance on professional, centralized personnel management. The altered approach initially resulted in more regularized employment relationships, welfare benefits, and paternalism (the "American plan"). Those interim practices eventually evolved into the modern equity-based human-resource method, promoting voluntary acceptance of management goals, that dominates in large, specialized establishments today.[5]

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[5] The idea of employee voluntary acceptance of management's goals was introduced into economics by mid-20th century labor economists, who associated it with worker trust in fair treatment by the firm. (See Kerr (1994)). Almost simultaneously, Herbert Simon used the concept in his seminal work on organizations. (See Simon (1991)). The idea was formalized and introduced into rigorous macroeconomic theory by Annable (1977, 1984), and worker acceptance or rejection of management goals plays a central role in TVGE. Also noteworthy here is the later work of

The nature of contemporary workplace mechanisms of exchange is no secret. Large-firm human-resources departments are responsible for identifying worker preferences and predicting their responses to personnel policies, including labor-pricing decisions. Particular attention is paid to job satisfaction. The evidence shows that department administrators, in consultation with senior management, use wage-setting practices that rely more on job-evaluation programs (maintaining established interpersonal reference standards) than on market-wage surveys. Jobs are defined with associated rates of pay; ports of entry for new hires (typically less desirable positions) are typically used; rules (providing a key role for seniority) governing the internal access to more desirable jobs are designed and implemented; formal grievance procedures are established. Due-process rules (especially with respect to discharge for cause) are the norm, effectuating "…standards of equity that a competitive market cannot or does not respect." (Doeringer and Piore (1971), p.29.) Another important reason that managers care about nonunion worker satisfaction is the threat of formal organization, which in the United States depends on the outcome of NLRB-supervised workplace elections.

III. MANAGEMENT OF EMPLOYEE BEHAVIOR

<u>Small Establishments</u>

Rational SEV firms seek to influence employee choices largely along two dimensions: (i) managing worker on-the-job behavior in order to minimize unit labor costs ($W_k/\acute{Z}_k$) and (ii) managing voluntary turnover in order to optimize any nonzero specific human capital. Management of small establishments, where direct supervision of employees is relatively unhampered by workplace-information problems, is less complex than in large establishments.

Worker supervision. A simple model introduces endogenous small-firm OJB monitoring into formal economic analysis:

Akerlof and Kranton (2005) on the sociological concept of identity, which focuses on firm investment in goal acceptance by employees and usefully elaborates on the earlier analyses. The Akerlof-Kranton choice to model the process as a preference change distances, perhaps unnecessarily, the analysis from the formal economic method.

(8.2) $\acute{Z}^m_k=f(\check{S}_k)$, such that $\Delta\acute{Z}^m_k/\Delta\check{S}_k>0$,

where $\check{S}$ denotes firm real outlays on workplace supervision. It follows that short-run (constant-capital) production is:

(8.3) $X_k=X_k(H_k, \acute{Z}_k, \acute{Z}^m_k)$, such that $\Delta X_k/\Delta\check{S}_k\geq0$.

The familiar optimizing condition for the profit-seeking firm equates the marginal value product of supervision to its unit cost.[6]

Optimal OJB monitoring is influenced by the cost of supervision and its effectiveness, which in workplace-equilibrium analysis is decreasing in workplace size as team production and specialization degrade the information that supports management's capacity to apportion productivity among synergistically interacting employees. In small, especially owner-managed, firms, workplace oversight is frequently a joint product with other duties, implying low-cost, effective supervision. This is not a new idea. From Alfred Marshall (1891, p. 284): "The small employer has advantages of his own. The master's eye is everywhere; there is no shirking by his foremen or workmen, no divided responsibility, no sending half-understood messages backward and forward from one department to another." (For more on monitoring, see below.)

Managing quits. The second class of management tasks is an exercise in rational human-capital investment. The analysis is familiar and requires no more than a brief summary.[7] Given that SEV worker discretionary workplace behavior is held constant by effective monitoring, the difference between a veteran employee's labor-services input and the input of a (market-homogeneous) new hire, denoted by $\acute{\eta}$, is:

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[6] Other, more elaborate models of workplace supervision produce similar conclusions. See, for example, Calvo (1987).

[7] Insider-outsider theory describes the relationship between quits and specific human capital in some detail. See Lindbeck and Snower (1988). From Phelps (1994, p.10): "… there is a moral hazard in the association between the firm and the employee. The hazard faced by the firm is that an employee whom the firm has given firm-specific training so that he or she can function within the firm may quit and thus impose on the firm the investment-like costs of finding and training a replacement. The firm hopes that the employee will not quit except for cause (the employer paying less or demanding more than the industry standard) but knows that it cannot typically enforce such an understanding, and so it will aim to motivate reduced turnover by taking whatever steps are cost-effective. One measure is to raise the wage above the market-clearing level, calculating that a small wage premium would be repaid by the *incentive* it created to quit less readily."

$$\text{(8.4)} \qquad \acute{Z}_{ik}((E^Q/H)_{ik}+(E^G/H)_{ik}+(E^S/H)_{ik})-\acute{Z}_{\acute{\eta}k}((E^Q/H)_{\acute{\eta}k}+(E^G/H)_{\acute{\eta}k})=\acute{Z}_k(E^S/H)_{ik}.$$

The notation was introduced in Chapter 2 and is defined in the Glossary. The replacement of a veteran worker with a new hire implies the loss of specific human capital for both the employee and the firm. For small establishments, $(E^S/H)_k$ is posited to be a modest amount, intuitively representing hiring and simple training costs. Those costs, once amortized, can fund only a small nonmarket wage premium, with which the firm manages its voluntary labor turnover.[8]

The firm's profit-maximizing labor pricing is $W_k>W^m$, reflecting the rational payment of a small nonmarket wage differential $(\gamma^o{}_k)$:[9]

$$\text{(8.5)} \qquad W_k = (1+\gamma^o{}_k)W^m.$$

Given a reasonable distribution of work-leisure preferences in the kth workforce, the small size of γ^o implies that it is in practice dominated by other determinants of the employee intertemporal job-attachment decision rule, making the simple model consistent with substantial turnover.

Workplace equilibrium. Rational workplace exchange for SEV establishments is governed by:

$$\text{(8.6)} \qquad \acute{Z}_k=\acute{Z}_k(W_k,W^m,\acute{Z}^m{}_k), \text{ such that if } W_k\geq(1+\gamma^o{}_k)W^m,$$
$$((\Delta\acute{Z}_k/\acute{Z}^m{}_k)/(\Delta W_k/(1+\gamma^o{}_k)W^m))<1.$$

Effective worker monitoring suppresses labor's capacity to spontaneously establish and enforce interpersonal or intertemporal reference standards, resulting in bundled OJB. The bundled class

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[8] From a macro modeling perspective, the wage incentive is both small and cannot prevent downward wage recontracting in response to adverse nominal demand shocks. It cannot therefore support the existence of involuntary job loss. Phelps's turnover theory (lucidly summarized in Chapter 1 of his *Structural Slumps* (1994)) attempts to establish a link between paying an incentive not to quit and unemployment by positing a wage spiral resulting from firms' competing to establish the small premium relative to each other and then, to sidestep that instability, turns to the queuing time implicit in the natural rate of unemployment (reflecting the job-rationing implicit in the wage premium) to reduce the present value of labor-market opportunity costs, providing an effective disincentive to quit. Of course, Phelps could have made his wage premium effective without resort to the NRU by incorporating the common practice of requiring new hires to go through a probationary period (during which firm-specific human-capital investment occurs) before receiving the wage premium. All competing firms could then use small wage incentives to discourage turnover without igniting an inefficient wage-wage spiral.

[9] It follows that $\gamma^o{}_k=(((P_k(0)/W^m(0))\sum(1+\mathit{r}+p)^{-t}(E^S_k(0)/H_k(0)))$; r and p are the constant discount factor ($\mathit{r} \in (0,1)$) and expected inflation rate respectively; and the series is summed from $t=0$ to $t=\varkappa$, the expected employee tenure at the firm. The wage increase $(\gamma^o{}_kW^m)$ is likely paid as a service award, reflecting a specified period of job retention.

of workplace exchange mandates market wage-taking, with the small γ^{o}_{k} adjustment, by profit-seeking management; and workplace equilibrium (reflecting rest points in the space of both employee and employer decision rules) occurs at $\acute{Z}_{k}=\acute{Z}^{m}_{k}$, $W_{k}=\sup \mathbb{K}_{k}=W^{a}_{k}=(1+\gamma^{o}_{k})W^{m}$.

The labor market cannot directly measure $\acute{Z}_{k}$. But, given bundled OJB, that limitation does not much matter. Optimizing worker behavior produces unit labor costs that are strictly greater than $((1+\gamma^{o}_{k})W^{m})/\acute{Z}^{m}_{k}$ throughout the range of available nonmarket wages ($W_{k}>(1+\gamma^{o}_{k})W^{m}$). The profit-seeking firm, therefore, effectively gauges its labor input ($\acute{Z}^{m}_{k}H_{k}$) by employee hours alone; and hours can be measured and priced in the marketplace.

Antoine Augustin Cournot, the nineteenth century French mathematician and economist, famously argued that, as firms become small relative to the market, their capacity to influence product pricing disappears. In the 21st century, generalizing exchange has identified a significant companion characteristic. As firms become (absolutely) small, their employees' capacity to influence their wages disappears. The marketplace's ability to govern product and factor pricing depends substantially on production scale, drawing uncomfortable attention to the problematic design of economic models that suppress technological heterogeneities.

Large Establishments

It has been demonstrated that, for large establishments offering class-I jobs, workplace exchange is rationally unbundled:

(8.7) $\acute{Z}_{j}=\acute{Z}_{j}(W_{j},W^{n}_{j},W^{m},\acute{Z}^{m}_{j})$, such that
          if $W_{j} \in [W^{n}_{j},W^{m}]$, $(\Delta\acute{Z}_{j}/\acute{Z}^{n}_{j})/(\Delta W_{j}/W^{n}_{j})>1$.

The employer and their employees simultaneously optimize labor pricing (at $W_{j}=W^{n}_{j}=\sup\mathbb{K}_{j}>W^{m}$) and worker OJB (at $\acute{Z}_{j}=\acute{Z}^{n}_{j}$). Profit-seeking management pays wage rents, resulting in job rationing.

Worker firm-specific human capital, the high incidence of which is characteristic of LEV firms, is embodied in labor hours only in the employing establishment, making E^{S}_{j} independent of

employees' market-opportunity cost. Optimizing management rationalizes its labor input along the two familiar dimensions:

- Optimizing $(\acute{E}^S/H)_j$ by managing employees' voluntary turnover; and
- Optimizing $(\acute{Z}/H)_j$ by managing workers' on-the-job behavior.

Managing voluntary turnover. The first class of management tasks is familiar from insider-outsider theories. In workplace-equilibrium theory, if employee discretionary OJB ($\acute{Z}$) remains constant, the difference between a veteran employee's labor-services input and the input of a (market-homogeneous) new hire, denoted by $\acute{\eta}$, is:

$$(8.8) \qquad \acute{Z}_j((E^Q/H)_j+(E^G/H)_j+(E^S/H)_j)-\acute{Z}^{\acute{\eta}}_j((E^Q/H)^{\acute{\eta}}_j+(E^G/H)^{\acute{\eta}}_j)=\acute{Z}_j(E^S/H)_j.$$

The replacement of a veteran worker with a new hire implies the loss of specific human capital for both the employee and the firm. For large establishments, $(\acute{E}^S/H)_j$ represents the firm-specific knowledge necessary to support specialized production and is intuitively posited to substantially exceed $(\acute{E}^S/H)_k$. [10] The rational response is to pay a small wage premium:

$$(8.8) \qquad (1+\gamma^o_k)W^m<(1+\gamma^o_j)W^m\leq G(t)W^m.$$

Replacement costs in the *j*th-venue, once amortized, help fund significant nonmarket wage premiums that reduce (non-retirement) inefficient voluntary turnover.

In the most important implication for the proper management of $(\acute{E}^S/H)_j$, the specific human-capital wage differential that discourages voluntary turnover in small firms is typically redundant in large, specialized establishments. It is subsumed in the larger nonmarket wage rent $(G_j(t)=W^n_j(t)/W^m(t)=G^T_j(t)+G^V_j(t))$ that results from optimizing employee-employer behavior in the circumstances of costly, asymmetric workplace information and consequent agency problems. In the model, as in practice, voluntary turnover is much lower in large, specialized establishments than in small firms.

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[10] It follows that $\gamma_o=(((P_k(0)/W^m(0))\sum(1+\textit{r}+p)^{-t}(E^S_k(0)/H_k(0)))$, where $\textit{r}$ and p are the constant discount factor ($\textit{r}\in(0,1)$) and expected inflation rate respectively; and the series is summed from t=0 to $t=\varkappa$, the expected employee tenure at the firm.

Managing behavioral efficiency. Formal workplace analysis assigns a critical role to the wage-rent variant of the classic hold-up problem. It has been demonstrated that, as part of the ongoing employer-employee contest over residual rents, large-establishment management rationally invests in efficiently responding to the importance workers' attach to $\mathbb{K}_j$. Less emphasized in the macroeconomic analysis, firms also invest in the capacity to influence the calibration of $\mathbb{K}_j$.

Workplace-equilibrium modeling has identified two classes of actions that introduce malleability in $\mathbb{K}_j$ and, therefore, unit labor costs:

- Employment downsizing, eventually inducing employee $\mathbb{K}_j$ recalibration (derived from intertemporal choice balancing wage rents and jobs); and

- Technical change, broadly defined to include innovations in (a) products and production processes, (b) management methods and procedures for organizing employee OJB, and (c) contract design.

Technical change, typically held constant in workplace-equilibrium modeling, can alter workers' capacity to develop and maintain interpersonal and intertemporal reference standards and is at the heart of a more fulsome examination of the rational management of labor input in large establishments offering class-I jobs.

IV. MORE ON MANAGEMENT IN LARGE ESTABLISHMENTS

The rational management of large-establishment worker OJB produces some of the most consequential nonmarket behavior in economic analysis. The formal modeling of that behavior is divided into four parts. First, workplace reference standards ($\mathbb{K}_j$) are provided the larger context of social capital, an established and useful concept in sociology. Social capital is used to help understand workplace mechanisms of exchange and firm policies with respect to OJB supervision and voluntary turnover. Next, the firm's employment policy is examined with particular attention to the incentives it generates, covering downsizing, management investment in workers' trust, change of control, and the role of labor productivity growth.

In the third part, attention turns to relevant technical change. Technical characteristics that hinder the establishment and maintenance of interpersonal and intertemporal reference standards are reviewed, and product, process, and workplace-organization technological change and its effect on the management of employee OJB are outlined. Fourth, contract-design technology is illustrated by piece-rates, gain-sharing, and two-tier wage structures, followed by a section on the record of limited of workplace innovations. In closing, the significance of reference-standard heterogeneity is briefly summarized.

Workplace Social Capital

Social capital. Firms encountering unbundled OJB rationally seek to manage workplace specific capital ($\mathbb{K}_j$), which is an unfamiliar concept to economic theorists. The basic idea, however, has engaged scholars in other disciplines. In an article that stimulated substantial interest outside economics, the late James Coleman – a rational-choice sociologist – modeled a more general process, which he named *social capital formation*. Characteristics of social capital include being part of a group where (a) members are trustworthy, fulfilling obligations and meeting expectations, (b) networks transmitting valuable information are formed, and (c) a set of success-oriented group norms and sanctions to enforce them are established. (See Coleman (1988).) In a nod to the substantial work done by sociologists on spontaneous organization, *workplace social capital* is used synonymously with $\mathbb{K}_j$.[11]

Joel Sobel (2002) has provided a summary of the analysis, albeit nascent, of social capital by economic theorists, using a concise working definition: "Social capital describes circumstances in which individuals can use membership in groups and networks to secure benefits." $\mathbb{K}_j$ is understood to be an establishment-specific, workplace application of the social-capital concept. Laurence Prusak and Don Cohen (2001, p. 92) conducted a three-year study of managerial

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[11] In Chapter 2, reference standards reflecting workers' preference for fair treatment were expressed in terms of job inputs ($\mathring{I}$) and outcomes ($\mathring{O}$), where the definitions of *a*, *b*, and *c* are unchanged. Formally, there exists a set of pairings of workplace outcomes and inputs $\mathbb{K}_{ij}=\{\mathring{O}^a_{ij}/\mathring{I}^a_{ij}, \mathring{O}^b_{ij}/\mathring{I}^b_{ij}, \mathring{O}^c_{ij}/\mathring{I}^c_{ij}\}$, demonstrating completeness and transitivity, for which employees' preference for equity is satisfied by the set's least upper bound: sup $\mathbb{K}_{ij}$. It deserves reiteration that the instinctive preference for equity (and the taste for redress of unfair treatment) is increasingly understood to be an outcome of evolutionary biology, having been embedded in neural networks as humans adapted to survival advantages available from group cooperation. From a prominent neuroscientist: "Our instincts for sensing and responding to fair exchange evolved in a social environment where tit for tat was king. What you did to me today was coming back to you tomorrow in kind." (Montague (2006, p. 186).)

activities designed to influence social capital formation, identifying its strong link to firm-specific human capital: "Organizations live by their social norms and values. 'The way things are done around here' and 'what we care about' define organizational identity and functioning. Organizations with high social capital have strong norms of cooperation. When employees are faced with adversity or opportunity, their knee-jerk impulse is to pull together."

Workplace-equilibrium modeling has adapted the social-capital framework to the formal economic method of optimizing, price-mediated exchange. Rational employees spontaneously establish and propagate group reference standards and, in appropriate circumstances, revise them. The exclusion principle limits workers' capacity to alter the norms that govern workplace behavior. But, given sufficient incentive and organizational help from management or a union, $\mathbb{K_j}$ can be recalibrated.

Mechanisms of workplace exchange. Labor pricing in the large- and small-establishment venues is the outcome of exchange-mechanism sets that greatly differ. Those mechanisms settle prices and arrange what is exchanged for what, where the exchange occurs, and when. It is useful in the context of management modeling to briefly review the earlier analysis of the intentional mechanics of workplace exchange.

Small firms have been shown to rely on labor prices resulting from market discovery. In specialized, large establishments, by contrast, workplace exchange is formally managed by intra-firm institutions that are shaped by unbundled OJB as well as inherent moral hazard. Workplace mechanisms that arrange and price the fundamental exchange of worker cooperative effort (job inputs) for monetary and nonmonetary compensation (job outcomes) are readily apparent. Departments specializing in human resources and wage administration, operating under the direction of senior management, are never absent in large establishments.

A critical responsibility of those corporate specialists is to understand the firm's employees, both their preferences and their capacity for (adverse) feedback with respect to management decisions. The task is to identify the relevant Workplace Exchange Relation of the early efficiency wage theorists. Within the context of the firm's working model of its employees, the

departments set wages and formulate/implement formal workplace rules, perhaps in a bargaining framework with a union. The optimizing activities have differing periods. Adjusting wage and benefit schedules is typically an annual exercise, while the administration of workplace rules occurs day-to-day. Particular attention is paid to job satisfaction. The evidence shows that department administrators, in consultation with senior management, use wage-setting practices that rely more on job-evaluation programs (maintaining established interpersonal reference standards) than on market-wage surveys. Jobs are defined with associated rates of pay; ports of entry for new hires (typically less desirable positions) are typically used; rules (providing a key role for seniority) governing the internal access to more desirable jobs are designed and used; formal grievance procedures are established. As noted, due-process rules (especially with respect to discharge for cause) are the norm, effectuating "…standards of equity that a competitive market cannot or does not respect."[12]

From John Dunlop (1988, pp. 47-48): "Every workplace of size that persists over time develops and in turn is governed by its industrial relations system. Such a 'web of rules' emerges irrespective of labor organization or collective bargaining; no continuing workplace is ever truly unorganized. While there are literally scores of these rules in any workplace, the following headings provide some indication of their principal features: (1) Wage level and job classification structure and method of wage payment; (2) Fringe benefits: holidays, vacations with pay, health and welfare, pensions, *et cetera*; (3) Internal labor market movements: hiring, transfers, promotions, temporary layoffs, leaves, permanent layoffs, retirement; (4) Hours and shifts, overtime and premiums; (5) Manning rules; (6) Safety and health; (7) Discharge and discipline; (8) Dispute resolution procedures; (9) Status of worker and management (and government) organizations and representatives; (10) Special rules shaped by the particular technology or markets."

Worker supervision and quits. Large-establishment workplace information costs and asymmetries imply inherently imperfect monitoring, providing latitude for workers to vary their

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[12] Doeringer and Piore (1971), p.29. Another important reason that managers care about nonunion worker satisfaction is the threat of formal organization, which in the United States depends on the outcomes of NLRB-supervised elections.

OJB in the pursuit of their own interests and making the duties of management more complex. Costly, unbalanced workplace information is posited to restrict the productivity of direct monitoring sufficiently that firms do not use it as a primary OJB constraint, relying instead on indirect incentives (including wage rents) to influence worker behavior.

Employment Policy

Job destruction.   Management's optimal employment policy plays a central role in dynamic workplace equilibrium and was modeled in Chapter 3. Here, it is sufficient to outline the moral-hazard problem that limits the effectiveness of the job-destruction threat to induce $\mathbb{K}$ malleability.[13] Downsizing programs, and the inadequate nonstationary residual rents that motivate them, provide management an opportunity to shape worker expectations with respect to their employment and income in the attempt to encourage recalibration of established workplace reference standards.

More activist strategies attempting to manage the hold-up problem, however, are constrained by moral hazard. Given information asymmetries, the different goals of employees and their employer necessarily limit mutual trust.[14] Wage cuts that reduce unit labor costs require careful planning and execution to assure that the workforce is amenable. Management does not expect changes in established workplace reference standards in response to high-frequency fluctuations in nominal product demand.[15] Given more time to influence $\mathbb{K}$, the firm still must provide its

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[13] Nonintuitive assumptions used in modeling endogenous $\mathbb{K}$ are usefully modified. Firm-specific job losses are allocated by seniority, not randomly; free riders exist; and, given moral hazard, worker rational expectations are myopic, not model-consistent.

[14] Freeman and Rogers (1999) asked a large sample of workers: "How much do you trust your company/ organization to keep its promises to you and other employees – 'a lot,' 'somewhat,' 'only a little', or 'not at all'?" (p. 45) They found that "… two-thirds trust their company only somewhat, while one-fifth trust it only a little or not at all." (p. 45)

[15] A third option, which avoids wage cuts and layoffs while remaining consistent with the universal employee preference for fair treatment, is *Kurzarbeit* (or "short-work"). In several European countries, the customary response to a reduction in nominal demand is to avoid layoffs by broadly reducing working hours – an income loss which public subsidies largely replace. In Germany, for example, the government pays affected workers roughly three-fifths of their lost salaries. (Undergoing training programs often enables employees to maintain their pre-recession incomes.) Worker acceptance of this arrangement as equitable is a product of European institutional history, including centralized bargaining (see Chapter 7) covering most employees, that would be difficult to recreate in countries such as the United States.

inherently distrustful, myopic employees substantial, clear evidence of sizable and permanent job loss before they conclude that their wage rents are irrationally large.[16] Meanwhile, the firm may be cutting other costs – curbing investments in research, plant, equipment, training, marketing efforts, and so on – to protect its near-term residual rents and market valuation.

Investing in credibility. The workplace-equilibrium analysis has identified an omnipresent management strategy in large establishments to ameliorate moral hazard by building trust among its employees and thereby increase its capacity to influence OJB and the calibration of workplace social capital ($\mathbb{K}$). The strategy's centerpiece is general investment in equity-based personnel practices, recognizing the central role of fair treatment in the evolution of human preferences. (See Montague (2006).) It follows that profit-seeking firms design workplace rules to promote fair treatment in compensation, promotion, layoffs, and other elements of job outcomes and inputs. Monitoring plays a subsidiary role; discharge for cause is a rare, near-judicial procedure.

Management's expected returns from greater influence over workplace social capital are increasing in labor rents. Rising wage premiums put upward pressure on job-loss probabilities resulting from management strategic choices: substituting capital for labor, moving the production establishment to more hospitable market circumstances (including out of the country), and outsourcing labor functions to vendors with lower costs. Those response classes will be considered in more detail below; for now, suffice it to note that, absent substantial management credibility, there is a lagged acceptance by workers of the likelihood of substantial job downsizing.[17] $\mathbb{K}$ flexibility is frequently too little, too late – and workplace morale too damaged – to save many jobs.

Change of control. Returns from management investment in influencing $\mathbb{K}_j$ improve when there is a change in control of the firm. Acquisitions and mergers, as well as corporate break-ups,

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[16] If the permanent job loss has, over time, become persuasive, workplace-equilibrium theory indicates that worker $\mathbb{K}$ calibration becomes more malleable. Sufficiently convinced employees will accept wage cuts with relatively modest protest – a prediction that is consistent with the evidence. Blanchflower (1991), for example, found (using U.K. data) a negative association between (i) employee assessment of the likelihood of his or her work establishment closing and (ii) the employee's actual wage change.

[17] Worker heterogeneity, if (as is likely) permanent job loss is allocated by seniority, will also slow rational $\mathbb{K}_j$ recalibration.

produce pervasive job insecurity within organizations, providing a window of malleability in the calibration of workplace social capital.

Instant downsizing credibility helps explain why take-over specialists can offer market-price premiums for their targets. Equity-market valuations are rooted in cash flows that are restricted by a hold-up problem rooted in established $\mathbb{K}$. New management has more latitude to alter workplace standards and operate the establishment more efficiently. The more robust cash flows frequently become the basis for an IPO, completing the cycle.

Role of productivity.   A condition of workplace equilibrium in large or effectively unionized establishments is the payment of variable, typically substantial, wage rents ($W^n_j > W^m$). Managers in such circumstances still have room to manage. The analysis emphasizes that profit-seeking firms are interested in unit labor costs, not labor prices. Once employees are receiving nonmarket reference wages, productivity growth becomes an especially important channel for controlling labor costs.

Firms rationally invest in retaining the capacity to manage productivity, including the introduction of capital equipment, new technologies, novel workplace organization, and downsized (or outsourced) operations. For example, managements rationally invest in raising the costs of union organization campaigns. Non-union large firms often pay wage rents that are consistent with relevant union reference standards (and adopt equity-based work rules and practices) in order to discourage formal workplace organization and protect their latitude to manage labor productivity and its effect on unit costs.

Technical Change: Factors Hindering $\mathbb{K}$ Investment

Investigating the role of technical change highlights the process of establishing and maintaining $\mathbb{K}$. Workplace-equilibrium modeling has identified a primary set of interrelated factors that hinders (to a greater or lesser degree) the spontaneous adoption and maintenance of workplace reference standards:

- Work establishments that are small;

- A low ratio of firm-specific to general human capital, making new hires more easily substitutable for veteran employees;

- Production functions that are separable with respect to the contribution of individual workers, reducing the synergistic task performance;

- Production that accommodates technological advances in worker supervision ($\acute{Z}^m_j$), e.g., recording systems that effectively monitor call-center employees;

- Class-II jobs in which employees derive relatively substantial satisfaction from their performance of work tasks; and

- Work establishments that have experienced substantial permanent job loss or, more generally, a significant increase in employee perceptions of job insecurity.

A secondary set of factors that tend to hinder Ҡ establishment and maintenance also follows from the analysis:

- Greater management credibility with its employees;[18]

- Firms that are recently established and non-union, having accumulated relatively modest workplace social capital;

- Types of general human capital experiencing relatively rapid growth in market-opportunity costs, dominating other (interpersonal and intertemporal) reference standards; and

- Creative exploitation of employees' inherent desire for equity.

In workplace-equilibrium analysis, technical change reducing establishment size, increasing production-function separability, enhancing workplace monitoring, decreasing factor specificity, raising the incidence of inherently satisfying work tasks, creating new firms and skills, making management more credible with employees, or increasing job insecurity diminishes workplace hospitality to spontaneous worker investment in and maintenance of $Ҡ_j$. In economies

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[18] Simon (1991) argued that firms' agency problems are frequently best dealt with by investing in attempts to change worker preferences, usually to facilitate their identification with the objectives of management.

experiencing sufficient incidence of such technical change, rational labor pricing (in the absence of government-dominated centralized collective bargaining) becomes less accommodating to rents and downward rigidity, improving macroeconomic efficiency.

Technical Change: Product and Process Innovations

Wage behavior, on average, was not the same before and after the industrial revolution. And, albeit more modestly, it will not be the same after the information-microelectronic revolution occurring today. For example, Carnoy (2000, p.56) concluded that the new micro-electronic technologies have created a new class of workplace. "Firms demand higher skills, self-programming ability, individual responsibility, and a willingness to work longer hours." In the language of workplace equilibrium, product and process innovations have in some applications generated an increased ratio of general to specific human capital, greater production-function separability, and more flexibility in work-task performance. Such employment is more easily monitored, more intrinsically interesting, less likely to be long-tenured, and (as a result) less likely to support spontaneous investment in $\mathbb{K}$. It is additionally unlikely to reach relatively large size.

Product-market disruption. Technological revolutions are most disruptive to established firms. New product competitors are created, altering market landscapes. If the capacity of spontaneously organized industry wage-setting practices to influence product pricing is diminished, existing firms will confront greater downward pressure on residual rents, creating the need to reduce costs and eventually downsize.

Production-process disruption. By their nature, the new technologies often translate into novel production processes. The information-microelectronic revolution occurring today has produced telecommuters, virtual team members, independent contractors, and laptop-linked traveling employees. An extreme example is the practice of "hoteling" employees who travel frequently, eliminating the one-person, one-desk workplace organization and providing temporary office locations to those who happen to be on-site, which must compromise the capacity of workers to

invest in $\mathbb{K}$. Such (admittedly atypical) organization would both inhibit the establishment of consensus workplace reference standards and make monitoring ($\acute{Z}^{\eta}$) more cost-effective.

More generally, a high ratio of general to specific human capital, the absence of synergistic team production, and significant intrinsic satisfaction from performing (usually self-directed) work tasks inhibit the capacity of many "new-economy" workers to spontaneously establish and maintain equity-based reference standards. Their reference wages ($\mathbb{K}$) collapse to the best alternative employment reference standards – i.e., the employee's market opportunity cost. If this class of workers grows large relatively to total employment (an unlikely outcome), macroeconomic characteristics of wage determination would change proportionately.

Technical Change: Workplace Organization Innovations

In the spirit of Alfred Marshall, who argued that production depends on land, labor, capital, technology, and organization, innovation can also directly alter the nature of labor management. In particular, novel methods of organizing work or building management credibility can be used to influence the establishment and maintenance of reference standards. Most notably, various types of workplace restructuring, utilizing the increasing body of knowledge about employee preferences as well as the nature, formation and maintenance of $\mathbb{K}$, can alter effective workplace size and production separability, the capacity to earn nonpecuniary satisfaction, the relative valuation of employees' fixed characteristics, and the ratio of general to specific human capital.

Ichniowski *et al.* (2000, p. 2) placed recent workplace innovations in a historical context: "What these diverse work practices have in common is that they depart from the traditional work systems and labor-management relationships that evolved in the United States out of the 'New Deal system of industrial relations'. The traditional system is characterized by tightly defined jobs with associated rates of pay, clear lines of demarcation separating the duties and rights of workers and supervisors, decision-making powers retained by management and the channeling of communications and conflicts through formal chains of command and grievance procedures. Current workplace innovations seek greater flexibility in work organization, cooperation between labor and management, and worker participation in the decisions and financial well-

being of a company." Four management strategies illustrate this (workplace-organization) class of technical change.

Flexible production processes. Some firms have reorganized production, partly to make work more interesting to their employees. Changes frequently include job rotation and team decision-making. Workplace innovation of this type has a number of variations and names, including "employee involvement", "quality of work life" and "high-performance work organization". Gershenfeld (1987, p. 124) provided an early definition: "… a structured, systematic approach to the involvement of employees in group decisions affecting work and the work environment with goals that include reducing product cost, improving product quality, facilitating communications, raising morale, and reducing conflict." The core idea is that more interesting, self-directed work provides employees greater satisfaction from their jobs, encouraging both working smarter and harder. Moreover, they are less likely to resent a job if they helped design it.

Within the framework of formal workplace equilibrium, such innovative practices can be understood as attempting to increase the class-II content of jobs.[19] Workers in class-II jobs rationally bundle their OJB and lack the capacity to defend interpersonal and intertemporal reference standards. Graham (1995) studied worker behavior at a Subaru-Isuzu factory, which used high-performance work organization. She found that, relative to traditional organization, employees tended to enjoy their work more and to identify more with their employers.

Outsourcing activities. Another strategy to hinder investment in workplace social capital is the outsourcing of work functions that are separable from the main operations of the establishment. The 1997 National Establishment Survey found that, since 1992, 38 percent of workplaces had outsourced activities that had previously been done in-house.[20] An observable variation of this strategy is to follow outsourcing with insourcing, then outsource again, and so on – an apparently inconsistent strategy that makes sense if management's implicit goal is to disrupt workers' capacity to invest in $Ҡ$.

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[19] More flexible production processes, especially those that emphasis more worker input to their operation and design, are also used to increase employee trust in management, which can increase its capacity to influence $Ҡ$.

[20] Osterman (1999), p. 105.

Second-class workers. A number of firms have also learned to exploit the heterogeneous nature of work within their establishments. Some jobs require relatively little firm-specific human capital, while others require substantial sunk investment in knowledge and skill. Building on that difference, some managements have organized separate long-term and short-term classes of employees. Their goal, from the perspective of workplace equilibrium, is to impede the transfer of workplace social capital from veteran workers to those new hires who require less on-the-job training and whose turnover is less costly, introducing more labor-cost flexibility into the firm.

There are, in practice, two types of second-class workers. First are classic temporary employees, working at one organization but on the payroll of another. Second are contingent employees, who are on the firm's payroll but their tenure is mutually understood to be temporary; they lack the formal and informal rights of regular workers. Temporary attachment constrains second-class employees' capacity to invest in sunk workplace social capital. Contact with veteran workers is limited, and regular employees are rationally reluctant to expend the effort to incorporate temporary workers into the informal organization of the workplace. The U.S. National Establishment Survey (sampling units with 50 or more employees), found that 87 percent of those using temporary workers reported their typical tenure to be less than a year.[21]

To reiterate, formal workplace economics predicts that second-class employees would be used in those parts of the production process where firm-specific human capital is less necessary and worker tenure can, therefore, be short-term with limited damage to productivity. An implication is that the incidence of firm use of such employees may be high but their share among total workers would be relatively small. The evidence supports that prediction. In the United States, half of all establishments with 50 or more employees used temporary workers in 1997, yet such workers only accounted for about 5 percent of the total workforce.[22]

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[21] Osterman (1999), p.104.

[22] Osterman (1999), p.103.

Contract-Design Technology

Performance pay. GWET emphasizes technologies in which the output attributable to individual employees is cannot be efficiently measured and, therefore, are not adaptable to the information requirements of piece-rate compensation systems. For example, team production characterizes most large-scale production. Most employees interact productively with colleagues; and most output reflects the contribution of multiple workers. Implicit production functions tend not to be separable into a series of additive functions, each involving only one employee. Available information does not support the assignment of final product reflecting the contributions of individual workers, greatly hampering the construction of an efficient contingent contract.

Another measurement problem is that it is frequently difficult to observe product quality. Generally, only some attributes of output can be measured accurately, if at all. If important characteristics cannot be measured adequately or in a timely fashion, piece-rate systems are substantially compromised. A pay standard that ignores product attributes that are costly to assess induces rational workers to modify their OJB in order to emphasize the characteristics that are highly compensated, harming the firm's overall efficiency and profits.

Piece-rate standards can also be costly to establish because of inherent moral hazard. The pure theory of risk bearing assumes that both parties to the contingent contract have the same information. But the worker typically knows his or her job better than the industrial engineer. The rational employee being paid piece-rate wages, therefore, may game the system, varying his or her OJB, for at least two reasons:

- To set a relatively favorable standard when under active observation by the industrial engineer or any other designer of the contingent contract, and

- To control production after the standard has been set so as to not attract the attention of management and risk having the terms of the contingent contract revised.

Finally, payment based directly on production tends to make employees of the same firm competitive with each other, resulting in behavior that is detrimental to overall establishment

efficiency. Generally, consistent with the OJB theory, piece-rate compensation systems appear to work best when work tasks are performed independently of a multiple-employee workplace environment (for example, sales personnel working alone). Lawler cites evidence that piece rates can decrease labor effectiveness when tasks require workers' cooperation.

Targeted, high-performance bonuses. Periodic payments over and above regular salaries, calibrated to particular employee performance, are a complex variant of piece-rates that is typically associated with highly compensated skill sets. The pay strategy is best understood in terms of work groups organized around the production of a particular product.

The total compensation of central players in the group, because of skill, leadership, and reputation, may reflect their market-opportunity costs. Other firms would be willing to employ them under similar arrangements to organize the same production, perhaps bringing along their customer base. Most of the remainder of the work group, however, earn wage rents as payment for their cooperative efforts with the highly paid group leader. GWET strongly indicates that the inherent preference for equitable treatment imposes an interpersonal wage structure on the group that mandates the payments of wage rents.

A beneficial feature for equity holders is that high-performance bonus payments are downward flexible when revenue and returns for the specific products deteriorate. Indeed, much of the design problem of bonus-centric contracts is to reflect the true return on the product, which may take substantial care and time to measure.

Gain-sharing. General profit-sharing arrangements are the most frequently encountered contractural innovation in large-establishment wage policymaking. The analytic framework is rooted in workplace information asymmetries, which are well known to produce non-optimal risk sharing in equilibrium. They are easily understood in the workplace-equilibrium framework. As modeled above, the reference wage provides a determinant labor claim on firm revenue. Profits *(Π)* are a residual, moving inversely with wage rents.

Shareholders are best understood to be displeased with the passive nature of their income determination. The residual profit share in the simple model is the repository of the all the volatility confronting the firm, increasing the likelihood of periodic losses. Management is rationally on the lookout for cost-effective wage-setting arrangements that allow some risk-sharing with their employees. In that search, the wage-policymaking problem is to change compensation practices without triggering adverse worker feedback.

An approach that has a substantial track record in specialized economies is to invest in convincing workers to adopt an additional reference standard, rooted in a preference for an equitable distribution of the Jensen residual (Π) described in Chapter 3 (equation 3.2):

$$\Pi_j(t) = P_j(t)X_j(t) - (G_j(t)+1)W^m(t)H_j(t) - \breve{r}^m(t)K^r_j(t) - P^{III}(t)\text{Ш}_j(t) = \Pi_j^T(t) + \Pi_j^V(t).$$

The variables are defined in the Glossary. Further define the residual profit share as $Ş$: $Ş_j(t) = \Pi_j(t)/(P_j(t)X_j(t))$. In practice, the additional reference standard is usually established by partitioning money compensation into the wage paid (W^n) and a periodic (usually annual) wage supplement. The latter is assumed to be an increasing function of $Ş$. Profit-based bonus payments introduce simultaneity in the determination of labor and capital factor-income shares.

Profit-sharing compensation plans are usually explained as an attempt to link worker performance to the performance of the firm. For the employee, however, that direct connection is usually muddied into incoherence by firm size and specialization, accounting procedures, information asymmetries, and external economic forces. Few workers believe that changing their individual behavior $\acute{Z}_{ij}$ has a discernible effect on reported profits. Despite that, profit-contingent modifications to specialized-venue labor pricing can still be useful to firms. By utilizing worker preferences for fair treatment, profit sharing can introduce increased efficiency-wage flexibility and employee risk-sharing. If the firm can extend employees' standards of equity to the distribution of residual rents and, thereby, allocate a portion of labor compensation to profit-based annual bonus payments, a degree of $\mathbb{K}$ malleability (and labor-price flexibility) that respond to product-market forces are introduced into workplace equilibrium analysis.

Profit-contingent compensation plans are wholly confined to LEV establishments. There is little place for the approach in market-wage-taking firms. In order to understand such plans, their incidence and economic consequences, a well-motivated model of worker behavior on the job is required. Market models tell us little about profit-sharing.[23]

Two-tier wage structures. An aggressive innovation with respect to $\mathbb{K}_j$ management is the two-tiered wage structure – i.e., paying new workers a significantly lower lifetime wage profile than existing workers. From the perspective of formal workplace equilibrium, this strategy has several characteristics:

- The heterogeneities between veteran workers and new hires are greatly aggravated in the attempt to break down the low-cost (equity-based) mechanism of inculcating established workplace reference standards.[24]

- The firm still sets the new-worker compensation package significantly higher than his or her market opportunity costs ($G_{ij}>1$), frequently with a steeper age-profile as workers accumulate general and specific human capital.

- The firm still sets the new-worker compensation package significantly higher than his or her market opportunity costs ($G_{ij}>1$), frequently with a steeper age-profile as workers accumulate general and specific human capital.

- Interpersonal reference standards within the second-tier are carefully maintained in the firm's wage policymaking, as management attempts to focus employee attention on fair treatment relative to his or her own cohort and away from the older "grandfathered" workers (who will be declining, over time, as a share of the workforce).

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[23] There are two types of profit-sharing plans. Non-discretionary bonus plans avoid problems of interpersonal reference standards in the plan execution. Remaining problems are rooted in asymmetric information – in particular, worker trust in profit accounting as well as variable internal contributions to profits. Discretionary bonus plans attempt to better match productivity and reward but is subject to problems rooted in imperfect monitoring and interpersonal comparisons. Line managers in practice take possible adverse worker reactions into account when distributing bonuses.

[24] The management can then attempt to design revised wage age-profiles to exploit the now more costly, asymmetric workplace information about compensation practices.

- Management invests in convincing its newer employees that lower labor costs are necessary to preserve their jobs and associated wage rents over the longer term. Chapter 3 generally modeled the role of expected job downsizing in the rational recalibration of Қ.

While two-tier systems are most frequently introduced in financially troubled firms, sufficient job-security turmoil could exist in a profitable or growing firm (burdened with a high G_j) to encourage an aggressive, patient management to attempt the change. (Examples here include the job uncertainty created by mergers and acquisitions or deregulation; illustrative of the latter case, two-tier systems were not unusual among airlines in the 1980s.) Management understands that such an altered approach to labor pricing necessarily produces an extended period of difficult labor relations. The change puts especially great pressure on workplace mechanisms of exchange that are tasked to convince new employees that management's assessment of the job consequences of maintaining the original one-tier system is accurate.

GWET indicates that the expected benefit-cost ratio of a two-tier labor-pricing policy is increasing in the size of wage rents paid to veteran employees. It is consequently not surprising that the advent of concession bargaining in the United States in the 1980s, in the aftermath of a protracted rise in nonmarket wage premiums (see Annable (1984)) and consequent firm-specific job destruction in the large-establishment venue, included a notable increase in two-tier wage plans. (See Martin (1990).) Contemporaneous studies, however, showed spotty success from managements' efforts to convince employees of the beneficial job consequences of the revised pay schedules. (See Cappelli and Sherer (1990) and McFarlin and Frone (1990).) Negotiated two-tier wage structures declined after peaking in the mid-1980s but appear to have increased somewhat in the aftermath of the 2007-09 "great recession"

It is important to understand that, even when maintained, two-tier compensation practices do not move labor pricing back to the marketplace. Wage determination remains a workplace activity, producing variable, chronic wage rents from simultaneously optimizing wages and $Ź_j$ subject to the recalibrated workplace social capital. Indeed, it must be management concerns about endogenous worker OJB that motivate its preference for the inherently difficult two-tier system rather than simply imposing the lower wage profile on veteran employees.

Limited Adoption of Workplace Innovations

Despite broad experimentation with innovative work and pricing practices over the past quarter century in the United States and Europe, the fundamental elements of the 'New Deal' system of large-firm worker management remain largely in place. That system persists as the most appropriate large-establishment baseline context for the construction of an axiomatic theory of worker on-the-job behavior.[25]

Ichniowski *et al.* (2000) exhaustively reviewed evidence on the replacement of traditional workplace practices built on seniority-based wages (as well as layoffs and promotion), narrowly defined jobs, and strict but information-limited supervision with flexible job design, job rotation, and contingent-incentive compensation plans. The authors concluded: "The diffusion of workplace innovations is limited, especially among older U.S. businesses. Firms face a number of obstacles when changing from a system of traditional work practices to a system of innovative practices, including the abandonment of organizational change initiatives after limited policy changes have little effect on performance, the costs of other organizational practices that are needed to make new work practices effective, long histories of labor-management conflict and distrust, resistance of supervisors and other workers who might not fare as well under the newer practices, and the lack of a supportive institutional and public policy environment."[26]

John Dunlop (1994, p. 397) agreed: "In my view most of the changes in human resource policies that have taken place in recent years, particularly in large manufacturing, are very much the

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[25] It needs emphasis here that the fundamental elements of the baseline system of (large-firm) employee management critically include the medium-term capacity (motivated by firm-specific product-market forces and inadequate profits) to rationally recalibrate workplace reference standards.

[26] Ichniowski *et al.* (2000, p. 33). If there has been limited adoption of innovative workplace organization, why have labor economists paid so much attention to the phenomenon? In part, the attention appears to be the result of misunderstandings rooted in the absence of a neoclassical theory of on-the-job behavior. Absent such a theory and its identification of the role of long-lagged firm-specific job losses, it is difficult to explain the nature and timing of changing worker preferences and established workplace standards as well as wage givebacks – all of which have had increasing incidence in the aftermath of the sharply rising wage gaps associated with adverse shifts in the terms of trade and the slowdown in productivity growth in the 1970s and 1980s. Absent an adequate OJB theory, those changes would appear to be exogenous to the existing employer-employee relations system, leading to efforts to attribute them to changing organizational technology. The problem with that causal role is that workplace innovations (at least so far) have been too limited, too experimental and occurring in the wrong places to explain the incidence of ongoing reductions in wage gaps. Workplace-equilibrium theory has no such problems.

direct consequences of changes in the environmental or external setting – greater global competition, layoffs and the quest for job security, new technology, changes to accommodate inventory controls, and the influence of regulatory developments relating to such matters as affirmative action, pensions, and health and safety. With some exceptions, the basic structural features of the industrial relations systems and human resource policies have not fundamentally changed. In a relatively few cases, changes in management philosophy and collective bargaining policies have affected outputs and internal processes, but the main dimensions of the respective systems are relatively unchanged. There appears to be no widespread transformation in substantive human resource policies in process broadly, across various environments, in the United States."

Agency problems, given workplace information imperfections and the well-understood fundamental differences in employer-employee goals, are the most difficult and enduring of the limitations on workplace innovations that make $\mathbb{K_j}$ more malleable. Freeman and Rogers (1999, p.45) asked a large sample of workers: "How much do you trust your company/organization to keep its promises to you and other employees – 'a lot,' 'somewhat,' 'only a little', or 'not at all'?" They found that "… two-thirds trust their company only somewhat, while one-fifth trust it only a little or not at all." Even given sufficient time to recalibrate $\mathbb{K_j}$, employees still confront moral hazard in their relations with management, contributing to their need for substantial evidence of sizable and permanent job loss before they conclude that their wages are irrationally high. Meanwhile, the firm may be cutting other costs – curbing investments in basic research, plant, equipment, training, working capital, marketing efforts, and so on – to protect its near-term profits and market valuation.

Heterogeneous Reference Standards

Finally, it should be noted here that practitioners have discovered that the investment required to convince workers to accept revisions in reference wages depends on what standard is being violated. Recall the three fundamental comparisons important to employee satisfaction that motivate $\mathbb{K_j}$:

- *Best-alternative-job comparison.* This reference standard provides no latitude. Firm survival requires at least matching employee opportunity costs.

- *Interpersonal comparisons.* The evidence indicates that workers' attachment to interpersonal comparisons is particularly strong, indicating that the violation of this class of reference standards is interpreted as an overt, hostile action by management. Some boss decided to treat the employee unfairly. In workplace-equilibrium modeling, interpersonal comparisons motivate management's reluctance to cut nominal wages. Extraordinary coordination (perhaps including actions by other firms) is necessary to reduce nominal compensation without violating established interpersonal comparisons. Low incidence of wage cuts in large, specialized establishments is rational. (See Chapter 3.)

- *Intertemporal comparisons.* To employees, violation of this class of inside reference standards can reflect more passive management behavior. For example, permitting inflation to gradually erode real employee living standards is an act of omission by the firm, less offensive than the act of commission needed to cut nominal wages. Limited evidence indicates relatively weaker worker attachment to this type of reference standard.

The distinction between the two classes of nonmarket reference standards in $\mathbb{K}_j$ matters to the firm, especially with respect to how it manages employee OJB. Recalibration of norms rooted in interpersonal comparisons require relatively more investment in convincing employees to accept the wage-policy change as well as more hard evidence of prospective job losses. Revision of norms rooted in intertemporal comparisons, by contrast, require relatively less investment in convincing employees as well as less hard evidence of coming job reductions. Formal economic modeling predicts that nominal wage cuts occur but would be rare, much less frequent than wages that are less than fully compensated for price inflation.

Heterogeneity can also be usefully introduced with respect to the costs to the firm from the various types of actions taken to reduce cooperative effort. Most notably, organized work stoppages typically inflict more damage than spontaneous activities. Accounting for such

heterogeneities would significantly enhance the explanatory and predictive capacities of workplace-equilibrium theory.

V. MANAGEMENT, ORGANIZATION, AND PERSONNEL ECONOMICS

Management Preferences

The assumption that most restricts economic theory from the adequate study of management behavior in large corporations is perfect information between investors, the principals who own the capital, and their agents, who manage the enterprise. Penrose (1959) revived interest in the latitude that costly, asymmetric information available to equity owners provides to management. If principal-agent goals differ, economic theorists need to understand management preferences.

Management objectives. Baumol (1959) recognized the independence that specialization, scale, and investor asset-diversification provide owners' agents within firms and made a strong case for a primary management preference for enterprise growth, constrained by equity returns adequate to insure investors' complacency. Believing Baumol underestimated the general difficulty of placating investors, Marris (1964) placed greater emphasis on equity-return restrictions on management latitude, helping to motivate significant work on the disciplinary role of corporate takeovers. (See, for example, Jensen and Meckling (1976) and Grossman and Hart (1976).)

TVGE modeling contributes to that literature. Given that takeovers generate uncertainty about job prospects in the merged enterprise, the threat of permanent job and labor-rent loss makes employees more amenable to recalibrating established wage standards ($\mathbb{K}_j$). Lower unit labor costs imply higher expected residual rents ($I\!I_j$), helping to explain why acquiring firms are able to rationally pay a premium over the market price of the firm's sunk capital. Formal workplace equilibrium helps us understand that takeovers inject some equity-friendly flexibility into the hold-up problem, making the unencumbered buying and selling of existing corporate assets compatible with target equity-holder's interests. Relevant here is the practice in some countries of imposing substantial administrative and legal costs on firms that downsize jobs. Generalized-

exchange modeling demonstrates how government restrictions on job destruction produce hold-up problems that enhance $\mathbb{K}_j$ durability and increase longer-term market inefficiency.

Herbert Simon. Simon was a giant in the systematic analysis of behavior inside large, complex establishments. His *Administrative Behavior* (1947) emphasized managerial decision-making, shaped both by inherent uncertainty and heterogeneous interests of the various classes of stakeholders in the large enterprise. Putting useful content into Chandler's new corporate forms that became dominant in twentieth-century economies, Simon argued that the objective of top corporate leadership becomes a division of residual rents that is acceptable to competing stakeholder interests, including but not limited to equity owners. In support of that thesis, Simon famously defined *satisficing* behavior, rooted in bounded rationality. (See also Cyert and March (1963).)

With respect to workplace equilibrium, satisficing can also be extended to worker OJB, describing the "realistic-assumption" case in which myopic expectations governs employee acceptance or rejection of management prognoses of job destruction. Simon would have been pleased with this application of his behavioral goal because employee-employer trust plays a central role. For the most part, however, stabilization-relevant TVGE modeling is surprisingly unburdened by myopia. Indeed, for most of what interests macroeconomists, two-venue macro modeling with its dominant workplace equilibrium and chronic variable market disequilibrium permits, with little results distortion, the use of the economic method of optimizing, continuous-equilibrium exchange. Generalized exchange microfounds more powerful coherent macro modeling than variants motivated by satisficing.

Simon importantly provided analytical roots for formal workplace-equilibrium analysis. He argued that "role personification" cognitive mechanisms motivate employee loyalty, defined as the general acceptance of management goals, in work environments generally perceived to be equitable. Simon understood that fair treatment is a necessary condition of employee-employer trust and that the loyalty resulting from that trust plays a crucial role in the enterprise's prospects.

Fritz Malchlup. In an attempt to reconcile the managerial (organizational) approach with the neoclassical analysis of textbook economic theory, Malchlup (1967) anticipated important TVGE themes. He argued that the existence of large profit margins provides the context for management efforts to satisfy the claims of various stakeholder groups associated with the firm. But, in circumstances of chronically adverse revenue or cost developments that erode profits sufficiently to begin threatening enterprise survival, management behavior reverts to closer adherence to marginalist tenets.

Malchlup provides something of a full circle here. Recall that he was a young participant in the Vienna coffee-house debates about Walrasian general market equilibrium that informed the continental tradition.

New Institutional Economics

Stepping back from Simon's contribution, workplace-equilibrium theory is generally recognized to be foundationally related to Ronald Coase's modeling of the rational choice between organizing transactions in a market or inside a firm. (See above.) With Coase (1937) as a starting point, new institutional theorists have pursued two, interrelated research agendas.

The first investigates contracting difficulties caused by costly, asymmetric intra-establishment information, seeking to explain regularities in the internal organization of firms. As already noted, Alchian and Demsetz (1972) provided path-breaking economic analysis by interpreting the firm as a monitor of inputs, a task that is complicated by its limited capacity to identify individual employee's E. Meanwhile, the second research program has used modern property-rights theory to investigate Coase's central question about the determinants of rational boundaries of a firm. Building on the incomplete-contract modeling of Grossman, Hart, and Moore, this approach has modeled, in the context of hold-up problems, the role of asset ownership in the capacity to influence incentives.

GWET enriches both classes of institutional research, identifying formal links to labor and industrial-relations analyses. With respect to internal organization of large, specialized

establishments, the introduction of the Kerr, Dunlop, *et al.* tenet that employees strongly prefer fair treatment by management makes rational workplace exchange (the simultaneous optimization of labor pricing and on-the-job behavior) consistent with the payment of nonmarket labor rents. As a result, the implications of OJB measurement costs go well beyond the need to internalize contractural externalities. In GWET, rational employer-employee interaction occurs in the context of continuous workplace equilibrium that dominates labor-market equilibrium and accommodates wage rigidities and involuntary job loss, microfounding policy-relevant formal macroeconomics.

With respect to the role of asset ownership, the introduction of workers' preference for fair treatment in the context of costly, asymmetric workplace information deepens our understanding of hold-up problems that are inherently associated with firm-specific investments.[27] In particular, in its modeling of intertemporal choice balancing job destruction and wage rents, GWET identifies an endogenous stochastic hold-up class that plays critical roles in optimal intra-firm behavior and enterprise size. Both production-capacity increases (via new capital investment) and decreases (via layoffs and job downsizing) are made consistent with continuous equilibrium, an important achievement for the formal economic method.

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[27] The preference for fair treatment contrasts with the ubiquitous assumption in formal theory of strictly decreasing utility in work effort, which industrial-relations scholars know to be false. Distaste for cooperative physical-effort is different from, and less readily motivated than, the employee's preference to be somewhere other than on the job. Practitioners argue that, once at work, loafing may make the worker's experience less satisfactory and his or her time on the job go more slowly. There is, on the other hand, ample documentation of employee dislike of significant work speed-ups. Some analysts have suggested a middle ground. Leibenstein (1976) argued that workers have a "comfort effort range" within which they can vary $\acute{Z}_{ij}$ without affecting their utility. Simon (1951) defined a "zone of acceptance", which he later summarized: "An employment contract contains all sorts of implicit (and explicit) limitations that set boundaries to the range of actions the employee will be directed to perform. These boundaries define the 'zone of acceptance' within which an employee can be expected to obey orders. The zone of acceptance is also sometimes called a 'zone of indifference', for the choice among alternative behaviors, while of major importance to the employer, may be of little or no concern to the employee." (Simon, 1991, p. 31) If work speed-ups push employees outside their indifference zones, latent preferences to shirk are activated. More generally, Simon and his colleagues, in modeling organizations, did important empirical work on the administration of and decision-making in complex, large firms. That evidence supports the existence of substantial worker zones of independence. "In most organizations, employees contribute much more to [firm] goal achievement than the minimum that could be extracted from them by supervisory enforcement of the (vague) terms of the employment contract. Why do employees not substitute leisure for work more consistently than they do? Why do they often work so vigorously for the welfare of the organization?" (Simon, 1991, pp. 32-33)

Personnel Economics

GWET is also recognized to be part of a more general research effort by economic theorists who are using the economic method of optimizing, price-mediated exchange to investigate human-resource management, most notably including "personnel economics" associated with the extensive work of Edward Lazear.[28] Both personnel-economics and workplace-equilibrium model classes are constructed in a continuous general equilibrium framework featuring utility functions, production functions, and agents' ability and willingness to substitute.

Lazear and Shaw (2007, pp.91-92) provide an overview of the personnel-economics modeling of workplace behavior: "Four primary building blocks from economics form the foundation of personnel economics: First, personnel economics assumes that both the worker and the firm are rational maximizing agents, seeking utility and profits. Of course, the economic approach allows for constraints or imperfections, such as imperfect information and transaction costs, and permits an individual's utility to be influenced by a variety of factors such as personal identity, competition, and peer pressure. Second, personnel economists assume that labor markets and product markets must reach some price-quantity equilibrium, which provides discipline for our models. Third, efficiency is a central concept of personnel economics. In many circumstances in which inefficiencies arise, the economists pushes the analysis to another level by asking where equilibrating market forces might have failed, and asking what actions firms and/or workers might take to reduce the inefficiency. Fourth, personnel economists emphasize the use of econometrics and experimental design to identify underlying causal relationships."

The most significant difference between the personnel-economics and GWET model classes is rooted in the second building block. Personnel economics is constructed on the assumption of dynamic general market equilibrium, which then provides workplace modeling its dominant equilibrium. GWET analysis, by contrast, is more ambitious, constructing a separate (workplace) venue of optimizing decision rules, constraints, and mechanisms of exchange in which to better embed their models. The marketplace-workplace venue separation becomes fundamental with

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[28] Lazear (1995, p.2) once described the primary goal of personnel economics: "… to find simple models that do well in describing important components of worker behavior."

the demonstration that general workplace equilibrium dominates general marketplace equilibrium. [29] Indicative of this difference, Lazear never cites Kerr, Dunlop, and the other middle-20th century labor economists who were the first to analyze large-establishment workplace behavior from a (literary) neoclassical economic perspective.

Personnel economics centrally features Lazear-Rosen (1981) tournament theory in its modeling of endogenous employee behavior. That model focuses on the substantial wage gains typically associated with promotions entailing greater management responsibility and is, therefore, limited to the OJB of employees who reasonably aspire to move up the firm's leadership hierarchy. From Lazear and Shaw (2007, p.94): "Tournament theory begins with the notion that prizes are fixed in advance…. Winning that salary depends on relative performance. Individuals are promoted not because they are good, but because they are better than others in the relevant group."[30]

GWET, by contrast, informs a different branch of human-resource economics by formally deriving workplace equilibrium from the optimizing behaviors of nonsupervisory, production workers and their employer.[31] The conduct and pricing of that large class of employees is neither explained nor predicted well by the tournament approach. Most problematic, few wage-earners reasonably aspire to move up the firm's leadership hierarchy; they understand, correctly, that they are not contending for the big paydays "won" by promoted managers. In a related problem, specialized-workplace information asymmetries produce monitoring limitations with respect to nonsupervisory, production workers that are inconsistent with tournament theory.

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[29] Formal separate-venue workplace analysis (Annable (1977, 1980, 1984)) slightly predates Lazear's work (Lazear, (1979); Lazear and Rosen, (1981)). Personnel economics generally emphasizes how the economic method can help elucidate and guide the choices facing human-resource managers, while the Workplace-Equilibrium Project focuses on how the optimizing workplace choices by employers and employees uniquely microfound policy-relevant macro theory.

[30] Promotion tournaments, motivated by promotion decisions requiring close evaluation of OJB, provide employees incentives to behave well in their jobs.

[31] More than 80 percent of U.S. private, nonfarm employment is classified as nonsupervisory, production workers.

VI. CONCLUSION

This eBook, uniquely among macro texts, has paid a great deal of attention to the huge literature on purposeful behavior inside large establishments. Incorporating that knowledge into coherent economic theory required generalizing optimizing exchange from the marketplace to the workplace. The second transactions class became crucial after the Second Industrial Revolution but, until recently, has eluded rigorous economic modeling. TVGE theory has been constructed on proper axioms, uniquely producing continuous-equilibrium involuntary loss of jobs, wage income, and profits in response to adverse nominal-demand disturbances. A critical message of the past century is that adequate analysis in support of stabilization policymaking must be informed by the learning-by-doing that created the professional-manager class and continues to shape the governance, incentives, and organization of large, specialized work establishments.

The SVGE firm as an algorithm. Screpanti and Zamagni (2005) insightfully described the mainstream SVGE firm as constructed on three interrelated pillars. First is the dominant product- and factor-market competition that reduces management to an atomistic, passive role. Second is the general agreement that the long run is the sum of many short periods. Firms must maximize profit in each short period in order to optimize in the long run. The third restriction is the most nonintuitive of the three questionable assumptions to practitioners, i.e., the firm is a technological black box that automatically achieves best-case efficiency. Those analytic foundations provide no room for familiar problems that provide most of the content for the best-practices management literature.

From Screpanti and Zamagni (2005, p.414): "With such premises, [SVGE] theory … completely excludes any serious consideration of the dynamics and life of the firm. And in fact, this model, while having a great deal to say about the price system, has little to say about the process of competition among firms and their internal organization." They conclude: "… no attention at all is paid to the key role of management. It is obvious that in such a theoretical framework there is no place for the firm as economic institution: the firm is nothing more than an algorithm."

TVGE innovations. Generalized exchange provides a more accommodating platform for the analysis of firms and their management, especially the new corporate forms that today dominate global production. The workplace venue is readily extended to incorporate the broad range of rational intra-firm decision-making that links the modern best-practices management literature to coherent macroeconomic theory.

TVGE innovations so far have centered on rational labor management and employee reference standards maintained by workplace specific capital. In large establishments, workers' urge to compare influences $\acute{Z}_j$ and hinders labor-price adjustments to changing market conditions. Workplace optimization, however, does not produce wages that are inherently downward inflexible. Generalized exchange identifies two classes of purposeful action that introduce downward malleability of labor pricing into continuous model equilibrium. First, rational employees can recalibrate established $\mathbb{K}_j$ in response to job downsizing induced by inadequate firm profitability. Second, managers can organize (broadly defined) technical change, in both (a) products and production processes and (b) management methods and procedures for organizing employee behavior, that hinder the development and maintenance of workplace reference standards and nonmarket efficiency wages.

In practice, firm-specific job destruction has played the more substantial causal role. Chapter 3 demonstrated that, if agents are well motivated and rational, greater wage flexibility results from long-lagged firm-specific job losses. But, as has been emphasized, it is important not to give in to economists' urge to overstate this channel. Recalibrated labor pricing almost never eliminates labor rents; wage determination remains firmly located in the workplace, not the marketplace, and continues to produce meaningful rigidity. Moreover, some indicators used in the popular literature to suggest an increasing market role in large-establishment labor pricing are misunderstood, largely because they are not interpreted within a formal economic model.[32]

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[32] From Osterman (1994, p. 308): "There are several trends commonly remarked on that suggest that [the American model of workplace organization is] of diminishing relevance. These include growing white-collar and managerial layoffs, which erode stability in what has heretofore been the most secure segment of the labor market; the rise of contingent or temporary employment arrangements; an alleged growing reliance on educational institutions rather than firms for training; and the emergence of regional networks as the locus of careers, rather than single organizations." The TVGE model class easily accommodates those trends without diminishing the relative importance of workplace exchange. A much better indicator of a shift away from LEV workplace labor pricing would be reduced job tenure, which would indicate a substantial weakening of wage rents. Osterman reviews the

The second idea features evolving technology and involves modeling management and the optimal timepath of $\mathbb{K}_j$. In TVGE modeling, employers are one of four classes of investors (joining employees, unions, and government) in the capacity to influence the existence and calibration of workplace reference standards. Large establishments offering Class-I jobs must pay attention to the transformation of labor hours at work (H_j) into cooperative effort (E_j). Worker latitude on the job makes that transformation a complex process, which the labor market (unable to measure unbundled $\acute{Z}_j$) cannot price. That market failure forces employers to organize large, specialized workplaces, designing and operating firm-specific institutions that price, recruit, allocate, train, motivate and discipline employees. Optimizing human-resource management is partly rooted in a critical subset of rational decision rules and constraints (unique in formal economic theory to workplace-equilibrium analysis) that respond to and influence workplace $\mathbb{K}_j$.

Agency problems circumscribe management capacity to influence $\mathbb{K}_j$. If the relevant production process is characterized by input nonseparabilities and Class-I jobs, the employer's ability to shape workplace social capital is sharply restricted by moral hazard. Firms seeking to influence $\mathbb{K}_j$ must first invest in managing the inherent distrust of their employees. The ubiquitous strategy here is to construct administrative mechanisms of workplace exchange that promote perceptions of fair treatment. Equitable treatment is recognized in TVGE thinking and provides a partial solution to the employer-employee moral-hazard problem, building trust over time that allows workers to identify with management's goals for the organization.

Large establishments offering Class-I jobs, confronting unbundled $\acute{Z}_j$, must pay wage incentives governed by nonconvex feedback as well as construct administrative mechanisms producing equitable nonpecuniary workplace exchange. The activist firm is limited to (a) influencing the

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Current Population Survey results on job tenure over time by gender and age and found remarkably stable distributions over a period of substantial economic volatility. Workplace venues of labor-related optimizing activities, centrally organized around long job tenure, continue to be fundamentally separate from the market venue, featuring short tenure and unstable labor-force attachment. Moreover, the downsizing phenomenon that spread job losses to white-collar, managerial employees is indicative of permanent job destruction that is a necessary feature of TVGE thinking. Temporary layoffs, which are generated by adverse shifts in aggregate nominal demand, remain largely confined to production workers.

calibration of workplace reference standards, partly by investing in fair treatment and building employee trust or (b), more aggressively, directly targeting workplace information asymmetries and employee preferences by reorganizing work processes sufficiently to restrict worker capacity to establish and maintain $Ҡ_j$.

Osterman (1999, p.6), among others, has argued that a (partial) breakdown in the institutional framework of workplace exchange is occurring in the United States: "The institutional structure of the labor market operates at two levels. Somewhat abstractly, the term refers to shared rules, which can be laws or collective understandings, held in place by custom, explicit agreement, or tacit agreement. These shared understandings, or norms, can … have a powerful impact on behavior, and when the norms shift, behavior can change dramatically. At a more concrete level are the tangible institutions – unions, job-training programs, temporary help firms – whose activities influence labor market outcomes."[33]

Workplace structures have been analyzed within the TVGE framework, demonstrating that ongoing (abstract and concrete) changes are consistent with optimizing activities inside LEV firms. Production and organizational technologies influence employees' capacity to establish and maintain workplace reference standards, affecting the degree to which $Ź_j$ is bundled and, ultimately, the labor market's role in pricing worker hours. Formal economic theory, once enhanced by axiomatic modeling of well-motivated exchange, can provide a roadmap for thinking about and modeling organizational innovations that affect worker satisfaction, labor productivity, and wage determination.

In particular, workplace equilibrium helps us understand the erosion of established reference standards that has occurred over the past three or four decades in a variety of U.S. industries. The model indicates that the increased incidence of $Ҡ_j$ recalibrations has largely been the (long-lagged) rational consequence of wage rents that became large in the aftermath of the series of

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[33] Note the curious tendency of economists to refer to workplace exchange as a labor market, a practice that must confuse readers.

adverse terms-of-trade shocks that occurred in the 1970s and early 1980s.[34] Subsequent firm-specific job destruction was associated with outsourcing and downsizing that were, unlike parts of continental Europe, little restricted by government action.

The overriding message of this chapter, and the entire book, is the fundamental need of modern economic analysis for generalized exchange. TVGE modeling makes clear that recalibrating $\mathbb{K_j}$ does not reflect the wholesale transfer of wage optimization from the workplace to the marketplace. Reasserting market hegemony in large, specialized economies require that information asymmetries be corrected sufficiently to bundle employee OJB, eliminating effective workplace social capital, and is simply not possible. It is unsurprising that the evidence assembled by Ichniowski *et al.* (2000) suggests that a great deal of labor-price optimization still occurs inside firms. They found that, despite broad experimentation with innovative work practices over the past several decades, the fundamental elements of the "New Deal" system of large-firm worker management (practices including seniority-based wages, layoffs, and promotion; narrowly defined jobs; close supervision; and the general effort to encourage employees to identify with the employer's goals) remain largely in place. That system, even while being significantly recalibrated, persists as the most appropriate large-establishment context for the economic modeling of rational employers and employees.

Moreover, even in the unlikely event that product and organizational innovation eventually eliminates unbundled $\acute{Z}_j$ in some subset of large, specialized firms, TVGE analysis would still be needed to explain the altered propagation of macroeconomic shocks. Indeed, generalized exchange will always be needed to explain past, and predict future, changes in macroeconomic performance resulting from recalibrated $\mathbb{K_j}$. SVGE models, with their necessarily bundled $\acute{Z}_j$, are inherently inadequate to that task, making them over-reliant on the explanatory capacity of technological residuals.

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[34] Annable (1984) provides evidence on rising labor rents in the aftermath of the oil shock. The workplace-equilibrium theory also predicted, given that large-establishment employees digested the job-destruction message and its implications for time paths of consumption, subsequent adverse terms-of-trade shifts would not generate 1970s-style stagflation.

The management narrative. Workplace-equilibrium exchange becomes a necessary part of formal economic theory with, first, the rejection of a 1-1 technical correspondence between production and labor hours in the context of costly, asymmetric labor-management information and, second, the acceptance of behavioral economists' work on reconciling axiomatic worker preferences with psychological, neurological, experimental, and practitioner evidence, especially with respect to the evolutionary urge for fair treatment. Provided that intuitive starting point, labor pricing in large establishments offering routinized jobs must relocate from the labor market to the firm-specific workplace, where wages are jointly optimized with employee behavior. Relocation is necessitated by the market's inability to measure cooperative labor input, a failure that ultimately forces profit-seeking firms to pay workers variably more than their opportunity costs. Endogenous labor rents help reconcile the intertemporal maximization of employee utility and employer profits, producing a dynamic stochastic workplace equilibrium that motivates powerful macro outcomes, including involuntary job loss, the breakdown in the classical dichotomy, the repeal of Keynes's second classical postulate, and chronic labor-market disequilibrium. Meanwhile, the generalized-exchange economy remains in continuous, decision-rule equilibrium.

TVGE modeling also provides an analytic infrastructure capable of incorporating much of the modern research on the management and the organization of work into formal economic theory. The new workplace literature is important.[35] It is the surviving (albeit isolated) effort by economists to understand how employees behave on the job and should be more widely read and taught. The subset of economists interested in useful prediction and intuitive explanation must reject the ubiquitous fiction that this class of behavior can be harmlessly assumed away.

This chapter contributes to the development of formal workplace analysis by outlining lines of future research that permit rational management, in nonunion and unionized firms, to more aggressively influence unit labor costs. They can respond to wage rents by outsourcing separable labor functions (breaking them away from the influence of established $\mathbb{K}_j$), using temporary workers for low specific-capital functions, and generally downsizing (perhaps relocating) high-

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[35] Two high-quality examples are Osterman (1999) and Appelbaum *et al.* (2000).

cost operations. Workers' preference for equity can be used to implement gain-sharing compensation programs, reducing management's risk concentrations. Managers can additionally exploit information costs and asymmetries as well as worker heterogeneities to mask reductions non-wage costs (e.g., non-transparently altering health-care plans or switching from defined-benefit to defined-contributions pensions). Such aggressive management, however, must be undertaken with close attention to employee reaction, i.e. as part of the simultaneous workplace optimization of labor compensation and worker OJB, and requires concurrent investment in building employee trust.

Workplace-equilibrium modeling introduces labor management into the formal economic method of optimizing, price-focused exchange organized around continuous general (decision-rule) equilibrium. The enriched treatment of management preserves TVGE central conclusions, while providing economists a rich tapestry from which to mix and match simplifying assumptions to their particular object of analysis, substantially enhancing their capacity to explicate and predict economic phenomena.