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# 14 Labor Disputes and Productivity in Japan and the United States

Alice C. Lam, J. R. Norsworthy, and Craig A. Zabala

## 14.1 Introduction

The quantity of effective labor in the work force depends not only on the number of workers employed but on how hard they work. Many explanations of the superior performance of the Japanese economy stress this fact. Japanese workers seem more dedicated and motivated than their American counterparts. We examine this phenomenon by comparing the effects of worker attitude on productivity and production costs in the U.S. and Japanese manufacturing sector. The findings suggest that worker attitude affects economic growth.[1]

In analyzing the effects of worker behavior on automobile industry performance—total factor productivity, labor productivity, and total unit cost—for the 1959–76 period, we simulated the effects of a 10% improvement in worker attitudes on industry performance (Norsworthy and Zabala 1985b). We found that positive changes in attitudes would have resulted in substantial cost savings over the last two decades. In 1976, for example, the estimated cost savings for automobile manufactures were approximately $5.0 billion. We also investigated worker-attitude effects on the shadow value of total capital input, assuming a significant capital-using effect from negative worker behavior in auto plants (Norsworthy and Zabala 1985c). A 10% improvement in worker behavior would save between $1.0 billion and $6.0 billion between 1959 and 1979. Thus, poor worker attitudes caused a large capital-using bias in technology and, thus, increased capital requirements. These results are

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strong and suggest consideration of similar patterns in other models of production.

In this paper, we extend our method to study the aggregate manufacturing sectors of Japan and the United States using comparable worker-behavior data. We expect significant differences between these two countries in behavioral effects on productivity and costs because of differences in industrial relations, management systems, and other institutions. We also expect to find significant differences in investment behavior that affects productivity and cost performance, as found in Norsworthy and Malmquist (1983).

In the following sections, we first discuss differences in institutional settings and industrial relations practices. Second, we introduce the variables used to depict workers' attitudes toward their jobs; these variables reflect institutional and systemic differences between the two countries and describe the cost and output data. Third, we introduce the translog cost function model, which is used to estimate the effects of worker behavior on the cost of production. Fourth, we present the estimation results and compare the estimated influences of worker attitudes on manufacturing productivity in the two countries.

## 14.2 How Worker Attitudes Affect Productivity and Costs

Worker attitudes affect not only labor productivity but also the productivity of other input factors. The mechanisms by which worker attitudes affect productivity and costs is important. The transaction-costs literature discusses deals with "shirking" or output restriction by workers and argues that without very close supervision—in the limit, one supervisor per worker—the worker has discretionary control over the quality, and even the quantity, of effort and concentration applied to his job. There is scope for the worker to manifest dissatisfaction in various forms of low-grade sabotage (Zabala 1983, 1989), which may take the form of breakage (increasing materials costs), letting machines break down through inattention, omitted adjustment or maintenance (increasing maintenance and/or materials costs), and absenteeism (increasing labor costs). These behaviors will typically increase the costs of supervision. While some of behavior of this type may be partially unintentional, there is little reason to doubt that dissatisfaction or alienation will generally give rise to more of it, resulting in higher costs and possibly a reduction in the quality of output.

## 14.3 Institutional Setting of Industrial Relations

Many institutions created for the resolution of labor-management conflict in Japan and the United States have similar outward forms, due in large measure to U.S. influence on Japan's reshaping of its economic institutions in the decade following World War II (Hanami 1981). However, the Japanese union

movements and their respective relations with management are quite different and, consequently, have different historical experiences that may result in different workplace behavior. (Shimada 1982a). In Japan, there are two major labor federations with social as well as political agendas, while in the United States there is one major labor federation, linked principally, although not formally, to one national political party. Some 25%–30% of Japanese workers, mostly in manufacturing, are aligned with the conservative majority in the Diet. Public-sector unions are more militant and aligned with the minority left-of-center political parties.

There are other important differences between Japanese and U.S. institutional structures for managing labor-management conflict. While many U.S. manufacturing industries are organized by industrywide unions, such as the United Auto Workers, United Steel Workers, International Association of Machinists, and so on, Japanese manufacturing workers are represented by unions that typically cover only one large enterprise. Among small- and medium-sized firms, the pattern is different and more similar to the one in the United States. Under these circumstances, the Japanese union has less bargaining leverage in terms of political power. Outside manufacturing, industrywide unions are more common, and many are considerably more militant than the unions in the manufacturing sector.

Since the early 1970s, annual nationwide wage negotiations, called the *shun-to* (spring offensive), set general wage levels across industries; typically, the largest unions in industry negotiate rates at their firm. This is followed by pattern bargaining at other firms. Instead of mass strikes and production stoppages, the *shun-to* is accompanied by mass demonstrations, intended to show power and solidarity, and by public bargaining between unions and employers that is reported in the national press. This public debate provides information and time for nonadversary bargaining when both parties sit down face to face. The *shun-to* is also used to set the nation's social agenda. For example, in the early 1970s a movement emerged, in response to changing demographics, demanding that the government raise the retirement age for Japanese public-sector workers from 55 to 60 years of age. Militant public-sector unions raised these demands in the *shun-to*. This in turn shaped a national debate that spilled over into Japanese manufacturing with the demand to raise the retirement age for all full-time Japanese workers. The debate extended beyond collective bargaining to concerns about income support programs—an inadequate social security system and nonexistent private-sector pension programs for an aging Japanese labor force with an increasing life expectancy (from 50 years in 1947 to 70 years in 1973 for men)—and future expectations of labor shortages.

While its present widespread influence is rather recent, the *shun-to* has affected the data for Japan in the last few years. In the United States, triennial industrywide pattern bargaining is a major influence on labor policy development. In Japan, social and political agendas of the main federation in the labor movement are more widely publicized and discussed than in the United

States, where a tradition of business unionism continues to exert strong influence. Finally, overt labor-management conflict in Japanese labor relations is uncommon in the manufacturing sector (Lam 1983), compared to the adversarial nature of U.S. collective bargaining.

Differences in national institutions can be expected to result in different patterns of labor-management conflict and in different structures and processes of nominally similar institutions in workplace bargaining. The time required for final adjudication of disputes in the two countries is dramatically different: the process takes much longer in Japan. The empirical evidence we have developed is consistent with the proposition that Japan's system of conflict resolution is more effective, but it is also consistent with lower levels of latent conflict in labor-management relations in Japan's manufacturing sector.

## 14.4 Structure and Processes in Dispute-Resolution Procedures

Dispute adjustment and resolution of unfair labor practices in the manufacturing sector are similar in both countries.

### 14.4.1 National Dispute-Resolution Institutions in the United States

The National Labor Relations Board (NLRB), created and guided by the National Labor Relations Act (NLRA or Wagner Act, 1935, which was amended by the Taft-Hartley Act, 1947), collects U.S. dispute resolution data routinely and reports them in the *Annual Report of the National Labor Relations Board.* The board does not initiate cases but acts only on those cases submitted by the company, union, or employee to administer of the basic laws governing the relationships between management and trade unions. Dispute-adjustment cases include representation disputes, for example, for determining collective bargaining representatives, changes in union affiliation, advisory opinions on the board's jurisdiction in regional or state agency or court disputes, unit clarification disputes involving employee classifications in existing bargaining units, or jurisdictional disputes and union deauthorization cases. Unfair labor practices include charges by unions and employees that employers interfered with, restrained, or coerced employees in exercising their legally sanctioned rights of self-organization; dominated or interfered with either the formation or administration of unions; discriminated in hiring or tenure of employment or discourage membership in a labor organization; discharged or otherwise discriminated against an employee because the employee filed unfair labor practice charges or offered testimony against company actions under the National Labor Relations Act; or refused to bargain collectively with elected representatives of their employees.

Conversely, employers can bring charges of unfair labor practices against unions if unions restrained or coerced employees who were exercising their rights to engage in or refrain from engaging in collective bargaining; caused employers to discriminate against employee to encourage or discourage union

membership; refused to bargain in good faith; participated in certain types of strikes and secondary boycotts; charged excessive or discriminatory union initiation fees or union dues; or caused employers to pay for labor services not performed (i.e., featherbedding).

Arbitration cases include disputes that cannot be resolved within the bilateral grievance procedure. After all bilateral steps in the grievance procedure have been exhausted, management and labor select an impartial outsider to decide the dispute. Often, this persons' decision is stipulated in the contract to be final and binding upon both parties (Zabala 1983).

The five-member board, appointed by the U.S. president, acts as a quasi-judicial body to decide cases on formal records, and it employs administrative law judges to hear and decide cases. All cases heard at the national level begin in regional offices, where regional directors process and investigate disputes. Appellate procedures exist within the board at the regional and national levels. Although the NLRB has no independent statutory power to enforce its decisions and orders, it may seek enforcement in the U.S. Court of Appeals. Grievants may also appeal board decisions to the federal judicial system. Arbitration cases are administered and heard by the Federal Mediation and Conciliation Service and other private associations, including the American Arbitration Association.

The volume of disputes is high, nearly doubling between 1958 and 1974. The year 1980 had record levels, with 24,411 total disputes filed with the board. In 1981, the NLRB closed 52,804 cases, with 25,211 pending, and a record $37,617,144 was reimbursed to employees for illegal discharges or discriminatory representation. In many U.S. industries, such as the automobile industry, a large proportion of arbitration cases in recent years involved disciplinary layoffs and firings. An overwhelming number of these cases result in reinstatement and backpay.

Unfair labor practice disputes, or charges of unlawful acts by employers or unions or both, increased dramatically throughout the 1958–81 period, doubling by 1969 and with a maximum of 19,246 cases in 1980. In 1981, the board closed 41,020 unfair labor practices cases. Most cases are resolved informally: 90% of unfair labor practice cases are disposed of within 40 days without formal litigation, and only 3% of the cases require an NLRB decision. Strikes ended in 205 of the cases closed in 1981, and collective bargaining commenced in 2,028 cases.[2]

### 14.4.2 Japanese Dispute-Resolution Institutions

The Japanese system has a strong resemblance to the U.S. system. This is because U.S. institutions served as models for many postwar economic institutions established in Japan. Japanese statistics on dispute adjustment and unfair labor practices are collected at the prefecture level and reported in the *Annual Report of the Labor Relations Commissions*. A network of local commissions operating under central direction and review by the Central Labor

Relations Commission (LRC) is the primary institution for the resolution of labor disputes and data collection in Japan; grievance and other dispute-adjustment mechanisms at the enterprise level are more limited than in the United Sates. Thus, the Labor Relations Commission (LRC) has an active role in administering and developing Japanese labor relations.

Dispute adjustment includes conciliation, mediation, and arbitration, as well as a semijudicial function that resolves unfair labor practice disputes. Moreover, LRCs perform major fact-finding activities prior to informal and formal negotiations. Lam (1983) has characterized the LRC's dual function as a government conciliation agency and a labor court. Unlike the U.S. system, the LRC system often extends collective bargaining agreements to other trade unions and industries. The LRC system operates at the national level (Central Labor Relations Commission [CLRC]) and in each prefecture (Local Labor Relations Commcssions [LLRC]) and for the maritime industry (Seamen's Labor Relations Commission [SLRC]).

The CLRC presides over interprefectural cases, cases of "national importance," and other appeals. The LLRCs preside over intraprefectural and prefectural disputes. (Hereafter, we refer to the total system as the LRC.) Unlike the U.S. NLRB, tripartite membership on LRCs includes equal numbers of representatives of employers, labor, and government. Consequently, LRCs are not formally subject to direct ministerial control. Revisions to the LRC legislation in 1949 limited authority in final LRC decisions in unfair labor practice disputes to public officials, because of adversarial company-union relations.

Although most dispute cases in Japanese manufacturing are handled by conciliation and then mediation, in recent years differences between the two processes have largely disappeared. Conventional arbitration, which explicitly acknowledges the adversarial relationship between parties, settles few disputes, since this technique does not conform to the Japanese tradition of compromise between bargaining parties. Unfair labor practice disputes include an employer's refusal to bargain, interference in union administration, or dismissals of union leaders due to union activities. The role of LRCs in unfair labor practice disputes borrows more from civil court proceedings than does the U.S. system, which has cumbersome legal proceedings dominated by lawyers at all steps of negotiations. The average length of time to resolve disputes is substantial: for example, it took 635 days for LLRCs to resolve 1976 disputes and 774 days for those filed in 1980.

### 14.4.3 Comparisons between U.S. and Japanese Trade Unions

Typically, Japanese trade unions initiate dispute-adjustment cases, as in the United States. Some Japanese scholars have argued that a major difference between the U.S. and Japanese systems is that the level of informal dispute adjustment in Japan is much higher, although informal negotiation in the United States is also widespread. Since Japanese unions in the manufacturing

sector are usually enterprise unions, we expect weak workplace bargaining, where Japanese-style dispute adjustment is a viable alternative. Japanese unions also use dispute adjustment to obtain satisfactory wage settlements as well as to make statements on social issues of national importance.

Shimada (1982a) and Lam (1983) have pointed out that Japanese workers and their unions behave much like American workers and unions in formulating their economic demands. Wage demands and demands to reduce the length of workdays and increase the number of holidays increased substantially during the period of rapid economic growth in the 1960s. In fact, until 1975, wage disputes constituted 50% of all cases and declined only as economic growth slowed. With slower economic growth came decreased wage demands, reflecting job security fears and demands for "noneconomic" policies. This behavior is similar to patterns in U.S. collective bargaining.

In the United States, a formal, four-step grievance procedure is clearly specified and used to resolve disputes at unionized firms. This procedure is used to a lesser extent at nonunionized firms, and arbitration is used only as the final step to resolve conflicts (Zabala 1983). In Japan, the industrial relations system does not include four-step grievance procedures at the plant level. LRCs replace workplace bargaining, an act that centralizes the dispute process but also creates inefficient settlements in terms of timeliness and presumably policies that improve worker morale (Zabala 1983). Thus, we expect that the low volume of LRC cases reflects at least partial disenchantment among Japanese workers with this form of dispute resolution.

In our previous work in the U.S. automobile industry, we used plant-level grievance data. As stated above, we analyze different dispute data for U.S. and Japanese manufacturing. Based on our earlier research, we suggest the following typology. *Type 1* grievance data are labeled grievance rates (per 100 employees), open grievance rates (e.g., unresolved grievances), and so on, collected by plant personnel as measures of shop tensions. *Type 2* grievances are arbitration cases, which are primarily shop worker grievances, involving step-four grievance rates, based upon the failure of labor and management to resolve the disputes at the first three steps of the formal grievance procedure (Zabala 1983). *Type 3a* grievances are dispute-adjustment cases, including representation complaints and collective bargaining process complaints by unions. *Type 3b* grievance data are unfair labor practice cases. *Type 3a, 3b* grievance data are described above and are consistent between the two countries.

There is a systematic nonrepresentativeness in similar Japanese data series since the trade unions most prone to use dispute-adjustment procedures are those in the small- and medium-sized enterprises. Among the medium- and small-sized enterprises, there are more conventional adversary disputes common to the United States. Hanami (1981) describes these relationships: "Industrial relations are conducted without established rules, governed by

emotional elements, and developed amid treacherous antagonism and misunderstanding." Also, dispute rates are higher among smaller firms because young trade unions are fighting for new rights or new terrain for policies before labor-management relationships are routinized. It is not surprising that in the small- and medium-sized firms, worker grievances often involve general economic and social discontent rather than plant-specific policies. Thus, the mediation of the LRCs is crucial for the resumption of consensual labor relations.

Nonrepresentativeness of the dispute data also occurs in the structures and processes of collective bargaining within each country. In the United States, adversarial collective bargaining includes substantial *union voice* for rank-and-file workers. In Japan, consensus decision making involves union, managers, work teams, and individual workers. The Japanese industrial relations system includes high levels of participation and formal and extensive information sharing. Disputes are minimized and problem-solving activities emphasize production management, rather than policy development and implementation in the collective bargaining framework. Joint problem solving takes place in formal and informal, regular and irregular meetings, quality circles, and work groups. Bilevel union representation involves (1) managers and union bargaining over basic pay rates, fringe benefits, working hours, and so on; and (2) joint consultation in strategic planning and corporate performance. There is some overlap however since bonus rates based on performance are determined in formal collective bargaining. Joint consultation meetings occur regularly at all levels of the enterprise—shop floor, plant, division, and corporate levels (Shimada and MacDuffie 1986). In the United States, grievances are policy devices used to interpret, revise, or develop new labor policies with attitude effects. In Japan, nonadversarial collective bargaining at the shop-floor level aids production and is not used for policy formation and implementation. We cannot test Kamata's thesis that Japanese workers have weaker shop-floor representation than American workers who labor in similar production environments but have dissimilar collective bargaining environments. We note the differences for future research.

The number of labor disputes that bubble up to the national level in Japan need not be large if changes in the number indicate widespread changes in worker attitudes, with associated effects on costs. This is an empirical problem: If the small number of disputes represent nothing but noise with respect to worker behavior, there will be very weak or no association with the cost of production; if the disputes correspond to significant cost and productivity-related manifestations of worker attitude, then the effect will be captured in the cost function.

The number of dispute-adjustment cases in Japan declined dramatically during the recession that followed the energy crisis. During this period, the major type of dispute shifted to broader issues, such as working conditions, employment levels, and, notably, job security. There has also been a greater

tendency for trade unions to bargain directly with the government over general economic policy, as is done in Western Europe. This fact partly accounts for declines in wage disputes. At a deeper level, unions and management may have lost confidence in the LRC over time and, thus, turned to the central labor movement to provide satisfactory labor policies. With the changing nature of disputes, the variety of worker demands, and the maturation of workplace bargaining, unions, in particular, have found the LRC's principle of compromise and delay ineffective in resolving worker grievances and discontents. Our findings in earlier studies suggest that worker-attitude indicators, for example, number of fact-finding cases, and enterprise grievance rates would be useful.

## 14.5 Data

For this paper, we use *type 3a* (dispute-adjustment cases) and *type 3b* (unfair labor practice disputes) grievance data, strikes, and quits (United States only) as our behavioral data set to illuminate the relationships between worker attitudes and productivity in U.S. and Japanese manufacturing since the late 1950s. Our decisions on data were based on availability and comparability between countries. We described the grievance data above. For Japanese manufacturing, the strike data are collected and published annually by the Ministry of Labor. For the United States, strike and quit data are collected and published annually by the Bureau of Labor Statistics. We believe that this set of behavior variables accurately depicts the sate of labor relations within the manufacturing sectors of both countries and can be used as attitude proxies to measure the impact of worker behavior on productivity and cost performance.[3]

Data limitations prevented analysis of other behavior data. Shimada (1982b) challenges popular stereotypes of Japanese workers with his findings that Japanese labor turnover is quite high, and Levine and Koji (1980) argue that some part of turnover results from latent industrial conflict. These findings suggest that Japanese workers are not unlike their counterparts in U.S. industry and that "exit voice" might be a significant indicator of worker attitudes, and might proxy for their effects on productivity and costs in Japan. Although we use quits data in our model of the U.S. production process, we were unable to obtain satisfactory quit data for Japan. We were also unable to obtain absenteeism series for either country. We expect that these variables would be good indicators of attitudes for our models of production. Thus, we are unable to compare various "exit voice" data between countries in this research.

Type 1 grievance data—actual grievance rates in unionized U.S. plants and the number of fact-finding cases by LRCs in Japanese plants—might provide useful information in our estimations, although U.S. coverage would account for less than 25% of all plants since the late 1970s because of declining union-

ization rates. These data were not available for this paper. We also believe that introducing positive measures of worker behavior—participation rates in team meetings, number of innovations and suggestions, voluntary participation in training programs—would provide useful information in our model of production; but we were unable to obtain these data.

The worker attitude indicators in the augmented cost function we estimate below are quits, $Q$ (for the United States only); strikes, $Z$; dispute-adjustment cases, $A$; and unfair labor practices disputes, $U$. The variables $Q$ and $Z$ are published for U.S. manufacturing by the Bureau of Labor Statistics and for Japanese manufacturing by the Ministry of Labor. The variables $A$ and $U$ are compiled for U.S. manufacturing enterprises by the NLRB and for Japanese industry by the LRC, an autonomous agency of the Ministry of Labor. These data represent full coverage and are reasonably representative of worker attitudes at this level of aggregation; they are routinely collected for both union and nonunion enterprises, although actions from unionized establishments dominate the NLRB's agenda. The importance of the variables $Q$ and $Z$ as indicators of worker attitudes has been argued in earlier work by Norsworthy and Zabala (1985a, 1985b, 1985c).

Cost data for Japan are from Norsworthy and Malmquist (1983). Capital input is a Törnqvist (Divisia) aggregate of structures, transportation equipment, other equipment, land, and inventories. The aggregation is based on capital service prices computed using an internal rate of return following Gollop and Jorgenson (1980). Capital stocks were developed from investment data taken from the Census of Manufactures, using the perpetual inventory method with geometric decay. Depreciation rates were taken from Nishimizu (1979).

The only difference between the data for Japan in that study and this one is that the labor input here is disaggregated to production worker and nonproduction worker components. We believe this separation is appropriate for the study of worker attitudes since the two groups are affected differently by technology and output growth. Energy and materials inputs and further details about data construction are provided in the earlier study.

For the U.S. manufacturing sector, we have used a preliminary version of the new Berndt-Wood data set, which permits us to add the years 1978–81 to the data for U.S. manufacturing used by Norsworthy and Malmquist (1983). Capital stock data are for equipment and structures only, and energy input includes feedstocks, unlike the U.S. data in the earlier paper.

In both countries, there are delays between the onset of a labor dispute and its final resolution. For the United States, we entered adjusted disputes for the following year to reflect delays in settlements. We used unfair labor practice disputes for the following year and dispute-adjustment cases for the second following year for Japan to allow for the effects of delays in dispute resolution.

## 14.6 The Model

The translog cost model has been used widely in a variety of studies in the last decade and has clearly surpassed the Cobb-Douglas function and the constant elasticity of substitution specifications as the model of choice for representing the production process.[4] For this application, we use an equilibrium unit cost function model to estimate the effects of worker attitudes: an equilibrium formulation because the appropriate valuation of capital input in disequilibrium is open to debate and a unit cost model (which imposes constant returns to scale) because scale effects are difficult to identify in aggregate time-series models. In general, the equilibrium translog model usually tracks the estimation period reasonably well, although it has its detractors.[5] The translog cost function is a logarithmic approximation to an arbitrary twice differentiable cost function based on a Taylor series expansion around the point $\ln C = 0$. We recognize five input factors: capital ($K$), production-worker labor ($L$), nonproduction-worker labor ($N$), energy ($E$), and materials ($M$).

Thus, the general cost function may be written:

$$C = C(Y, P_k, P_l, P_n, P_e, P_m, T),$$

where $Y$ is output, $P_i$ is the price of input $i$, and $T$ is a time trend, often described as an index of technical change. Denoting logs by lower case characters, the translog cost function is written

$$\begin{aligned} \ln C_o = {} & a_o + \Sigma_i a_i p_i + \tfrac{1}{2} \Sigma_i \Sigma_j a_{ij} p_i p_j \\ & + s_t T + \Sigma_i s_{Ti} p_i T + \tfrac{1}{2} s_{TT} T^2 \\ & + a_y y + \Sigma_i a_{iy} p_i y + \tfrac{1}{2} a_{yy} y^2, \\ & i, j = K, L, N, E, M. \end{aligned} \tag{1}$$

For the unit cost function, we restrict $a_y = 1$, $a_{iy} = a_{yy} = 0$. For convenience, we then subtract $Y$ from both sides, thus

$$\ln C = \ln C_0 - Y,$$

denotes the logarithm of the total unit cost of production. Further, to save estimated parameters (a concern because there are so few observations for manufacturing in Japan), we impose the restriction

$$s_{TT} = 0.$$

Homogeneity of degree one in input prices is imposed by the following parameter restrictions:

$$\begin{aligned} \Sigma_i a_i &= 1, \\ \Sigma_i a_{ij} &= \Sigma_j a_{ij} = 0, \\ \Sigma_i s_{Ti} &= 0. \end{aligned}$$

Under the assumption of cost minimization, Shephard's lemma implies that the equations for the shares of each input factor in total unit production cost are equal to the elasticities of total cost with respect to the input prices:

$$(2) \qquad s_i = \partial \ln C / \partial p_i = a_i + \Sigma_i a_{ij} p_j + s_{Ti} T, \quad i = K, L, N, E, M.$$

The conventional practice is to estimate the cost function jointly with all but one of the share equations. This, then, is the form for estimating the standard translog cost function models.

To include the effects of worker attitudes, we augment the cost function by inserting (the logs of) the worker-attitude indicators discussed above, just as we would introduce any other nonpurchased inputs that might affect the production process.[6] The augmented unit cost function then becomes

$$C = C(p_i, R_k, T),$$

where

$$R_k, \; k = A, U, Q, Z,$$

respectively, denote adjusted disputes ($A$), unfair labor practices ($U$), quits ($Q$), and strikes ($Z$), where $r_k = \log(R_k)$.

Then, the translog approximation to this unit-cost function is:

$$\begin{aligned} (3) \qquad \ln C = {} & a_0 + \Sigma_i a_i p_i + \tfrac{1}{2} \Sigma_i \Sigma_j a_{ij} p_i p_j \\ & + s_T T + \Sigma_i s_{Ti} p_i T \\ & + \Sigma_k c_k r_k + \tfrac{1}{2} \Sigma_k \Sigma_l c_{kl} r_k r_l \\ & + \Sigma_l \Sigma_k c_{ik} p_i r_k, \end{aligned}$$

where

$$\begin{aligned} i &= K, L, N, E, M, \\ k &= A, Q, U, Z. \end{aligned}$$

Thus, the indicators of worker attitude have first- and second-order influences on production costs just as do the conventional inputs, and the indicators interact with the inputs as well as with each other.

Under this specification, the share equations then become

$$(4) \qquad s_i = a_i + \Sigma_j a_{ij} P_j + s_{Ti} T + \Sigma_k c_{ik} r_k.$$

The augmented cost function is then estimated jointly with four of the five share equations. Zabala (1983) has found that behavioral expressions of worker attitude in response to the work environment typically operate with a lagged effect. Thus, it is labor policies and work conditions of the recent past that give rise to behaviors in the present. While acute changes in conditions have more immediate results, this generally lagged effect reduces the problem of simultaneous determination of attitudes and the quantities of input factors

(input prices are assumed exogenous). Vestiges of bias from simultaneous determination can certainly remain in the estimates we present below.[7]

Given estimates of the augmented cost functions, we may determine the elasticity of the cost of production with respect to each of the attitude indicators by

$$(5) \qquad e_{ck} = \partial \ln C/\partial r_k = C_k + \Sigma_k C_{kl} r_k + \Sigma_i C_{ik} p_i,$$

where

$$i = K, L, N, E, M,$$
$$k = A, Q, U, Z.$$

The effects on marginal cost of indicator $r_k$ is then given by

$$(6) \qquad \partial C/\partial R_k = C/R_k \times \partial \ln C/\partial \ln r_k.$$

Finally, we may construct a measure of the effects of attitudes on production costs by weighting the indices of the attitude indicators by their respective marginal costs and summing. Thus,

$$(7) \qquad I_w = C \times (\Sigma_k \partial \ln C/\partial \ln r_k \times 1/R_k), \quad k = A, Q, U, Z.$$

In any year, the proportional change in production costs due to negative attitudes—which is the negative of the corresponding change in total factor productivity—will be

$$(8) \qquad d = I_w/C = \Sigma_k \, d \ln C/dr_k$$

To avoid the difficulties of comparing the productivity and cost differences between the two countries in common currency terms, we will simply use the annual values of $d$ from equation (8) for comparison.

## 14.7 Empirical Analysis

### 14.7.1 Estimation Results 1

The augmented cost function models were estimated for the manufacturing sectors of Japan and the United States for the periods 1965–78 and 1958–80, respectively. The results for Japanese manufacturing are shown in table 14.1. Due to homogeneity restrictions, the cost function parameters associated with materials ($M$) are not estimated directly; similarly, the second-order parameters for strikes, $Z$, are not estimated, but are inferred from existing parameters.

Table 14.2 shows the estimated own-Allen partial elasticities of substitution, and table 14.3 the cost elasticities associated with each of the worker attitude indicators. Tables 14.4, 14.5, and 14.6 show corresponding results for U.S. manufacturing. Table 14.7 below shows the total cost elasticities for the two manufacturing sectors for their respective estimation periods.

**Table 14.1 Estimated Cost Function Model, Japanese Manufacturing, 1965–78**

| Parameter Name | Estimated Value | Standard Error | *t*-statistic |
|---|---|---|---|
| *AO* | 11.1011 | .014988 | 740.631 |
| *AK* | .265802 | .009219 | 28.8306 |
| *AL* | .087381 | .001692 | 51.6274 |
| *AN* | .029563 | .000622 | 47.4553 |
| *AE* | .021912 | .001630 | 13.4397 |
| *AKL* | −.036751 | .005984 | −6.14067 |
| *AKN* | −.021098 | .003334 | −6.21779 |
| *AKE* | .011714 | .004494 | 2.60624 |
| *ALN* | .021316 | .012364 | 1.72426 |
| *ALE* | .018580 | .004498 | 4.13002 |
| *ANE* | .092085 | .001818 | 5.06482 |
| *ST* | −.012916 | .002807 | −4.59982 |
| *STK* | .068900 | .001929 | 3.57173 |
| *STL* | .092177 | .001357 | .67909 |
| *STN* | .001638 | .000666 | 2.45800 |
| *STE* | −.004338 | .000793 | −5.46565 |
| *ALL* | −.019278 | .013726 | −1.40445 |
| *ANN* | −.029958 | .014451 | −2.07308 |
| *CA* | −.131481 | .046428 | −2.83191 |
| *CU* | .083229 | .053591 | 1.55302 |
| *CZ* | .111858 | .054941 | 2.03593 |
| *CAU* | .152060 | .057921 | 2.62528 |
| *CAZ* | .140907 | .033932 | 4.15259 |
| *CUZ* | −.202413 | .140785 | −1.43377 |
| *CKA* | .052999 | .016864 | 3.14265 |
| *CKU* | −.058823 | .016082 | −3.65769 |
| *CLA* | .031360 | .0036767 | 3.70004 |
| *CLU* | −.009759 | .0037954 | −2.57127 |
| *CNA* | .003314 | .0014169 | 2.33965 |
| *CNU* | −.002601 | .0014674 | −1.77245 |
| *CEA* | −.009982 | .0031332 | −3.18601 |
| *CEU* | .012355 | .0027863 | 4.50542 |

*Note:* Key to parameter names: $K$ = capital; $L$ = production-worker labor; $N$ = nonproduction-worker labor; $E$ = energy; $A$ = disputes adjustments; $U$ = unfair labor practices; $Z$ = strikes.

In preliminary estimates of the cost functions without the worker-attitude indicators, both sectors exhibited nonconcavity in early years for capital and energy prices. Concavity was imposed by restricting the $a_{kk}$ and $a_{EE}$ parameters to zero. For Japan, this had the added benefit of reducing the number of parameters to be estimated. In consequence, all the own-Allen partial elasticities of substitution have the correct sign, and the corresponding input factor demand schedules are downward sloping.

In Japan, the average annual rate of cost change, given by the $s_T$ parameter, is −.0129, corresponding to total factor productivity growth of 1.29% per

**Table 14.2 Own-Allen Partial Elasticities of Substitution for Japan, 1965–78**

| Year | Capital | Production-Worker Labor | Nonproduction-Worker Labor | Energy | Materials |
|---|---|---|---|---|---|
| 1965 | −3.19715 | −14.9715 | −91.8636 | −31.7277 | .699319 |
| 1966 | −2.88712 | −14.0569 | −82.6761 | −37.3110 | .759410 |
| 1967 | −2.83564 | −14.1467 | −84.7511 | −38.1942 | −.765745 |
| 1968 | −2.89788 | −15.0820 | −88.5929 | −37.4315 | −740769 |
| 1969 | −2.94922 | −14.9954 | −88.0302 | −35.8958 | −.734760 |
| 1970 | −2.88089 | −14.8450 | −80.9179 | −37.4542 | −.570955 |
| 1971 | −3.26449 | −14.4085 | −73.4642 | −34.2569 | −.699768 |
| 1972 | −2.76220 | −12.9708 | −67.1035 | −44.6362 | −.801840 |
| 1973 | −3.02002 | −12.8735 | −62.7135 | −37.0063 | −767647 |
| 1974 | −3.30986 | −13.0715 | −60.1869 | −27.0552 | −.744338 |
| 1975 | −3.27200 | −12.5813 | −55.5272 | −26.6714 | −765644 |
| 1976 | −3.27539 | −12.6501 | −56.5135 | −26.4505 | −.763571 |
| 1977 | −3.64671 | −12.3814 | −51.8016 | −24.9059 | −.724170 |
| 1978 | −3.39022 | −12.3100 | −51.8388 | −28.1690 | −.750163 |

**Table 14.3 Cost Elasticities for Attitude Indicators for Japan, 1965–68**

| | Disputes Referred to LRCs | Unfair Labor Practice Charges | Strikes |
|---|---|---|---|
| 1965 | −.077932 | .135806 | .0114178 |
| 1966 | −.159589 | .169528 | .0575843 |
| 1967 | −.187181 | .196407 | .0571942 |
| 1968 | −.110320 | .110666 | .0661729 |
| 1969 | −.123840 | .134979 | .0538747 |
| 1970 | −.938256 | .0750949 | .0810498 |
| 1971 | −.002877 | .0542922 | .0124814 |
| 1972 | −.131481 | .0932289 | .111858 |
| 1973 | −.038643 | .0478906 | .0432072 |
| 1974 | .122801 | −.0429827 | −.0464368 |
| 1975 | .106955 | −.0195364 | −.0558456 |
| 1976 | .106401 | .0083032 | −.0869417 |
| 1977 | .140026 | .0562864 | −.169113 |
| 1978 | .088802 | .0717245 | −.129844 |

year. The trend in relative input factor utilization not accounted for by other factors in the model—often called biased technical change—is positive for capital and production and nonproduction worker labor, and negative for energy and materials.

For the United States, the average annual rate of total factor productivity growth is 0.7% per year, and unexplained trends in relative factor intensity are positive for capital, nonproduction labor, and materials, and negative for production worker labor and energy.

**Table 14.4 Estimated Cost Function Model for U.S. Manufacturing, 1958–80**

| Parameter | Estimated Value | SE | *t*-statistic |
|---|---|---|---|
| AO | 6.65346 | .0164108 | 405.433 |
| AK | .019490 | .012274 | 1.58793 |
| AL | .289242 | .005911 | 48.9267 |
| AN | .081622 | .008199 | 9.95484 |
| AE | .062455 | .005647 | 11.0584 |
| AKL | −.058193 | .007444 | −7.91687 |
| AKN | −.066572 | .004707 | −14.1405 |
| AKE | .031369 | .003553 | 8.56311 |
| ALN | .005487 | .005186 | 1.05808 |
| ALE | −.014506 | .005917 | −2.45165 |
| ANE | .031923 | .002911 | 10.9644 |
| ST | −.007080 | .002273 | −3.11453 |
| STK | .004050 | .001683 | 2.40576 |
| STL | −.001519 | .000804 | −1.88807 |
| STN | .001888 | .001121 | 1.68377 |
| STE | −.001996 | .000782 | −2.55326 |
| ALL | .094837 | .014917 | 6.35745 |
| ANN | −.002821 | .004528 | −.62310 |
| CA | −.004804 | .049558 | −.09694 |
| CU | −.021224 | −.03061 | −.69333 |
| CQ | −.040594 | .016846 | −2.40973 |
| CZ | .158377 | .037786 | 4.19134 |
| CAU | .009580 | .249915 | .38335 |
| CAZ | .348573 | .113167 | 3.08016 |
| CUZ | .000040 | .046656 | .00087 |
| CAQ | −.104289 | .044527 | −2.34212 |
| CUQ | .111645 | .021427 | 5.21035 |
| CQZ | .167533 | .049301 | 3.39812 |
| CKA | .044169 | .21321 | 2.07164 |
| CKU | −.071363 | .022534 | −3.16678 |
| CKQ | .020346 | .010753 | 1.89206 |
| CLA | .000898 | .009380 | .09580 |
| CLU | −.008909 | .010234 | −.87052 |
| CLQ | .013794 | .005043 | 2.73494 |
| CNA | .025954 | .014041 | 1.84840 |
| CNU | −.042870 | .014845 | −2.88783 |
| CNQ | .016772 | .007154 | 2.34445 |
| CEA | −.020889 | .010317 | −2.02464 |
| CEU | .037555 | .108701 | 3.45495 |
| CEQ | −.023857 | .004933 | −4.83613 |

*Note.* $Q$ = quits; for other parameters, see table 14.1 above. SE = standard error.

**Table 14.5** **Own-Allen Partial Elasticities of Substitution for the United States, 1956–80**

| | Capital | Production-Worker Labor | Nonproduction-Worker Labor | Energy | Materials |
|---|---|---|---|---|---|
| 1958 | −13.0789 | −1.38246 | −8.46371 | −20.8431 | −1.19678 |
| 1959 | −13.3746 | −1.38973 | −9.61571 | −19.7145 | −1.10188 |
| 1960 | −13.9458 | −1.35576 | −8.31190 | −23.8269 | −1.19009 |
| 1961 | −14.2307 | −1.37053 | −8.59380 | −22.1218 | −1.16641 |
| 1962 | −14.6426 | −1.36390 | −8.58289 | −23.0257 | −1.15887 |
| 1963 | −16.2070 | −1.34402 | −8.37832 | −23.7549 | −1.15918 |
| 1964 | −17.4828 | −1.35057 | −8.62148 | −22.3701 | −1.13221 |
| 1965 | −14.5656 | −1.36023 | −8.74267 | −25.3102 | −1.13999 |
| 1966 | −12.7360 | −1.34296 | −8.17741 | −32.2869 | −1.19170 |
| 1967 | −13.8096 | −1.33280 | −8.04691 | −30.7266 | −1.19285 |
| 1968 | −15.2027 | −1.34620 | −8.73380 | −26.3132 | −1.13808 |
| 1969 | −16.0053 | −1.30455 | −7.98864 | −29.1096 | −1.19553 |
| 1970 | −20.1943 | −1.31052 | −8.25295 | −23.1352 | −1.15776 |
| 1971 | −22.9103 | −1.33241 | −8.74542 | −19.5600 | −1.11722 |
| 1972 | −19.9003 | −1.36750 | −9.85762 | −19.6281 | −1.06015 |
| 1973 | −14.2169 | −1.37694 | −9.19305 | −21.9709 | −1.13272 |
| 1974 | −11.9761 | −1.45099 | −8.66048 | −15.9872 | −1.19708 |
| 1975 | −13.4311 | −1.45047 | −8.26527 | −13.8791 | −1.22186 |
| 1976 | −13.4141 | −1.49092 | −9.49470 | −12.5652 | −1.14427 |
| 1977 | −15.7005 | −1.47753 | −9.65428 | −11.7283 | −1.13247 |
| 1978 | −13.0729 | −1.46812 | −9.57869 | −12.2343 | −1.14343 |
| 1979 | −13.8871 | −1.49505 | −9.36756 | −11.1454 | −1.17406 |
| 1980 | −14.5727 | −1.55272 | −10.1319 | −9.22754 | −1.12755 |

### 14.7.2 Estimation Results 2

The first-order effects of the attitude indicators are measured by the parameters $c_A$ $c_O$, $c_Z$, and, in the United States, $c_Q$. Second-order effects are measured by the parameters $c_{AD}$, $c_{AZ}$, and $c_{SZ}$ (with additional terms for $Q$ in the U.S. model) and interactions with input factors by $c_{ir}$; that is, $c_{KA}$ is the partial effect of adjusted disputes on capital requirements, and so on.

The overall cost effects of each of the indicators are shown in tables 14.3 and 14.6, and of their sum in table 14.7. In overall terms, the effects in the United States of attitudes as manifested in production costs and productivity were to raise production costs and reduce total factor productivity by about 8% in the late 1950s and 1960s, rising more rapidly in the 1970s to about 11% in the late 1970s. The effects in Japan were to raise costs and to reduce total factor productivity by nearly 7% in 1965. This effect declines slowly to 1973 and rather sharply thereafter to about 3% in 1978. These rates are not especially large, compared to the U.S. auto industry where total cost elasticity with respect to better indicators of worker attitude was .24.

Table 14.6 Cost Elasticities for Attitude Indicators for the United States, 1958–80

| Year | Disputes Referred to NLRB | Unfair Labor Practice Charges | Quit Rate | Strikes |
|---|---|---|---|---|
| 1958 | .090266 | .0075699 | .0217394 | −.036681 |
| 1959 | .068860 | .0053790 | −.0067716 | .014494 |
| 1960 | −.009884 | .0137394 | .0386882 | .117814 |
| 1961 | −.003617 | −.0098877 | −.0114907 | .108095 |
| 1962 | .012163 | .0020485 | −.0225933 | .916150 |
| 1963 | −.020722 | −.0069601 | −.0289838 | .139392 |
| 1964 | −.013556 | −.0130771 | −.0237373 | .133747 |
| 1965 | .006031 | .0099952 | −.0482822 | .116357 |
| 1966 | .008164 | .0513433 | −.0939478 | .119848 |
| 1967 | .025306 | .0360233 | −.0673207 | .091344 |
| 1968 | .076332 | .0293724 | −.0487660 | .029308 |
| 1969 | .094563 | .0419415 | −.0448769 | −.003863 |
| 1970 | .075721 | .0106047 | −.0724908 | .019357 |
| 1971 | .071379 | −.0317793 | .0240316 | .026299 |
| 1972 | −.004804 | −.0212241 | −.0405943 | .158377 |
| 1973 | .009712 | .0153951 | −.0673164 | .137910 |
| 1974 | .146048 | .0155280 | .0139675 | −.073272 |
| 1975 | .024073 | −.0451165 | .0418093 | .094710 |
| 1976 | .055679 | −.0481791 | .0394685 | .059970 |
| 1977 | .119205 | −.0505240 | .0717341 | −.031496 |
| 1978 | .036554 | −.0360443 | .0148252 | .096051 |
| 1979 | .085484 | −.0334776 | .0421227 | .021725 |
| 1980 | .056910 | −.688292 | .0658762 | .065809 |

This contrast between worker-attitude effects through time in Japan and the United States corresponds to the finding in Norsworthy and Malmquist (1983) that total factor productivity rose in U.S. manufacturing somewhat more slowly (.7%–1.0%) before 1973 but slowed down in the United States to about .5% per year after the energy crisis of 1973, while it accelerated in Japan to about 1.4% per year.

In the U.S. automobile industry, Norsworthy and Zabala (1985b), using similar methods, found a strong cyclical component to worker attitudes—the negative effects of worker attitudes were stronger in expansions and weaker in recessions. No such pattern appears in the aggregate U.S. manufacturing sector in this study. In Japan, however, there is a substantial reduction in the negative effect of attitudes after 1973. In the pre-1973 period, output was growing rapidly in Japan's manufacturing sector—about 12% per year, and employment of production and nonproduction workers was slowly increasing. Between 1974 and 1978, however, labor input in Japan was reduced by more than 10%, and output grew far more slowly than before. It is reasonable to conclude, therefore, that similar cyclical forces that restrained the overt expression of worker attitudes in cost-increasing and productivity-reducing

Table 14.7 **Total Cost Elasticities for Worker-Attitude Indicators, The United States and Japan**

| Year | United States | Japan |
|---|---|---|
| 1958 | .0825843 | |
| 1959 | .0819522 | |
| 1960 | .0829811 | |
| 1961 | .0830990 | |
| 1962 | .0832336 | |
| 1963 | .0827259 | |
| 1964 | .0833753 | |
| 1965 | .0841020 | .0692909 |
| 1966 | .0854080 | .0675235 |
| 1967 | .0853532 | .0664205 |
| 1968 | .0862477 | .0665192 |
| 1969 | .0877652 | .0650138 |
| 1970 | .0888898 | .0623191 |
| 1971 | .0899309 | .0638965 |
| 1972 | .0917536 | .0636063 |
| 1973 | .0957011 | .0524545 |
| 1974 | .0102271 | .0333817 |
| 1975 | .0105476 | .0315735 |
| 1976 | .0106940 | .0277625 |
| 1977 | .0108919 | .0271993 |
| 1978 | .0111386 | .0306832 |
| 1979 | .0115855 | |
| 1980 | .0119767 | |

behaviors in the U.S. auto industry also had that effect in Japanese manufacturing after 1973. Indeed, if there is a mystery in the conclusions of this study, it must be: Why were the negative effects of worker attitudes in U.S. manufacturing *not* damped by the post-1973 recession?

The answer may simply be that we do not have a sufficiently sensitive model of U.S. manufacturing to capture these effects. Or that, unlike autos, formal shop dispute-resolution processes are less efficient, and manufacturers rely more on arbitration and mediation services for outside intervention in labor relations.

In particular, the statistics of the national dispute-resolution process in Japan may reasonably well reflect the attitudes of Japanese workers, because it is the primary formal organization for managing labor-management conflict. In the United States, by contrast, considerable use is made of the grievance machinery in unionized plants. In the U.S. automobile industry, we found grievance statistics to be sensitive indicators of productivity- and cost-related worker attitudes, and the same may be true for other unionized sectors, with the result that statistics of formal submission of labor disputes to third parties are less useful in the United States than in Japan as indicators of worker attitude.

## 14.8 Recent Developments in Labor Relations and Productivity in Japan

Despite vast differences between the Japanese and U.S. economies, fashions in U.S. economic policies, national and corporate, are often communicable and, at times, highly contagious for Japan. For example, Japan is currently undergoing waves of deregulation of industry and of privatization of government-operated enterprises similar to that which began in the United States in the late 1970s. Similarly, in the United States, the Japanese style of management has been widely discussed, and many U.S. firms have experimented with different labor and general management practices, for example, the team concept management system.

Anything in Japanese management connected with productivity or product quality quickly obtains the attention of American business.

One set of concerns that seems important is based not on the Japanese mystique, but on demographic trends: while the rate of growth of the Japanese economy has slowed down considerably in recent years, the widespread practice of early retirement (between ages 55 and 60 for many large enterprises) is straining the capacity of those enterprises to retire members of the cohort now reaching retirement age. Japan, virtually alone among major industrial countries, had a "baby boom" in the 1930's, and that group would normally retire between 1985 and 2000. This is the same large group that has recently passed through its most productive years. Throughout the late 1960s and the 1970s, while the U.S. labor force (1) grew younger and less experienced by absorbing the postwar U.S. baby boom and (2) increased in female participation, the Japanese labor force was growing older and more experienced. In conventional labor quality terms (see, e.g., Gollop and Jorgenson, 1980), the Japanese labor force was improving while the U.S. labor force was declining in productive capacity. Those trends are now reversing. The Japanese baby boom cohort is due for retirement even as the U.S. baby boom cohort is just entering its most productive years. Other things equal, this portends well for productivity in the United States relative to Japan. The demographic pattern mentioned above created another type of stress in the Japanese system that may tend to worsen worker attitudes. Rapid output growth—in excess of 10% per year in manufacturing—created employment and promotion opportunities even when accompanied by rapid labor productivity growth. Slower growth, and the somewhat delayed retirement of the Japanese workers approaching retirement age, has slowed down the growth of jobs, particularly in high quality, management-tracked jobs, even as Japanese universities are producing highly qualified graduates in record numbers. The scarcity of good jobs and promotion opportunities may lead to somewhat less favorable attitudes on the part of new labor force entrants. Indeed, some Japanese businessmen have been saying for several years that younger workers take for granted the pay and working conditions that their predecessors found very satisfying.

## 14.9 Summary

Compared to U.S. manufacturing, we find lower effects in Japan of negative attitudes. Japanese manufacturing plants are also characterized by nonadversarial collective bargaining, with lower grievance rates, fewer unresolved grievances, fewer strikes, and higher in-process quality audits.

The empirical evidence concerning the effects of worker attitudes on productivity in Japan and the United States is consistent with the widespread idea that Japan's system of conflict resolution—for the manufacturing sector, at least—is more efficient than the U.S. system in terms of productivity and costs. An alternative interpretation is that there is less potential for conflict in labor-management relations in Japanese manufacturing. Our finding of lower negative effects cannot distinguish these explanations. Another hypothesis to test is that, in future years, as Japanese business experiences the usual cycles, top-heavy bargaining will cause erosion in both trade union and employee commitment, as that which occurred at Nippon Steel Corporation in 1979 and the early 1980s.

# Notes

1. Our work to date has focused primarily on the U.S. automobile industry, where we have forged a quantitative link between *worker attitudes*, measured in an objective and reproducible way, and the *productivity* and *cost of production* (Norsworthy and Zabala 1982; 1985a, 1985b, 1985c). That link is quantitatively important, and the worker-attitude index is robust, as we have shown for different econometric specifications (Norsworthy and Zabala 1990). We are currently engaged in a cross-sectional plant-level study of the U.S. Postal Service that studies a more limited set of worker-attitude indicators, but includes the effects of selected management policies on worker-attitude formation as well as the effects of worker attitude on productivity and costs (Norsworthy and Jang 1989).

2. We should point out that there are significant policy shifts in dispute outcomes in an agency whose leading members change with each new administration, suggesting four-year cycle effects (Sockell and Delaney 1987). We do not account for these effects in this paper.

3. Type 3a and 3b grievance data cannot be described as worker-attitude proxies since they include disputes by management as well as trade union and employees. See discussion of *shun-to* in sec. 14.3 above; also see sec. 14.4 above. A pure type 3 worker-attitude variable should be purged of disputes sent to the NLRB by management. We could not obtain such a measure for this paper. The other behavioral data are consistent with our earlier research with worker-attitude data.

4. Binswanger (1974) presents an exceptionally clear description, which we will not repeat here.

5. The counterculture in production modeling claims (with some merit) that the equilibrium model tracks well because the (ex post) service price of capital adjusts to a level consistent with the quantity of capital input, rather than the reverse. Norsworthy

and Zabala (1985c) hold that an explicit disequilibrium model is preferable for measuring the effects of worker attitudes on the level and value of capital input.

6. Norsworthy and Zabala (1985b); see also F. R. Lichtenberg (1981).

7. The instrumental variables solution is an approach to dealing with the simultaneity issue. A preferred solution would be to augment the model with explicit representation of the formation of worker attitudes by labor policies based on technology, and other conditions of work. For the total manufacturing sector, it would be very difficult to develop any but the most general attitude-formation model. At the industry and plant levels, it may be possible to measure some of the important determinants of worker attitudes required to extend the production model to encompass attitude formation.

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## Comment

Mary Jean Bowman

This paper—along with others published by Norsworthy and Zabala since 1982 and on up to the present time—starts with the proposition that worker attitudes affect total cost, cost structures, and productivity and that attitude indicators should be added to conventional production functions. This they do for manufacturing in Japan over the years 1965–78 and in the United States over the years 1958–80. Their analysis makes use of an equilibrium translog cost function and its production dual, entailing the crucial assumptions of cost minimization and constant returns to scale.

The availability and selection of attitude indicators is critical to such an endeavor. So also, in the present case, are the institutional contexts and their implications for interpretation of those indicators. The contribution by Lam et al. provides an essential and insightful comparison of the Japanese and U.S. systems for settlement of industrial disputes.

Attitudes are measured indirectly, using observable forms of behavior as indicators. This is not a study of what explains the behavior—let alone the unobserved "attitudes" and how these relate to the systems for settlement of disputes. Empirically, it is in fact the latter that are entered in the regressions, as the title of this paper, though not its underlying argument, suggests. For

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both Japan and the United States the "attitude indicators" are: $A$, disputes referred for solution to the LRCs in Japan and the NLRB in the United States; $U$, unfair labor practice charges; $Z$, strikes. Only in the United States did they have quit rates, $Q$.

The cost function in the basic model, without worker attitudes, incorporates five input variables (physical capital, production workers, nonproduction workers, energy, and materials). Time trend $T$ is taken to represent technological change, which is interacted with the other input variables. Attitude variables are then inserted, interacting these variables with each of the conventional inputs, and the estimated cost function is estimated jointly with four of the five share equations. This provides the basis for estimating the elasticity of the total cost of production with respect to each of the attitude indicators. Finally, the authors construct an overall measure of effects of attitudes on production costs by weighting the attitude indicators by their respective marginal costs.

I have two questions relating to methodology. First, the assumption of constant returns to scale and the assumption that time trend $T$ stands for technological change evade the perennial problem of sorting out economies of scale and technological change stressed earlier by Nadiri. This is common enough. But we must ask, nevertheless, What in fact may $T$ be saying? Perhaps there is a special problem here in view of the changes that have occurred over the years covered in the experiences and roles of the LRCs in Japan. Has the assumption that $T$ is exogenously determined technological change blocked thinking about interactions between changing structures and the attitude indicators?

Second, even setting aside unavoidable problems in making cross-national comparisons, a problem is created in the inclusion of $Q$ for the United States but not for Japan. This would seem to invalidate the comparisons of "total" attitude effects in the two countries. But even if $Q$ were available for Japan there would be a dilemma here. Although turnover is considerably higher in Japan than often is assumed, the lack of data on quits in Japan may not be accidental, and especially, perhaps, with reference to manufacturing industry over the years covered. Furthermore, dissatisfaction would have had to be more intense in Japan than in the United States before a Japanese worker would take the costly alternative of quitting. Differing age structures will be important in this respect as well.

Some of the other findings raise questions that would seem to call for comment by the authors relating back to the systems of dealing with conflicts in Japan and in the United States and their histories. Putting tables 14.1 and 14.4 side by side highlights, for example, the contrast between Japan and the United States in elasticities on nonproduction workers and on their interaction with physical capital. Does the shifting emphasis in LRC activities with increased white-collar involvement say something here? Also interesting are contrasts between the two countries in elasticities on the variable $A$, which,

taken alone, is more strongly negative in Japan than in the United States but becomes more strongly positive in interaction with production labor in Japan than in the United States.

The authors point not only to the decline in total cost elasticities for worker-attitude indicators in Japan in the 1970s (not surprising) but also to a puzzling lack of such a change (even a slight increase in those elasticities) in the United States. I share their puzzlement, but this raises another question. Does using an optimizing constant-cost model create more of a problem in short-term shifts of capacity utilization in relation to worker behavior in the United States than in Japan? For that matter, what about the very different situations with respect to unemployment insurance in the two countries as a factor in these differences?

While I still have some concern that contrasts between the situations and systems in Japan and in the United States may raise greater problems for empirical comparisons than the authors explicitly recognize, this most recent version of their paper is a big improvement in this respect. Moreover, the importance of contrasts in demographic changes and associated time paths of aggregate productivity is now made explicit, albeit without explicit attention to the associated processes of in-firm human resource development. Do such considerations not weaken somewhat the case for incorporating attitudes in production functions, whatever their indicators?

Very much to its credit, a study such as this raises many basic questions that go beyond anything that could be asked of the authors in one investigation. As they recognize, "industrial conflict" is only one part of a broader interplay of incentive structures, rules of the game, how shirking is monitored, and personnel and human resource development policies generally in their relationships to worker attitudes and behavior. The sorting out of some of the commonalities and differences between Japan and the United States (and within each of these countries) in these respects is a challenge that may prove to be of rising importance in the future.