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Piece rate payment schemes and the employment of women : the case of Hong Kong

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**PIECE RATE PAYMENT SCHEMES
AND THE EMPLOYMENT OF WOMEN:
THE CASE OF HONG KONG**

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Abstract

Past studies unanimously confirm that establishments with high shares of women workers are much more likely to adopt piece rate schemes. This result follows the presumption that women are poorly motivated by deferred compensation because of their shorter expected tenure. An original survey of establishments provides the first test of the determinants of piece rates in Hong Kong. Unique survey questions identify the presence of deferred compensation for which the share of women was ^{presumably} a proxy. Despite these controls and their significance, the share of women fully retains its role. We suggest an alternatives to the received theory behind the association between women and piece rates.

I. Introduction

The "new economics of personnel" brought renewed interest in the decision by firms to adopt piece rate payment schemes.¹ These schemes individualize worker rewards by making earnings proportional to results. While the vast majority of the new literature has been theoretical, empirical studies in a variety of countries confirm many of the central theoretical predictions about the influence of piece rates and about their determinants. One of the strongest empirical relationships demonstrates that establishments with high shares of women employees are more likely to use piece rate schemes (see Goldin 1986, Brown 1990, Drago and Heywood 1995 and Heywood, Siebert and Wei 1996).

While each study confirms this relationship, they also present the identical explanation. Following Goldin (1986), women have shorter expected tenure and, as a consequence, cannot be well motivated by deferred compensation schemes of the sort explored by Lazear (1979, 1983). Hence, women will be largely absent in those firms that defer compensation. As deferring compensation efficiently motivates only long term workers, firms with high shares of women must adopt the alternative short term motivational scheme of piece rates. According to Goldin, women are "naturally" sorted into piece rates schemes as they are not interested in paying the near term costs of deferred compensation. Thus, previous empirical studies use the prevalence of women workers as a proxy to identify the absence of deferred compensation.

Using a unique survey of Hong Kong establishments, the determinants of piece rate adoption are estimated. The determinants

of piece rate schemes in Hong Kong are compared with those from other economies. In addition to the prevalence of women, the survey contains measures specifically designed to directly capture the presence or absence of deferred compensation. These measures confirm that deferred compensation and piece rates are alternative motivational schemes and that the presence of deferred compensation makes piece rate use less likely. Despite the strong role of these measures of deferred compensation, the prevalence of women continues to be an important determinant of adopting piece rate schemes.

We suggest this continued importance implies that the prevalence of women indicates something beyond the absence of deferred compensation. Patterns of historical segregation may have arisen because of the difference between production in which an individual's production is countable and those in which it is not countable due to team production. We argue that team production imposes a greater cost for those with lower labor market attachment. Thus, women with historically lower labor market attachment are less likely to be observed in team production and more likely to be subject to piece rates.

Correctly identifying the determinants of piece rate adoption ranks as an important research topic. Petersen (1992) demonstrates that variations in piece rate use by establishments contribute substantially to the distribution of earnings within an occupation. Pencavel (1977), Seiler (1984) and Lazear (1996), each confirm that piece rate use results in higher earnings than straight time pay for otherwise equal workers. The adoption of a piece rates influences current earnings and is associated with the length of the employment relationship and the presence of internal labor markets. As Petersen

states (1992, pp. 100), "in order to understand the part of (earnings) inequality generated by different payment systems, we need first to understand the process by which establishments adopt specific forms of remuneration." It is toward that understanding that our work moves.

The next section summarizes the argument that deferred compensation is a substitute for piece rates. It also summarizes the other hypotheses to be tested. The third section describes the survey and presents the descriptive statistics. The fourth section details a series of estimations and compares the results with those from other economies. The final section draws several conclusions and suggests our alternative view of the association between women and piece rate schemes.

II. Hypotheses

We have grouped the determinants of piece rate incentive schemes into five broad categories. We will consider each of these categories in turn beginning with that of central interest. In each case we will identify the relevant hypotheses and the variables available in our survey.

A Substitute for Deferred Compensation

Piece rate schemes are an alternative to deferred compensation. Lazear (1979, 1983) argues that a firm may rearrange the profile of earnings by paying workers less than their marginal product early in their tenure and paying more than their marginal product late in their tenure. Rearranging earnings serves to build quasi-rents which are repaid only if workers complete their tenure. This mechanism increases the cost of losing the current job thereby

reducing shirking and reducing the optimal monitoring cost of the firm. For workers who have low expected tenure, the accumulated quasi-rents are lower and the influence on shirking is smaller. As a consequence, the monitoring cost associated with short tenure workers remains high suggesting that deferred compensation is less likely.

The logic above implies that the relative benefits of piece rates, reduced monitoring and increased output, appear greater for short tenure workers paid by regular time rates than for long tenure workers subject to deferred compensation. (See Heywood, Siebert and Wei 1995 for a theoretical model.) As mentioned, women have shorter expected tenure and so are less likely to be motivated by deferred compensation and will be more likely subject to piece rates (Goldin 1986).² Thus, women should be sorted out of deferred compensation schemes and into establishments using piece rates.³ Indeed, past studies proxy the absence of deferred compensation by the presence of high shares of female employees and uniformly find that establishments with high shares of females are more likely to adopt piece rate payment schemes.

The essence of deferred compensation is that the earnings profile over a worker's tenure is steeper than would otherwise be implied (Lazear 1979). Only with this steeper profile can early earnings build up quasi-rents that are paid back later. The survey we helped create attempts to directly measure the slope of the tenure profile by asking establishments to identify the earnings of otherwise equal workers with five years of tenure and with 10 years of tenure. On the basis of these answers we compute a rate of pay increase over the five year period. We follow Lazear and suggest that those firms with larger percentage increases are more likely to have deferred

compensation.⁴ We consciously use the existing workforce to generate both earnings measures. The profile across the existing workers seems the best indicator for potential workers of the slope of their earnings profile. Moreover, the earnings change measure seems especially compelling as an indicator of deferred compensation in Hong Kong where the use of employer provide health insurance and pensions are uncommon. Thus, any deferred compensation is likely to appear in the form of earnings late in the worker's tenure rather than in pensions or increased health insurance use in old age.

We recognize that a steeper profile may also be indicative of internal labor markets in which workers are promoted within the firm over their tenure. Yet, this realization does not change the logic for adopting piece rates or the nature of our testing approach. The possibility of internal promotion motivates only those workers anticipating a long tenure (Addison and Siebert 1991). Thus, women are presumably less likely to be motivated by internal labor markets and more likely to be sorted into firms adopting the alternative motivational scheme of piece rates.

In addition to measures on the slope of the earnings tenure profile, our survey contains two other measures designed to capture the use of deferred compensation. The firms are asked to identify whether or not turnover costs for workers are high enough to be of major importance. When costs are high deferred compensation which acts to bind the worker to the firm would be more likely. Thus, we anticipate that establishments which indicate the importance of turnover costs would be less likely to use piece rates. In addition we know whether or not establishments have had recent layoffs. This indicates an establishment in which long term employment relations are

less prevalent and in which deferred compensation is consequently less likely.

While two previous studies use an indicator of layoffs, ^{老波同音} no previous studies measure the importance of turnover costs or the slope of the earnings profile. If a high share of women workers does ^{代表} proxy an establishment unlikely to use deferred compensation, these three more direct measures should reduce or eliminate the role of the proxy. Once the adoption of piece rates has been conditioned on the other indicators of deferred compensation, the gender composition of the establishment should be less influential.

The major alternative to either deferred compensation or piece rates is the use of straight time rates with managerial supervision to insure worker effort. Piece rates act to conserve managerial resources by linking effort and reward. Thus, relative to either deferred compensation or straight time rates, less supervision should be observed in establishments with piece rates. This notion received strong support from work by Eisenhardt (1988) who found that retail firms with formal incentive schemes had many fewer supervisors per worker. Our survey does not include a measure of supervisors but we do know whether a regular appraisal is made of each worker. Such an appraisal would seem unnecessary when effort and reward are linked and we anticipate that those firms with such appraisals will be less likely to have piece rates.⁵

Other Determinants

The second set of determinants of piece rate schemes capture dimensions of the product market. Following past studies, a series of industry dummy variables are included. (The variation across

industries may be associated with the ability to institute a piece rate scheme because the product determines whether or not individual output can be identified (Brown 1990). A measure of market structure is introduced as it has long been hypothesized that intense competition gives more incentive to control costs and so to introduce incentive pay schemes when possible (McKersie et al, 1964). On the other hand, firms with market dominance may have attained this position because they controlled cost effectively. We test for this using a variable denoting whether or not the establishment has "few" competitors. Following Drago and Heywood (1995) our sample includes profit maximizing firms that have public ownership. These firms presumably minimize labor costs and are subject to same incentive scheme tradeoffs as private firms. In any event they are a small share of the sample and we include a dummy in the estimation to control for their presence.

The third set of determinants are elements of industrial relations. It seems sensible that unions may object to piece rate schemes as they prefer the solidarity associated with low wage differentials. Indeed, Brown and Philips (1986) attribute the decline of piece rates in California canneries to strong opposition by unions. Yet, Brown (1990) argues that merit pay based on perceptions of effort are the most arbitrary and this suggests that unions may prefer piece rates to merit pay. To test for these conflicting effects we include whether or not the establishment has a recognized union. We note that unions are not very prevalent in Hong Kong and that they are generally perceived to be weak.

As a second effect, Levine and Tyson (1990) argue that a cooperative industrial relations climate is more likely to result in

incentive pay schemes. This argument may well apply to piece rates because negotiations over the terms of the scheme will be easier with a cooperative climate in which workers perceive that "fairness" can be obtained. Only then will workers be convinced that the employer is not simply going to lower the piece rate (or change other dimensions of the plan) once workers put forth greater effort.⁶ We proxy a cooperative industrial relations climate with an indicator of whether or not the establishment has a joint committee for consultation about the terms of employment.

The fourth set of determinants revolve around the nature of production. Technical change affecting jobs or working practices necessarily causes revision in prices per piece and has been argued to make piece rates less likely (Brown 1990). Each revision raises questions of fairness and requires absorbing the costs of determining the new rates. We control for such technical change and also for substantial organizational change which might generate the same difficulties.

In addition capital intensity is perceived as making piece rates less likely. Parsons (1986) argues that piece rates run the risk of encouraging damage or abuse to valuable and complex machinery. Indeed, high capital intensity means that more machinery is entrusted to each employee and, under piece rates, maintenance may suffer (Brown 1990). Unfortunately, we do not have a direct measure of capital intensity and our only proxy is the age of the establishment. The pattern of industrial development in Hong Kong has been such that this may capture an element of capital intensity. Earlier years saw a concentration of labor intensive industries which have been replaced by newer firms with far greater capital intensity. These structural

shifts in Hong Kong have been particularly pronounced as described by Suen (1995). While many of the labor intensive establishments have moved to China, we suspect that older firms remain more likely to have the lower capital intensity associated with their vintage and thus be more likely to use piece rates.

(Large scale production is typically perceived as making piece rates more likely.) The fixed costs of establishing and administering a piece rate scheme are spread over a larger number of workers. Indeed, these lower per worker fixed costs have been confirmed by the International Labor Office (see Brown and Medoff, 1989). Our estimates will include the number of manual employees in the establishment to control for this possible influence. In addition, we will control for whether or not manual workers represent the largest group of workers within the establishment. Together these variables should capture the notion that piece rates will only be established when the resulting cost savings are sufficient to cover a substantial fixed cost.

The final major set of empirical determinants of piece rate schemes follow from the (sorting argument identified by Lazear (1985). According to the theory, not only do piece rates elicit additional effort from existing workers but they attract more productive workers by providing them above average earnings for above average production. Lazear (1996) indicates that when the Safelite Glass Corporation changed from straight time to piece rates, per worker output increased 41 percent and that 3/8ths of this increase was due to attracting more productive workers. He also found that absenteeism decreased substantially. This is also a combination of absenteeism being more expensive under a piece rate scheme and workers with lower absenteeism

being attracted to an environment in which low absenteeism is better rewarded.

In an effort to control for this type of sorting the survey identifies establishments particularly sensitive to variations in worker productivity and absenteeism. These establishments should be more likely to offer piece rates in order to attract workers with the relevant characteristics. Specifically, two variables identify whether or not establishments consider productivity to be among the most crucial determinants when hiring and whether or not establishments consider absenteeism to be among the most crucial determinants when hiring. While these proxies may not be ideal, past estimates of the determinants of piece rates have no controls designed to capture sorting and this represents a unique aspect of our study.

III. The Survey and Data Description

In February of 1996 our survey was mailed to a random sample of establishments in Hong Kong. The data bank of establishment names and addresses is maintained by the Census and Statistics Department and was made available to us. The mailing had the advantage of a cover letter from the Manpower and Education Branch of the Hong Kong government encouraging all establishments to respond. By the end of March a total of 770 responses had been returned by profit making firms for a gross response rate of about 31 percent.⁷ See "A Fact Finding Study" (1996) for more detail on the questionnaire and the survey methodology. Use of the critical variable, the slope of the tenure profile, forced us to eliminate all firms less than ten years old. This reduced the sample to 472 while the sum of all missing data resulted in a final usable sample of 173 establishments.

Our dependent variable is whether or not nonmanagerial, nonprofessional and nonsales workers in the establishment are paid according to piece rates. We identify these workers as manual workers and note that they are largely comprised of blue collar and lower level service workers. The answer to this question provides a binary dependent variable indicating the adoption of a piece rate scheme. It is just such a binary variable that was used in estimations for Australia (Drago and Heywood 1995) and the U.K. (Heywood, Siebert and Wei 1995). Unfortunately we do not know the share of compensation that piece rate payments represent and our relatively small sample size does not allow us to make use of coverage information (See Brown 1990 who uses such information for the U.S.).

The means and standard deviations of the main variables are presented in Table 1. A total of 23.9 percent of establishments report the use of piece rates for the relevant workers, a figure very similar to the 21.3 percent in the U.K. (Heywood, Siebert and Wei 1996).⁸ The average share of employment by women is 45.4 percent. This is divided with a 43.8 percent share in the establishments without piece rates and a 50.8 percent share in the establishments with piece rates. These figures are all the shares of the manual workers that are female. The average tenure slope is 36.2 percent over the five year period with a large standard deviation of 31.0. This average implies that each year of tenure between 5 and 10 is associated with an annual earnings increase of 6.4 percent. This figure was calculated from survey questions asking the average pay for manual workers with 5 and 10 years respectively. The change in pay shows substantial variation with the standard deviation essentially the same size as the mean. A substantial share of the observations

were close to zero indicating that tenure did not contribute to earnings.

As the dependent variable is either zero or one, we estimate all of our determinant estimations with the probit procedure which fits the dependent variable to a cumulative normal distribution. While this procedure allows for the bounded dependent variable, the resulting coefficients are not easily interpreted. However, the multiplication of the coefficients by $z - f(X'\beta)$ (f is the p.d.f) allows calculation of typical slope coefficients (see Maddala 1983, pp. 23). We use these typical slope measures to present elasticities for the more important variables.

IV. Results and International Comparisons

We begin by presenting our parsimonious estimation that includes all of the determinants except those three that capture the presence of deferred compensation: the slope of the tenure profile, the importance of turnover costs and the recent use of layoffs. We then reestimate the equation adding these indicators. We examine carefully the influence of the indicators of deferred compensation on the role of the variable capturing the percent of women.

The first column in Table 2 presents the parsimonious estimations. A variety of the hypotheses are confirmed. Most importantly, the data from Hong Kong confirms those from the United State, United Kingdom and Australia by finding that plants with a larger share of female manual workers are more likely to have piece rate payment schemes. The result is statistically significant at the five percent level and the magnitude is substantial. The elasticity is approximately one-half, a value about 3 times that found for the

U.K. and 2 times that in Australia. If this large influence reflects the absence of deferred compensation in female dominated plants, it should shrink or vanish once the more direct measures of deferred compensation are included.

In addition, the presence of appraisal plays the expected role. Those firms using a regular employee appraisal are much less likely to adopt piece rate schemes. The high statistical significance and the large elasticity suggest this is one of the most crucial determinants. Plants that adopt piece rates do so to elicit effort in a manner that conserves on managerial resources. Once in place, the piece rate acts as a "self-monitoring" scheme that reduces (but surely not eliminates) the need for other managerial oversight. This is precisely what the reduced use of appraisal schemes demonstrates.

The age of the firm seems to proxy the capital intensity in the anticipated manner. The sectoral shifts in Hong Kong imply that there are virtually no high labor intensity firms that have started up recently. Any labor intensive firms are older and it is labor intensive firms that are presumed to more likely to adopt piece rates. Thus, the strong partial correlation between the age of the firm and use of piece rates appears sensible. While the logic obviously seems reasonable, the proxy remains imperfect and it remains possible that age is playing an additional role of which we are not aware.

There is also modest support for the sorting role. The signs on both the importance of worker productivity and the importance of absence are positive with the latter significant. To the extent that firms adopting piece rates do so in the knowledge that sorting will result, it makes sense that firms sensitive to these worker characteristics would adopt piece rates. Obviously, this stands as

much more oblique confirmation of sorting than that presented by Lazear (1996) yet it is the first such confirmation in across establishment studies. Finally, it is crucial to note that none of the other results are sensitive to these sorting variables. In particular neither the role of the prevalence of women nor the indicators of deferred compensation change behavior with the sorting variables removed.

As anticipated for Hong Kong, unionization makes no difference. Indeed, none of the remaining variables (excluding the industry dummies) achieve statistical significance. Nonetheless, the estimation in total is highly significant and does a reasonable job explaining the presence of piece rates with a psuedo r-squared (the likelihood ratio index) of .255 and the dependent variable predicted correctly in 83 percent of the cases. Moreover, we emphasize that this stands as a baseline to which we will add the other indicators of deferred compensation. These inclusions will obviously alter the nature of the results.

Column two presents the augmented specification which includes the three indicators of deferred compensation: the percentage change in pay, whether manual worker turnover is costly and the use of dismissals (layoffs). First, note that the estimation does perform better than the parsimonious one. The estimation in total remains highly significant, the psuedo r-squared increases to .302 and the percent of correct observations increases slightly to 85 percent. Second, a likelihood ratio test rejects the null hypothesis that the three additional variables add nothing to the estimations.

The three new variables confirm, on balance, that deferred compensation and piece rates are motivational substitutes in the

workplace. All three coefficients are of the expected sign and two of the three are statistically significant. As the rate of pay increase within the firm becomes larger, the chance of adopting a piece rate scheme diminishes substantially. Similarly, when the firm has used dismissals in the last three years, the use of a piece rate is more likely. While the coefficient of the turnover cost measure does not reach significance, it has the anticipated negative coefficient (worker's can be bonded with deferred compensation) and does have a t-statistic greater than 1.2. Thus, on balance the direct measures of deferred compensation perform well in the estimation and confirm the widely held hypothesis that piece rates will be observed where deferred compensation is not used.

The remainder of the results stand roughly as before. Most importantly, this includes the role played by the share of the manual workers who are women. That role remains virtually identical in size and would meet an even tougher significance test. Even after controlling for the direct measures of deferred compensation, plants with large shares of women are more likely to adopt piece rates. The magnitudes of these effects are worthy of more detail.

Table Three presents a variety of projections designed to capture the relative magnitudes. In each case all variables not identified are set to their mean values. The projections vary three measures, the percent women, the change in pay and the use of dismissals. In each case the new value of the underlying vector is passed through the cumulative normal to predict the likelihood of adopting a piece rate. When the change in pay is 65 percent over 5 years (approximately one standard deviation above its mean) and the plant has not used dismissals, we assume that deferred compensation is likely.

Similarly, when the change in pay is 5 percent over 5 years (approximately one standard deviation below its mean) and the plant has used dismissals, we assume that deferred compensation is unlikely. We project the likelihood of piece rates for two levels of the prevalence of women: 20 percent and 70 percent. These are also about a standard deviation either side of the mean. Thus, Table Three presents four projections in total.

First, the influence of deferred compensation is substantial resulting in a six fold increase in the likelihood of adopting piece rates in plants with low shares of women and almost a four fold increase in plants with high shares of women. Second, the magnitude of the role of the share of women is striking. When the share is high, a plant not using deferred compensation is three times more likely to adopt piece rates. When the share is high, a plant using deferred compensation remains almost twice as likely to use piece rates. While it remains possible that the share of women is simply a proxy for deferred compensation, the current results surely make that questionable. Including three more direct measures of deferred compensation did nothing to alter the role that the share of women play. Even after the inclusion of these direct measures it remains a central determinant in the adoption of piece rates.

Table 4 facilitates a broader comparison of our results for Hong Kong with those from other economies. As emphasized, the share of women employees plays a central role in every economy. Indeed, it stands as the only central result confirmed across all four economies. Two of the indicators of deferred compensation are unique to the Hong Kong survey while the use of dismissals (layoffs) was used in both the UK and Australia. While dismissals were not identified as a

determinant for Australia, the Hong Kong estimation mirrors that in the UK finding that establishments using layoffs are more likely to adopt piece rates. The firm age proxy for Hong Kong mirrors the result found for the more direct measure of capital intensity in the Australia study while the U.K. and U.S. studies found no influence for capital intensity. The finding that firms with appraisal systems are less likely to use piece rates confirms the inverse relationship between managerial resources and piece rates in the U.K. and helps isolate the positive relationship in Australia as paradoxical. The absence of an influence for unionization or consultative committees fits with the balance of results from other economies. Unions have the anticipated negative influence on piece rates only in the UK and no influence of consultative committees has been confirmed in any economy. The sorting variables are unique to the Hong Kong study while the Hong Kong study had no measure of part time workers.

The one major result absent from the Hong Kong estimation is the confirmation of firm size as determinant of piece rate payment schemes. While all three other studies present such confirmation, the size coefficient in the Hong Kong estimations was routinely insignificant and the sign was negative.⁹ It could be the case that other factors work against the traditional size effect. Large firms with greater hierarchy and larger internal labor markets are known to be more likely to adopt promotion based incentive schemes (see Medoff and Abraham, 1980 and Baker, Jensen and Murphy, 1988). This may be particularly so in Hong Kong and these competing schemes may undercut an otherwise evident tendency to use piece rates.

V. Discussion and Conclusions

This paper expands the set of studies which examine the determinants of piece rates. It does so in an economy not previously examined, Hong Kong, and provides explicit comparisons with those done in other economies. It confirms a variety of theoretical predictions including that piece rates are more likely when managerial resources are not being spent on other mechanisms such as appraisal systems. The study also provides at least oblique confirmation of the sorting hypothesis. Most fundamentally, the study examines the crucial played by the share of establishment employees who are women.

The parsimonious estimation confirmed the traditional positive relationship between high shares of women employees and the adoption of piece rates. Three indicators of deferred compensation were then included in the estimation. Two of these were unique to the Hong Kong survey. These new indicators confirmed that when deferred compensation was more likely, piece rates were less likely. Yet, these new results did not at all change the importance of the share of women employees as a determinant of piece rate adoption. This seems surprising as the only rationale consistently advanced for the role of the women share has been that women can not be well motivated by deferred compensation. Thus, when women are a large share of the establishment's work force, deferred compensation is less likely and so piece rate adoption is more likely.

While the results from our estimations do not make this logic impossible, they do reduce the likelihood that it is the only explanation for the strong role played by the share of women.¹⁰ Certainly, the slope of the tenure earnings profile, together with the other two variables, would seem to more directly capture the

presence of deferred compensation. The persistence of the share of women as a determinant would seem to demand additional explanation. To conclude we suggest three alternative explanations that may play some role in explaining the continued strength of the share of women employees in the face of the alternative indicators of deferred compensation. We do not pretend that we can directly test for these alternatives but contend they should be part of further surveys and empirical testing.

The view of women workers as being characterised by shorter expected tenure is obviously correct but incomplete. Lower expected tenure is only one manifestation of lower labor force attachment. For instance, Corcoran and Duncan (1979) find that women are more likely to take time off for their own illness, more likely to take time off for the illness of a family member, more likely to place limits (either hours or distance) on the jobs they accept and are more likely to quit in the near future for reasons unrelated to job training. Indeed, these differences are observable not only across occupations but also within (see Wood, Corcoran and Courant 1993). This broader view of lower labor force attachment may provide insight into the concentration of women on piece rate schemes.

The essence of piece rate schemes is that output of each worker is distinct and can be attributed to an individual. Such a production process involves a minimum of team work (Alchian and Demsetz 1972). When team work characterises production, identifying an individual contribution is necessarily difficult. Moreover, when team work characterises production, low labor force attachment imposes a much higher cost. For example, when a worker calls in sick at the last minute a firm without team production loses just that worker's output

but a firm with team production risks losing much or all of the output of the entire team.

Those firms with a production process characterized by team work will use managerial oversight as a method of monitoring effort. This monitoring process may involve deferred compensation but need not. The process could also include merit pay allocations or sanctions for workers who shirk. Whatever the monitoring process involves, it will not include piece rates and production will be sensitive to low labor force attachment. Thus, we might anticipate a positive relationship between the percent women workers and piece rate adoption that goes beyond the use of deferred compensation. The lower labor force attachment of women makes them less desirable in team production and it is only in the absence of team production that piece rates can be successfully used.

The long history of gender segregation in work tasks may feed into the differential use of piece rates. Women have traditionally worked at home at tasks that do not contain large elements of team production. Their movement to the labor force in jobs related to their tasks at home would further increase the likelihood that they would be subject to piece rates. As an illustration, the needle trades have a long tradition of piece rate adoption. These tasks are similar to those historically performed by women at home and are characterized by only modest degrees of team production.¹¹ It seems likely that women would be concentrated in needle trades and that piece rates would be adopted. This seems likely without any appeal to deferred compensation.

To the extent that societal pressures concentrate women in "women's work" (tasks similar to those traditionally done at home)

there may be yet another element driving the strong correlation between women and piece rates. A disproportionate share of women are segregated into occupations characterised by low levels of team production and thus particularly suitable for piece rate adoption. Thus, one need not assume (although it may be the case) that the concentration of women in piece rate schemes is efficient to generate a sensible theory behind the correlation. It could be societal pressure for women to remain in a narrow set of occupations combined with the characteristics of production in those occupations which generates the correlation. *☆ implication*

In short, (we suggest that broadening the discussion beyond deferred compensation stands the best chance of explaining the relationship between women workers and piece rates. Lower labor force attachment more generally argues that women may be concentrated in occupations with low levels of team production and, hence, a high chance of using piece rates. This tendency may be compounded by the skills women bring from traditional work at home and by societal pressures to keep women in these jobs. Certainly, the results from Hong Kong suggest that the association between women and piece rates goes beyond deferred compensation. While additional research is surely warranted, the current results do call for a broader focus of the sort we suggest.

There remains an alternative explanation for the role of an establishment's percent women in predicting use of piece rates. Discrimination against women may be particularly difficult when earnings are based on an objective measure of performance such as the actual number of pieces produced. Thus, women may avoid work settings in which earnings and promotion result from a male supervisor's

subjective evaluation of effort and may search for jobs which directly tie earnings to an undeniable indicator of performance. Indeed, Belman and Heywood (1988) found a tendency for blacks in the United States to be more likely to be found on piece rates, a result consistent with this logic. Obviously, even a piece rate scheme leaves some latitude for discrimination such as arguing that pieces don't meet the quality standard. Nonetheless, this alternative suggests another alternative to the standard notion that women are disproportionately found on piece rates because they have shorter employment duration and again calls for a broader research agenda.

TABLE ONE

Definitions, Means and Standard Deviations

- ✓
- Piece Dummy=1 if a piece rate is used for the payment of nonmanagerial, nonprofessional and nonsales workers ("manual") (.213 , .423)
- %Women Percentage women among manual workers (45.4, 25.5)
- PayChange Percentage increase in earnings for line workers associated with the difference between 5 and 10 years of tenure (36.3, 31.0)
- Dismiss Dummy=1 if the establishment has had layoffs in the workforce during the last 24 months (.312 .463)
- Turnover Dummy=1 if the establishment identifies the turnover costs associated with manual workers as important (.254 .437)
- PubFirm Dummy=1 if the establishment is a government owned for profit firm (.012 .107)
- FirmAge The number of years that the firm has been in business (25.4, 23.3)
- MPower Dummy=1 if the establishment reports that there are only a "few" competitors in its product line (.341, .475)
- Union Dummy=1 if the establishment recognizes a union (.029, .168)
- Consult Dummy=1 if managers consult with employee representatives on a regular basis (.382, .487)
- Size The number of manual workers in the establishment (342.2, 1022)
- Manual Dummy=1 if manual workers represent the largest group of workers in the firm (.671, .471)
- TechChng Dummy=1 if new machinery or equipment has been introduced in the last three years (excluding routine replacement) (.370, .484)
- OrgChng Dummy=1 if substantial changes in work organization or working practices have been introduced in the last three years (excluding those associated with new machinery or equipment) (.312, .484)
- Appraise Dummy=1 if the company conducts a regular appraisal of all staff (.734, .443)
- Productivity Dummy=1 if the establishment identifies individual worker productivity as among the most important factors when hiring manual workers (.509, .501)
- Absence Dummy=1 if the establishment identifies individual workers' expected absenteeism as among the most important factors when hiring manual workers. (.040, .198)

TABLE TWO

Probit Estimations

	without measures of deferred compensation	with measures of deferred compensation
Constant	-5.551 (99.05)	-4.439 (100.0)
%Women	.0103** (.0061)[.487]	.0112** (.0053)[.469]
FirmAge	.0134** (.0051)	.0123* (.0066)
MPower	.1932 (.2784)	.1634 (.2908)
Union	-2.344 (61.05)	-3.085 (59.24)
Consult	-.3698 (.2953)	-.3379 (.3093)
PubFirm	-4.156 (99.04)	3.038 (99.99)
Appraise	-1.032** (.2923)[.790]	-1.107** (.3051)[.792]
Size	-.0006 (.0004)	-.0007 (.0005)
Manual	.4539 (.4485)	.5580 (.4693)
TechChng	-.2298 (.2795)	-.2470 (.2958)
OrgChng	.1458 (.2901)	.2492 (.3026)
Productivity	.5686 (.4039)	.6448 (.4125)
Absence	1.223* (.7204)	1.497* (.7969)
PayChnge		-.0123** (.0061)[.409]
Turnover		-.3980 (.3279)
Dismiss		.5113* (.2804)[.149]
Industry Dummies	YES	YES
Chi-squared	47.62	56.51
Pseudo R-Squared	.255	.302
Value of p.d.f at at means (z)	.222	.201
Sample Size	173	173

*significant at the 10 percent level

**significant at the 5 percent level

TABLE THREE
Projected Probabilities

	Deferred Compensation is unlikely	Deferred Compensation is likely
Percent Female Equal 20	.066	.389
Percent Female Equal 70	.172	.614

Note: These projects are made using the full sample and by setting all other variables than %Women, PayChnge and Dismiss to their mean values. See the text for details.

TABLE FOUR
Comparisons Across Economies

	USA	Australia	UK	Hong Kong
%Women	+	+	+	+
PayChange	na	na	na	+
Turnover	na	na	na	0
Dismiss	na	0	+	+
Union	0	0	+	0
Consult	na	0	0	0
Capital Int.* (Age)	0	-	0	-
MPower	na	-	0	0
Size	+	+	+	0
TechChng	na	0	+	0
OrgChng	na	na	0	0
Managerial** Resources (Appraisal)	na	+	-	-
Productivity	na	na	na	0
Absence	na	na	na	+
Parttime***	na	-	-	na
Industry Dummies	yes	yes	yes	yes

*The UK study the presence of "high technology" to proxy capital intensity.

**The UK and Australia studies both use the share of managers as an indicator of managerial resources.

***The UK measure was the share working parttime while the Australia measure was the percent officially designated as "casual."

Note: USA (Brown 1990), Australia (Drago and Heywood 1995), UK (Heywood, Siebert and Wei 1996).

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¹This new emphasis is summarized in the Journal of Labor Economics (1987) volume dedicated to the subject and in the new text by Lazear (1996).

²Indeed, in February 1996, full-time men employees in Hong Kong had an average tenure of 81.2 months while that for full-time women employees was 54.7 months. These figures are computed from the "Public Survey" commissioned by the Education and Manpower Branch of the Hong Kong government.

³It is possible that women even compete harder for piece rate jobs knowing that their alternative is straight time rate jobs.

⁴The five year benchmark was chosen to minimize the influence of investment in employer specific human capital which should have been undertaken very early in a worker's tenure.

⁵Note that firms with appraisals may include those with deferred compensation because detection of shirking is still needed even when the costs of job lost are high.

⁶See Gibbons (1987) for a model of an employer doing just this.

⁷Officials of the Census and Statistics Department suggested to us that the characteristics of the respondents aligned well with the full population.

⁸The U.K. figure also identifies piece rate use for manual workers which, while close, need not be identical with the definition we have adopted.

⁹The variable was alternatively entered as a log and as a dummy variable above a variety of critical levels. At no time were we able to confirm the expected finding of a significant positive relationship with piece rate adoption.

¹⁰Indeed, the simple correlations between the women share of the workforce and two significant indicators of deferred compensation are exceedingly low .04 for the change in pay and .03 for dismissals.

¹¹Indeed, the entire "putting out system" in which women were paid for work done at home was both centered on the needle trades and used virtually only piece rate payments.

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