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The Effects of Group Incentives in an Indian Firm
- Evidence from Payroll Data

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Abstract

This paper estimates the effects of group incentives on productivity, pay and employment in a large unionised firm in India. Using plant-level monthly time series data from the payroll office for the period 1985-95, and controlling for both (plant) fixed effects and (contract) time effects, the paper provides econometric evidence on the effectiveness of both the level and intensity of incentive pay on the outcome measures. In addition, the relative performance of two types of group incentives defined on the basis of group size is also analysed. At the firm level, the results generally confirm predictions from theory that productivity returns to incentives are non-linear and concave in shape and that the effectiveness of incentives is decreasing in group size. I argue that the latter is most likely due to the lessening of the free-rider problem and the increased effectiveness of peer/mutual monitoring associated with smaller groups. The results also point to a negative relationship between the level of incentives and employment over time.

Keywords: Group Incentives, Compensation, Free Riding, Peer Monitoring, Trade Unions, India

JEL Classification: J3, J33, J51, C22, C23

Introduction

Conventional wisdom suggests that group incentive schemes are often rendered useless in firms and organizations that attempt to implement them due to both the first and second-order free-rider problems. The first order problem, or the $1/N$ problem, refers to the fact that since a single individual has a small if not negligible impact on measured group performance, there is a high probability that the individual will free-ride on the efforts of others. In other words, the marginal probability that the individual is paid the incentive when she works hard is so small that there is a clear incentive to shirk. This moral hazard problem increases as the firm gets larger (Holmstrom, 1982) which means that the above marginal probability is decreasing in firm/group size (Knez and Simester, 2001).

However, the above first order free-rider problem may be mitigated if the group whose collective performance is rewarded is made sufficiently small. The latter will then generate a self-enforcing system of peer or mutual monitoring as well as foster cooperative behaviour. The idea behind the latter is that the incentives to identify (if not penalize) a shirker are much larger in small groups and become severe in large groups (Lazear, 1998) and this would be truer in unionised settings. Even though group-based incentives reduce monitoring costs associated with supervisory control, Knez and Simester (2002) point to two reasons why mutual monitoring may not support a high group effort norm. First, there is an incentive to free-ride on the monitoring and sanctioning efforts of one's co-workers given that it is costly to monitor and sanction one's colleagues. This is the second-order free-rider problem and this too is decreasing in firm/group size. Thus, the effectiveness of mutual monitoring decreases as the group size increases and the costs of mutual monitoring rises. Second, to the extent employees in a given firm are geographically dispersed in different plant locations, mutual monitoring becomes near impossible, and thus large firms do not usually generate mutual monitoring schemes (Kandel and Lazear, 1992).

Although small group size clearly seems to be a panacea to the two free-rider problems, there are costs associated with this strategy as well. Difficulties arise if some groups are legible for incentives and some groups are not, and this leads to what Milgrom and Roberts (1992) call 'influence activities' and 'lobbying costs' that are unproductive. Groups not getting the incentives argue that those legible are just fortunate and that all should be made recipients. In unionised settings these costs can become particularly severe, as rank and file members excluded from the group incentives can question the union's legitimacy itself. It becomes difficult for the union to sell a group incentive scheme to its rank and file if its beneficiaries are only a small subset of its constituency. The union will be

able to sell a group incentive plan to its supporters if and only if it can convince the latter that they *all* stand to gain monetarily over time even though each individual employee is risk-averse and thus reluctant to exchange some fixed earnings for variable earnings.

This paper examines the effects of a group-based incentive plan on productivity, pay and employment across four plants of an unionised Indian firm using monthly time series data over a ten-year period. The incentive plan is so structured in this firm that we are able to test for the relative performance of two types of group incentives distinguished on the basis of their sharing rules. To my knowledge this is the first detailed econometric study of the effects of incentives in a firm situated in a developing country labor market. The rest of the paper is organized as follows. In the next section I briefly review a few earlier US studies on group incentives as a point of entry. In Section II I present some institutional background to the specifics of the Indian economy and its labor markets. Section III details the firm and the data base and describes the group incentive schemes. Section IV sets out the empirical procedures and then presents and discusses the results. Finally, the conclusion summarizes.

Conceptual and Methodological Issues

Nalbantian and Schotter (1997: 314) in their experimental study on the effects on productivity of group incentives express surprise at the paucity of empirical research in this area given the significant theoretical advances that have been made in the analysis of contract theory, especially as it relates to optimal labor contracting.[1] While in recent years there has emerged a substantial empirical literature in the US that uses rigorous econometric techniques to test for the effects of incentives on a host of productivity measures (see the review of this literature for example in Weitzman and Kruse, 1990; Prendergast, 1999; Cappelli and Neumark, 2001; Ichniowski and Shaw, 2003), the authors contend that "there has been no direct investigation of the *relative* performance of alternative *types* of group incentive systems". Consequently, "there is little empirical basis for discriminating amongst the various group incentive programs, especially as concerns the structure of the sharing rules or payoff formulae that distinguish them" (1997: 314).

An important reason for the above, according to these authors, "has to do with the difficulty of using naturally occurring data to answer these questions": preference and

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[1] In their *experimental* study on the effects of group incentives on productivity the authors found the following: 'shirking happens' (effort levels approach the shirking equilibrium towards the end of the game), 'history matters' (positive past group experience leads to high current output levels), 'a little competition goes a long, long way' (setting up an intra-firm team tournament-like competition effectively increases group effort), and that 'monitoring works but is costly'.

production function parameters are usually not observable, and even if data were available they are usually of unreliable quality. In addition, there are the familiar methodological problems of 'endogeneity' and 'control'. According to Prendergast (1999), researchers must attempt to overcome two identification problems: the 'standard empirical identification problem' that the choice of contracts is endogenous, and the 'theoretical identification problem' that outcomes are equally consistent with other plausible theories. These problems become especially acute when comparisons are made across firms "operating in diverse and highly idiosyncratic environments" (Nalbantian and Schotter, 1997: 315).

One way out of these methodological and empirical difficulties is to painstakingly collect data that enables one to carry out what Ichniowki and Shaw (2003) call 'insider econometrics'. This novel methodology entails several processes: identifying a "narrow production process that can be modelled empirically", carry out intensive field research through site visits and open-ended interviews so as to understand the production process thoroughly, and finally, obtain "accurate panel data on production, technology, and organizational practices from the broadest possible sample of worksites using this process". Unlike both survey and case study research, this 'insider' approach "makes it possible to develop particularly convincing econometric estimates of the impact of organizational practices on performance".

However, all labor econometric research that uses data from companies do not constitute insider econometric research as the authors convincingly point out. Since this methodology's real aim is to estimate the effects of 'organizational-level' practices on performance, the data must contain organizational observations with and without the 'treatment' variables. In addition, performance for individuals or small units within the firm should be clearly measurable. Consequently, econometric case studies that use personnel records to trace employment patterns within a firm, such as in Baker, Gibbs and Holmstrom (1994), are not considered as 'insider' studies. Using this methodology for example, Ichniowski, Shaw and Prennushi (1997) examined the effects of several human resource management practices on performance in 36 different steel finishing lines in the US.

One US study that in some measure motivated the present study and is related to the exercise in this paper are the effects of firm-wide group incentives at Continental Airlines (Knez and Simester, 2001). In this paper the authors isolate the effects of a firm-wide bonus scheme by comparing the change in performance at outsourced and non-outsourced (where the bonus scheme applied) airports and found that performance improvements were larger at the latter. Their explanation for this 'surprising result' was that at Continental Airlines, the

organization of employees into autonomous work groups, dispersed between airports and terminals, induced mutual monitoring among employees within each work group. The factors that facilitated mutual monitoring also facilitated consensus thereby reducing the 'costs of sanctioning' among group members with a high degree of interdependence. As the authors put it: "Conditional on a work group agreeing to adopt a high effort norm, consensus that an employee is performing poorly will develop quickly and support sanctioning" (2001: 766). Effective mutual monitoring in this setting provided an effective solution to the free rider problems. They also found that the incentive scheme was self-funding.

The present study is located within the above economic discourse on incentives in firms and organizations except that it analyses a firm situated in a developing economy. Analysing one firm over time avoids the usual problems associated with unobservable idiosyncratic factors that typically influence firm performance in inter-firm comparison studies. The data base at one level seems to be like the 'insider econometrics' discussed above. Individual and plant output as well as all other variables are clearly measured and accurate coming as they do from plant-level payroll offices, thus enabling one to estimate fairly precise econometric estimates of the effects of particular group incentives on the outcome measures. In addition, extensive 'field visits' were carried out to the four geographically dispersed plants that entailed not only understanding the production processes, but more importantly involved carrying out open-ended interviews with financial and human resource managers, union officials and rank and file workers seeking their (often conflicting) views of the group incentive schemes in place. These visits made clear to me the importance of inter-plant differences in terms of both local labor market conditions as well as union goals and objectives.

At another, possibly more important level, the data falls short of what Ichniowski and Shaw (2003) call 'insider econometrics'. Although all the variables in the data base used in this study are accurately measured, the sample does not contain organizational observations with and without the 'treatment' variables, i.e., I do not have data before the group incentive schemes were in place in this firm. Thus, I am unable to assess the impact of these firm-wide incentives on *improvements* in performance. What I do instead is to present accurate estimates of various *elasticities* that relate the responsiveness of several outcome measures (i.e., productivity, pay and employment) to changes in both the level and intensity of incentive pay. Before proceeding to discuss the firm and the data base, I first sketch out in brief the institutional and historical background of the Indian situation as it

relates to the specific time period under consideration (1985-95) so as to situate the specific firm in the overall macro environment.

Institutional Background (*circa* 1985-95)

The period 1985-95 reflects an important decade with respect to some critical structural transformations in the overall Indian economy, especially in relation to unions, labor relations, and labor market changes.[2] During the first three decades of planned industrialization in India (1950s to the mid-1970s), the national government played a determining and strategic role in guiding outcomes both in the labor market as well as in the labor relations system. The latter was largely characterized by tripartite centralized bargaining between well-defined employer groups, government agencies, and large national trade union federations. Wage determination and the structure of bargaining mostly took place at the industry or regional level often with the use of bureaucratically administered Wage Boards. Consequently, both management and unions at the plant/firm level had little say in determining pay structures and outcomes. The labor relations regime at this time minimized industrial strife by actively promoting 'responsible unionism' through effective governmental intervention in all aspects of industrial relations outcomes.

However, during the period of internal liberalization in the 1980s, the state gradually started retreating from the economic domain by significantly changing its domestic economic policies so as to increase both internal competition and export growth. Similarly, the central government became increasingly hesitant to intervene in the labor relations arena as it had earlier, and preferred instead to let the various state governments solve their own industrial relations problems. Although the 1980s was characterized by fairly high growth rates it came to be known as the period of 'jobless growth' (Ghosh, 1992; Bhalotra, 1998). Labor markets got tighter as employment elasticities declined rapidly in nearly all major sectors (Papola, 1994). The rigid employment security provisions of the Industrial Disputes Act of 1947[3] made it very difficult to retrench workers during downturns, and consequently, firms were reluctant to hire additional workers during upswings (Fallon and Lucas, 1991). Constrained on their demand curves, firms attempted to increase their enterprise productivity using an array of strategies: technological up-gradation, outsourcing to non-union sites, and more relevant to the present context, changing the nature of the

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[2] For a comprehensive historical treatment of these transformations in India that attempts to theorize about distinct phases that are marked by structural breaks, see Bhattacherjee (1999; 2001). For a detailed analysis of India's macroeconomic policies, see Joshi and Little (1994).

[3] The 1982 amendment to this Act required the employer of a firm employing more than 100 workers to seek permission of the concerned state government before the firm could retrench or layoff its workers.

compensation package with union acquiescence to include a variety of incentive pay schemes in the total compensation package. The labor relations regime of the 1980s, in sharp contrast to the earlier period, attempted to maximize labor productivity with firms actively promoting 'independent' trade unionism and decentralized collective bargaining.

While employment growth declined during 1980/81 to 1988/89, the capital-labor ratio and labor productivity at the macro all-India level increased at an average annual rate of 8% and 7.5% respectively (Papola, 1994). In terms of wage movements, while workers in profitable firms and industries experienced rising real wages during the latter part of the 1980s, often as a consequence of informed collective bargaining at the plant-level, low-paid employees in the declining sectors of production witnessed real wage erosion (Ghose, 1992; Bhattacherjee and Datta Chaudhuri, 1994). Whereas some writers attributed the rise in both wages and labor productivity to technological change brought on by employers as a response to increased domestic competition (Jose, 1992), others argued that it was union militancy and high wages in specific sectors that resulted in technological change that subsequently led to a decline in employment growth (Ahluwalia, 1991). Whatever the causality, it was clear that employees, unions and management faced a considerably different labor market environment at the enterprise level in the 1980s compared to the 1970s and earlier.

It was in the early 1990s that the Indian economy, faced with a severe foreign exchange crisis, decided to adopt the World Bank-IMF 'stabilization and structural adjustment program'. In 1991, the *rupee* was devalued, tariffs were brought down, import quotas were reduced, state monopoly on imports and exports was ended, and the government set about reducing its fiscal deficit. On average, the Indian economy grew at around 5.3% during the first five years of the economic reforms (1992-96), and contrary to expectations, investment performance actually improved after the reforms, with the private corporate sector now emerging as the economy's 'leading' sector (Nagaraj, 1997). Multinational corporations reacted favourably and achieved entry and growth through various mechanisms, such as, the ousting of Indian partners, extensive mergers and acquisitions, and through expansion and fresh entry (Chaudhuri, 1995). By the mid-1990s however, a whole range of issues on the economic reform agenda remained incomplete: infrastructure development, greater transparency in investment procedures, review of import duties, and most importantly, public sector and labor market reforms.

On the employment front, although the initial stabilization years took their toll on organized manufacturing employment, the subsequent structural adjustment process led to

employment growth at around 2.3% between 1992 and 1995 (Deshpande and Deshpande, 1996). In a more recent analysis, that compares the employment and labor market situation between 1993/94 and 1999/2000[4] (that is, nearly a decade of economic reforms), Sundaram (2001) found the following: (a) the workforce grew at about half the rate of the population growth rate, (b) the declines in the worker-population ratios for all groups were primarily due a beneficial rise in the student-population ratios, rather than due to an increase in unemployment or a change in the age-structure of the population, (c) a significant drop in the share of the workforce in 'agriculture and allied activities', (d) the manufacturing sector recorded a slight rise in its share in the aggregate workforce while the service sectors ('transport, storage and communication', 'trade, hotels and restaurant') recorded the largest increases, (e) labor productivity (gross value added per worker at constant 1993-94 prices) increased at a compound annual rate of over 6% whereas average wage earnings at the lowest level increased at over 2.5%, and finally, (f) except for 'urban women', the other three segments (by gender and by urban/rural) faced increased unemployment, though these rates fell for people within these groups with higher education.

While these important findings are somewhat encouraging in terms of the effects of structural adjustment reforms on labor market outcomes in the Indian economy, it needs no stressing that a 'permanent' job in India's organized manufacturing sector is a very coveted position among blue collar workers. The case study below illustrates how employers, employees, and unions have had to deal with issues of compensation, productivity, and employment at the enterprise level during this critical ten year period when India's economy traversed from a relatively insulated state into the world of economic reforms and globalisation.

The Firm, the Data Base and the Group Incentive Schemes

ITC Limited is one of India's foremost private sector companies with a market capitalization of around US $ 4 billion and a turnover of US $ 2 billion.[5] Over the years, ITC has evolved from a single product company to a multi-business corporation. Its businesses or divisions/firms are spread over a wide spectrum, ranging from hotels to packages foods, from international commodity trading to branded apparel, from tobacco and cigarettes to foods and confectionary, and finally from packaging and paper products to

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[4] Based on a comparative analysis of the National Sample Survey Organisation's Employment-Unemployment Surveys for 1993/94 and 1999/2000.

[5] See ITC's website for further information: www.itcportal.com

agricultural exports. It is one of the country's biggest foreign exchange earners (US $ 2 billion in the last decade) and consistently rewards its 180,000 shareholders. ITC employs around 15,000 people at over 60 locations across India.

Among ITC's two 'core principles' with respect to its corporate governance are that management should have the 'freedom to drive the enterprise forward without undue restraints' and that this freedom be 'exercised within a framework of effective accountability'. The company strongly believes in 'empowering' its employees so as to actualise their full potential. It also believes in full transparency in its interactions with its unions and employees during collective negotiations without jeopardizing its strategic interests. Finally, the company is fully committed to its policy of voluntary bilateral collective bargaining with unions that are truly representative of their rank and file members.

The data base used in this study is from one of ITC's divisions/firms enumerated above. It consists of four regionally dispersed plants that produce the same product with more or less the same production technologies but with different installed capacities.[6] The product market structure faced by this firm in India changed considerably during the decade: between 1985-90 the firm was a dominant player in a relatively protected domestic market, whereas with the onset of globalisation, this dominance came to be increasingly threatened by foreign imports during 1990-95. In September 1995 I was asked by the human resource department of this firm to undertake a wage-productivity study. The objectives were two-fold: (a) visit their four plants in order to understand the production processes, interview plant managers from different functional areas, union officials as well as rank and file workers, especially soliciting their views on the group incentive schemes operational in this firm, and (b) analyse the wage-productivity time-series data that the firm provided me from their computerized payroll offices at the four plants in conjunction with data from their corporate headquarters. The basic findings were presented to senior ITC managers at their corporate headquarters in Calcutta in March 1996.[7]

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[6] The specific division is not identified at the request of the firm. Although the four plants produce the same product with identical technologies, the output composition differs in terms of different brands. The data base does not distinguish between these brands and thus 'value-added' in production cannot be estimated.

[7] The terms of reference of my contract was that I could use this data base for purely research purposes five years after March 1997, i.e., in 2002. I am grateful to Nalin Miglani and Anup Singh who requested me to undertake this project. In addition, I thank several plant managers, union officials and other employees at the four plants and at their corporate headquarters in Calcutta, who helped me out with various queries and sat through long interviews both individually and in small groups. I especially thank the management information systems employees at the various payroll offices for providing me with the time-series data that they laboriously had to clean so as to make it consistent and comparable.

The Plants

Before proceeding to describe the structure of the data base and the group incentive schemes a few words about the four plants are in order. While two of the plants are located in large metropolitan cities (one in the east the other in the south), the other two plants are located in district towns (one in the east another in the north). This geographical distinction implies that the labor market conditions that characterize these four plants are different. The ones located in the large cities are more competitive, and these two cities are the capitals of relatively more industrialized states. On the other hand, the ones located in the districts are almost one-company towns exhibiting characteristics of bilateral monopolies. They are both located in relatively poorer agrarian states.

There is yet another way that the four plants can be distinguished. In an inter-state study on the effects of labor regulation on economic performance in India, Besley and Burgess (2002) show that the industrial relations climate affected the pattern of manufacturing growth in the period 1958-92. They define this climate in terms a 'pro-employer', a 'pro-worker', or a 'neutral' regime based on the number and content of amendments that the states added on to the nationally legislated Industrial Disputes Act of 1947. According to their classification, two of our sites are deemed as 'pro-employer' (one each in a city and a district) and the other two are 'pro-worker' (again one each in a city and a district).

Plant-level bargaining characterizes the structure of collective negotiations in this firm, with each labor contract being on average four years in duration.[8] Although plant-level unions negotiate with plant-level managers, the corporate human resources department located at the headquarters sets the overall guidelines to be followed when negotiating over various aspects of compensation policy. As the labor contracts are not simultaneously negotiated across the four plants, there is considerable learning by watching and hearing from the experiences of others. In 1992 there was a concerted attempt by the unions in three of the plants to create a firm-wide bargaining structure, but lukewarm response, if not outright hostility, from the unions in the other plant and considerable management resistance from the plants as well from the corporate headquarters aborted this attempt. The latter suggests that there may have been considerable differences in the nature of these plant-level unions in terms of their goals and objectives across the four plants.

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[8] The duration of the contract period varies from three years in one plant to five and a half years in another. The last observation in the series is August 1995. The latter occurs well before the third labor contract in all the four plants comes to an end.

The Data Structure

The data base consists of plant-level monthly time series data on several measures of productivity (physical as well as cost productivities), compensation (guaranteed as well as incentive pay), absenteeism, and employment for the period January 1985 to August 1995. This information is recorded and collated at the four payroll offices, sent to the corporate headquarters, and are comparable across the four plants. In a few instances the data are missing, and hence this pooled cross section time series panel is somewhat unbalanced. It should be borne in mind that although the compensation data refers to actual *rupees* paid in a given month, they in a critical sense also reflect outcomes from a collective bargaining process. As mentioned earlier, the series contain three labor contract periods and the data base indicates in which month a new contract comes into force in a given plant. In the empirical specifications that follow, I use two contract dummy variables to control for these 'structural breaks' in the time series.

I use three measures of productivity as dependent variables. The first one is the productivity per worker measure (the number of units in thousands produced per worker per hour). The data base contains monthly plant production, but since the monthly absenteeism rate as well as the monthly employment level varies across the plants, I compute a per worker measure so as to control for these variations. The firm refers to the monthly employment data as 'on roll' employment, i.e., the number of workers on its 'rolls'.[9] The second measure of productivity is the monthly absenteeism rate and this could also be interpreted as a measure of worker satisfaction in the Freeman-Medoff (1984) voice-option sense. Earlier studies have estimated the effects of various forms of employee participation on absenteeism rates, for example, Wilson and Peel (1991) examine 52 engineering and metal working firms in the UK. Finally, the third measure of productivity used is a cost-productivity variable: total labor costs per unit of output (in thousands). Total labor costs here refers to all cash costs and does not include the cash equivalent of what the firm calls 'employee benefits in kind' (that is, per worker expenditure on canteen, uniforms, and medical), although the latter are also contained in the data base.[10]

While the above refer to three productivity outcome measures, I am also interested in estimating the effects of incentives on monthly employee pay and on 'on roll'

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[9] Thus, productivity per worker = plant output / ['on roll' employment – ('on roll' employment) x (absenteeism rate)] for a given month in a given plant.

[10] Consequently, possible trade-offs between say incentive pay and employee non-cash benefits that unions may be making during contract negotiations are not considered in this paper. The first and the third productivity measures are similar to the ones used in Cappelli and Neumark (2001). Similarly, like their study, I too have no measure of establishment profitability.

employment in the firm. The pay measure that I use is total monthly pay per worker (in *rupees*) and refers to only cash payments arising from all guaranteed and incentive pay and from monthly overtime payments. Examining the effects of group incentives on employee pay and employment together could suggest trade-offs that unions and management may be engaged in during collective negotiations.

The Group Incentive Schemes

The group incentive system described below is fairly representative of other such schemes in comparable Indian firms. The structure of pay in this ITC firm is divided into two categories. 'Steady' or 'guaranteed' pay does not vary with productivity but are periodically negotiated over during collective bargaining, with management of course taking into account average productivity levels during the last contract period. The 'steady' pay component in turn consists of various parts: 'basic' pay, 'house rent allowance', 'personal pay', and a fixed as well as a variable cost-of-living adjustment. The latter is based on the 'Consumer Price Index for Industrial Workers' and varies over time, but is considered as part of the 'steady' pay package. In sharp contrast, 'risk' or 'incentive' pay depends directly on productivity and are based on specific sharing formulas that management determines, with the detailed rates of return being subject to negotiations with the unions at the four plants.

The structure of incentive pay in this firm operates at three levels of centralization, or in other words, incentive pay consists of three components. The Annual Productivity Bonus (APB) is a firm-level profit sharing scheme as it is dependent on annual firm performance. It is paid if and only if the productivity of the firm's entire workforce rises, and the actual amount paid is a percentage of an employee's 'basic' pay (which is the largest component of 'steady' or 'guaranteed' pay).[11] Although management's initial intention with this scheme was to generate cooperative behaviour at the firm level, in practice it has turned into a relatively small price to pay to avert annual industrial conflict over the bonus issue, a phenomena that plagues several firms and industries in India. One manager told me that the "APB is more a legal compliance than a real incentive". Nevertheless, unions do view the APB as a mechanism that ensures pay stability and some managers view it as a "growth dividend" to its employees.

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[11] The APB varies between 20%-33% of an employee's 'basic' pay, and in practice every employee receives some minimum guaranteed bonus amount (usually 8%-9%). In this data over the decade 1985-95, the APB on average formed around 5.7% of an employee's total monthly (cash) pay.

The other two schemes are forms of 'gain sharing' and are the real group incentives in this firm.[12] The Productivity Index Plan Scheme (PIP) is a plant-based incentive system that is determined by the plant's monthly output and is shared by all employees, with the actual amounts varying by stipulated job designations. The PIP kicks in only after monthly output exceeds a certain agreed-upon threshold level. Although the PIP schemes are different in each plant in terms of the minimum threshold level and the various rates of payment beyond this level, reflecting varying union and management preferences during collective negotiations, the basic structure is the same.[13]

At the most decentralized level is the Departmental Incentive Scheme (DIS). In this system, the incentive paid on a monthly basis is a clear and precise function of machine output in specifically designated departments within a plant, often demarcated as 'autonomous work groups'. Although the initial idea on the part of management was to restrict the recipients of this incentive exclusively to those employees working within these designated departments, union resistance to this restriction in three of the four plants led management to reluctantly agree to make all the employees recipients albeit at different levels, i.e., employees working within these designated departments receive considerably higher payments than others. In the remaining plant (located in a city) the DIS scheme was implemented only in 1992, but unions at this site agreed with management that the recipients would only be production workers (much to the dissatisfaction of non-production workers). Again, like the PIP, the actual payment schedules under the DIS are negotiated separately at the plants during contract negotiations.[14]

During my 'field visits', I heard several views regarding both the PIP and the DIS from managers, union officials and individual employees. Nearly all managers agreed that the PIP considerably enhanced their flexibility at the workplace, and some felt that it should be based on daily rather than monthly output even though this would entail higher

[12] According to Cooke (1994: 595), "The differences between profit sharing and gain sharing are found largely in the performance criteria used in making bonus calculations and, to a lesser extent, in the timing of bonus calculations and payments. Bonuses received under profit sharing are based on profits, typically calculated annually, semi-annually, or quarterly. Bonuses received under gain sharing, on the other hand, are based on measures of performance other than profits (for example, on reductions in cost-to-sales ratios that might include labor, materials, or overhead costs, or on improvements in quality, scrappage, safety and so on)."

[13] In this data over the decade 1985-95, the PIP on average formed around 6.1% of an employee's total monthly (cash) pay.

[14] Unfortunately, in one of the plants (located in a district), the payroll office did not separate the PIP and DIS components but lumped all incentive payments together. In this data over the decade 1985-95, the DIS on average formed around 3% of an employee's total monthly (cash) pay.

monitoring costs. Several managers and union officials at two of the plants stated that the PIP had gone up too much and that this was due not to union preferences as such but to the induction of high-speed machinery, and felt that money should be shifted from the PIP to the DIS. Many managers too felt that this shift was in order as PIP had "outlived its purpose" and "had sort of become a kind of stable pay" having "no role to play in increasing productivity". As one manager put it: "PIP is a collective thing and an individual worker has no control over the collective behaviour of employees and also has no control over individual machine breakdowns, etc.". Thus, while there was considerable consensus that the DIS was more effective than the PIP, a few managers did suggest that the DIS led to some inflexibilities, since once the rates were determined during contract negotiations, it became "very difficult to redeploy employees and/or introduce technological change at the shop floor without granting additional pay".

It was clear to me that management in this firm was keenly aware that as a result of increasing productivity due to these incentive schemes, several 'non-essential' employees would be made redundant over time. Thus, a conscious strategy to identify and target 'shirkers' and 'undesirables', especially among non-production workers, for 'voluntary retirement schemes' prior to contract negotiations was followed. While union leaders and individual employees recognized the monetary benefits that accrued as a result of the incentive system, they were equally wary of its consequences on the level and growth of plant-level employment. In one city-plant, employment fell from around 1200 in the late 1970s to around 461 in 1995 with nearly 380 employees opting for 'voluntary retirement schemes' between 1988 and 1992. In another city-plant, 125 workers quit in 1994 under similar buyout schemes. In the two district-plants the situation was and continues to be considerably different as there are few alternative employment opportunities for employees, and unions in these two sites would rather dilute the intensity of incentives than allow management to target employees for periodic buyouts. In all the four plants however, management signalled its intentions of using higher wages and benefits as a bargaining chip to get the unions to agree to some targeted 'voluntary' reductions, and unions complained that in some instances, management used it as a precondition to commence contract negotiations.

Empirical Procedures, Results and Discussion

The baseline autoregressive regression model used here is a first-differences of the logarithms specification with both (plant) fixed effects and (contract) time effects:

$$\Delta\ln(Y_{i,t}) = \beta_0 + \beta_1\Delta\ln(Y_{i,t-1}) + \beta_2\Delta\ln(Y_{i,t-2}) + \beta_3\Delta\ln(Z_{i,t}) + \beta_4\Delta\ln(Z_{i,t})^2 + \text{Plant-Fixed-Effects}$$
$$+ \text{Contract-Time-Effects} + \varepsilon_{it}$$

where 'i' indexes the plants (i = 1..4) and 't' indexes time (t = January 1985……August 1995). 'Y' refers to the four outcome measures used: [prod/w] = productivity per worker per hour (in physical units); [absentr] = absenteeism rates (in percentages); [labcosts/output] = total labor costs per unit output (in *rupees*); [$\sum$pay/w] = total pay per worker (in *rupees*); and ['onroll'] = employment 'on rolls'. 'Z' refers to the incentive measure and 'Z^2' controls for the possibility of declining returns to incentives. I use three different specifications/measures of incentives: first, the aggregate level of incentives, ($\sum$IP/w) = total incentives per worker (in *rupees*); second, the intensity of incentives, ($\sum$IP/$\sum$P) = the percentage of incentive pay to total pay per worker; and third, I split up incentive pay into its two gain sharing components, ($\sum$PI/w) = 'plant incentives' per worker (the PIP scheme, in *rupees*), and ($\sum$DI/w) = 'departmental incentives' per worker (the DIS scheme, in *rupees*).[15]

There are three plant dummy variables and two contract dummy variables[16] in the regression equation. The plant dummies control for a range of factors that vary by plants: technology and installed capacity, local labor market conditions, and most importantly, union preferences (and their degree of risk aversion) towards incentive versus guaranteed pay.[17] The contract dummies, unique to each plant, control for the fact that the actual rates of return to the two gain sharing schemes are somewhat changed (or renegotiated) with each successive contract.

A second-order autoregressive model was chosen using the *F*-statistic approach.[18] To avoid the usual problems associated with non-stationary stochastic trends I opted for

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[15] I also tried using the average monthly 'annual productivity bonus' per worker as an incentive measure but the results were totally insignificant as the APB is a function of an employee's 'basic' pay and is not directly related to well-defined productivity outcomes.

[16] The contract dummies are coded in the following way: C1=1 if the latest contract, 0 otherwise and C2=1 if the middle contract, 0 otherwise, and thus the excluded/reference contract is the earliest one.

[17] They could also reflect the preferences of plant-level management, but anecdotal evidence from my field work suggests that in this firm, management preferences were similar across the four plants, as the human resources department at the corporate headquarters had a strong say in plant-level matters relating to compensation and personnel matters.

[18] Here one starts with a model with many lags and performs hypothesis tests on the final lag. For example, one might start by estimating an AR(6) and test whether the coefficient on the sixth lag is significant at the 5% level; if not, drop it and estimate an AR(5), test the coefficient on the fifth lag, and so on.

using the first-differences approach as it eliminates random walk trends in the time series.[19] I did carry out a series of augmented Dickey-Fuller (ADF) tests and found that all the time series variables, except 'on roll' employment (and thus, productivity per worker), were stationary around a linear time trend. Employment was non-stationary because, as mentioned earlier, its level systematically decreases as a new contract comes into force. I however chose to stick to the first-differences approach as the time series is monthly and possibly subject to problems of seasonality.[20] Finally, a log-log specification is chosen over a log-linear specification due to its better fit and a higher adjusted R^2; thus, the estimated coefficients are all elasticities.

The baseline regression model allows for different intercepts but imposes an identical slope on the incentive variables, but as the elasticities of the dependent variables with respect to the incentive measures may change with each successive contract, I also interact the latter with the contract dummy variables in the extended model.

Results and Discussion

Table 1 presents some descriptive statistics by plants. Examining the city plants first, we note that the percentage of incentive pay to total pay varies from around 6% in the 'pro-worker' plant B to around 10% in the 'pro-employer' plant A. Even though the average annual growth in worker productivity is the same in both these plants, it is evident that plant A workers experienced high rates of nominal growth in their incentive pay (unlike workers in plant B), whereas workers in plant B experienced a higher rate of nominal growth in their total pay. Whereas the percentage of incentive to total pay increased over time in plant A, it considerably decreased in plant B. The higher increase in total pay in plant B is associated with a greater decrease in employment levels (employment halves over the decade) compared to plant A. These differences reflect varying union preferences for pay versus employment at these two city sites, and perhaps these preferences are conditioned by the different 'labor regimes' within which they are embedded.

Examining the district plants we immediately note that employers face an employment constraint in these one-company towns: employment hardly falls over the decade. Productivity growth in these two sites is considerably lower than in the city plants

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[19] There are three main problems associated with stochastic trends in time series analysis: the autoregressive coefficients could be biased towards zero, the usual *t*-statistic can have a nonnormal distribution under the null hypothesis even in large samples, and problems emanating from spurious regression. For details see Stock and Watson (2003).

[20] I am grateful to Jan Bentzen for pointing this out.

and the growth in total pay is also lower. Unlike the case of the city plants, the 'pro-worker' plant here seemed to prefer more incentives than the 'pro-employer' plant.

(Table 1 about here)

Table 2 presents the results of the first productivity measure, productivity per worker per hour. The first three runs are the baseline models whereas runs four to six are the same runs with the incentive-contract interaction terms. From runs 1 and 2 we note that the elasticity of worker productivity with respect to both the level and intensity of incentives is positive and significant (specifically, a 10% increase in incentive pay is associated with nearly a .8% increase in worker productivity, and a 10% increase in the percentage of incentive pay to total pay increases worker productivity by .7%). There are declining returns to both measures as evidenced by the negative coefficients on the square terms (not significant though t >1) suggesting that high intensity of incentives can be dysfunctional. These results are consistent even when the interaction terms are included (runs 4 and 5).[21]

(Table 2 about here)

However, when incentive pay is decomposed into the two gain sharing schemes (runs 3 and 6), we observe the following: it is the departmental-level incentive scheme (DIS) that is associated with positive and significant productivity returns, whereas the plant-level incentive scheme (PIP) is associated with negative effects on worker productivity. For example, when the interaction effects are included (run 6), a 10% increase in the level of PIP pay reduces worker productivity by 2.2%, whereas a 10% increase in DIS pay increases productivity by 3.3%. The latter is most likely due to the lessening of the free-rider problem and the increased effectiveness of peer/mutual monitoring associated with smaller groups. These results are consistent with the theoretical points regarding the importance of group size in the incentive literature. In addition, it corroborates ITC management's feelings regarding these two schemes as conveyed to me during my interviews.

Table 3 presents the results of the second productivity measure, the monthly absenteeism rate. Again like before, both the level and intensity of incentives significantly reduces the absenteeism rate, although at very high levels the rate increases and this possibly indicates worker dissatisfaction (runs 1,2,4 & 5). When decomposed (runs 4 & 6), the results indicate the following: unlike the earlier case of worker productivity, here it is the PIP rather than the DIS that significantly reduces the absenteeism rate. However, at high levels of DIS the effect on the absenteeism rate is ambiguous: without the interaction

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[21] The productivity returns to incentives increase significantly over time, i.e., over each successive contract period. During the latest contract period (approximately late 1992 to July/August 1995), a 10% increase in incentive pay predicted nearly a 2% increase in worker productivity.

terms the effect is negative (run 3), whereas with the interaction terms it increases the absenteeism rate (run 6). If absenteeism is viewed as a worker satisfaction measure then it appears as if workers are considerably more content with the PIP rather than the DIS scheme. The latter result vindicates the point made by Milgrom and Roberts (1992) that there are costs associated with a small group size strategy when designing incentive structures.

(Table 3 about here)

Table 4 presents the results of the final productivity measure: labor costs per unit of output. Here too both the level and intensity of incentives reduces labor costs (runs 1,2,4 & 6). When the incentives are decomposed however a similar pattern emerges: PIP significantly increases labor costs but at higher levels significantly reduces it, whereas DIS significantly lowers labor costs but at higher levels significantly increases it (runs 3 & 6). Specifically, a 10% increase in PIP increases unit labor costs by around 1.3% to 2%, whereas a 10% increase in DIS lowers costs by about 3% to 3.5%.

(Table 4 around here)

The above sets of results thus sheds light on the *relative* performance of alternative *types* of group incentive systems that are distinguished in terms of group size and sharing rules within the same firm. From the firm's point of view, PIP is an expensive scheme with which to lower absenteeism rates, which it effectively does (workers are content). However, it has a negative effect on worker productivity and increases labor costs per unit output. At higher levels though PIP does lower costs. It is the DIS scheme that significantly increases worker productivity and lowers labor costs; however (in contrast to the PIP scheme) at higher levels it increases both absenteeism and labor costs. It seems clear that the DIS scheme is considerably more effective in lessening the first and second order free-rider problems and in increasing the effectiveness of peer monitoring. However, the firm should probably weigh the costs and benefits of both schemes carefully before shifting most of the money from the PIP to the DIS.

What are the effects of these incentive schemes on what workers and their unions value most? Table 5 presents the effects of these incentives on average monthly pay. While an increase in the level of incentives is associated with an increase in pay, the relationship, as we would expect, is clearly non-linear (runs 1,2, 4 & 5). Employees are reluctant to substitute some steady earnings for variable earnings beyond a certain threshold because of

the higher risks associated with the latter.[22] When decomposed (runs 3 & 5) it is apparent why the *average* worker is content with the PIP; it significantly increases his *average* monthly pay whereas the DIS does not. In fact high DIS levels have a negative effect on average pay. The stress here is on the average worker; recall that the actual monthly amounts paid as PIP and DIS varies by stipulated job designations as agreed upon during contract negotiations at each plant. Thus, some select ('fortunate'?) workers experience significant pay growth as a result of the DIS and my hunch (corroborated with anecdotal evidence gathered in the field) is that the variance in pay probably increases as more money flows into this scheme. The unions in this firm have to simultaneously balance the interests of the few workers who gain considerably from the DIS with the vast majority of its constituency who gain little.

<div align="center">(Table 5 about here)</div>

Table 6 presents the effects on monthly employment levels. At the outset let me state that the coefficients on the contract controls were large and significant and it is these discrete employment declines that takes place when a new contract comes into force that accounts for the 'structural break' in the time series. The coefficients on all the incentive variables are negative, and although not by and large significant, are usually larger than their standard errors. High levels of PIP are associated with significantly lower employment levels (runs 3 & 6). It is no wonder that unions in India that attempt to maximize the wage bill rather than the economic rent are so wary of incentive pay systems. However, in this firm high levels of DIS have a positive effect on employment (runs 3 & 6) and unions were aware that putting money into this scheme allowed management to expand production due to enhanced productivity even though it involved increased risk in terms of pay stability for the average worker.

<div align="center">(Table 6 about here)</div>

Conclusion

This paper focussed on the effects of group incentives on productivity, pay and employment in a large unionised firm in India. Using plant-level monthly time series data for the period 1985-95, and controlling for both (plant) fixed effects and (contract) time effects, the paper provides econometric evidence on the effectiveness of both the level and intensity of incentive pay on the outcome measures. In addition, the relative performance of two types of group incentives defined on the basis of group size was also analysed.

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[22] Weitzman and Kruse (1990) point out that an optimal ratio of variable to fixed earnings should provide sufficient income stability for risk-averse workers as well as sufficient incentives to induce greater effort.

The empirical results generally confirm predictions from personnel economics theory that productivity returns to incentives are non-linear and concave in shape and that the effectiveness of incentives is decreasing in group size. Specifically, both the level as well as the intensity of incentives increased worker productivity and lowered both absenteeism rates and labor costs per unit output. The DIS scheme, associated with a smaller group size, was considerably more effective than the PIP plan, associated with an entire plant. The latter is most likely due to the lessening of the free-rider problem and the increased effectiveness of mutual monitoring associated with smaller groups.

While the level of incentive pay positively affected an average worker's total pay, the intensity of incentive pay negatively impinged on the latter especially at high levels. Workers gained monetarily from the PIP and their satisfaction is reflected in lower absenteeism rates associated with this scheme. For the average worker the DIS was not so attractive as it involved variable income, and more importantly, was dependent on the combined work effort of those workers fortunate and/or skilled enough to be in the demarcated 'autonomous work group' zones. The results also point to a negative relationship between the level of incentives and employment over time in this firm.

This paper is an addition to the now burgeoning empirical work on the effects of incentives in organizations with the novel feature being that it focussed on a firm in a developing country during a critical decade as its economy moved from a relatively closed environment to one of economic liberalization and globalization. Unlike earlier empirical studies, and due largely to data limitations, this study estimated various elasticities rather than directly measure the impact of incentives on improving economic performance. Finally, some methodological issues pertaining to problems of endogeneity (i.e., contract choice is endogenous) and simultaneity will have to be resolved, and this will be the focus of future research with this unique data base.

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Table1: Descriptives by Plants

	A	B	C	D
Labour market	city	city	district	district
Labour regime[@]	'pro-employer'	'pro-worker'	'pro-employer'	'pro-worker'
Mean $\Sigma IP/\Sigma P$ (%) & (s.d) [Firm: 7.75%, (3.09)]	9.8% (3.5)	5.9% (2.7)	7.7% (2.0)	7.7% (2.7)
Average annual growth in $\Sigma IP/\Sigma P$ (1985-95) [Firm: - 1.3%]	11.8%	- 15.2%	- 3.2%	2.4%
Average annual growth in worker productivity (1985-95) [Firm: 8.7%]	15.7%	15.4%	4.8%	.5%
Average annual growth in *nominal* ΣIP (1985-95) [Firm: 13.7%]	30.1%	4.9%	8.5%	13.1%
Average annual growth in *nominal* ΣP (1985-95) [Firm: 14.2%]	14.5%	20.1%	11.7%	10.7%
Employment (t = 1→ t = end)	2137 → 1677	858 → 461	1615 → 1426	1497→1498
Average annual growth in employment (1985-95) [Firm: - 2.2%]	- 2.1%	- 6.1%	- 1.1%	0%

[@] Classification as per Besley & Burgess (2002)

Table 2: Dependant Variable: $\Delta\ln[prod/w]_{it}$

Runs → Regressors ↓	1	2	3	4	5	6
$\Delta\ln(\Sigma IP/w)_{it}$	.079*** (.021)			.070** (.029)		
$\Delta\ln(\Sigma IP/w)^2_{it}$	-.005 (.004)			-.004 (.004)		
$\Delta\ln(\Sigma IP/\Sigma P)_{it}$		.072*** (.019)			.060** (.026)	
$\Delta\ln(\Sigma IP/\Sigma P)^2_{it}$		-.005 (.004)			-.003 (.003)	
$\Delta\ln(\Sigma PI/w)_{it}$			-.072 (.073)			-.224*** (.055)
$\Delta\ln(\Sigma PI/w)^2_{it}$			.029 (.047)			.053 (.062)
$\Delta\ln(\Sigma DI/w)_{it}$			.189** (.073)			.333*** (.071)
$\Delta\ln(\Sigma DI/w)^2_{it}$			-.038 (.053)			-.065 (.072)
(Plant) Fixed Effects	yes	yes	yes	yes	yes	yes
(Contract) Time Effects	yes	yes	yes	yes	yes	yes
(Incentive ⊗ Contract) Interaction Effects	no	no	no	yes	yes	yes
R^2	.176	.174	.426	.180	.176	.605
Overall F	3.0**	3.13**	3.07**	5.38***	4.01***	17.74***
Observations	387	387	207	387	387	207

All runs contain AR (2) lags. Heteroskedasticity-robust standard errors in parentheses. (***: significant at .001 level, **: significant at .05 level, *: significant at .10 level, all two-tailed tests)

Table 3: Dependant Variable: $\Delta\ln[absentr]_{it}$

Runs → Regressors ↓	1	2	3	4	5	6
$\Delta\ln(\Sigma IP/w)_{it}$	-.067*** (.022)			-.027* (.014)		
$\Delta\ln(\Sigma IP/w)^2_{it}$	.006 (.006)			.004 (.003)		
$\Delta\ln(\Sigma IP/\Sigma P)_{it}$		-.048** (.018)			-.023* (.012)	
$\Delta\ln(\Sigma IP/\Sigma P)^2_{it}$		.006 (.004)			.004* (.002)	
$\Delta\ln(\Sigma PI/w)_{it}$			-.063** (.024)			-.031** (.015)
$\Delta\ln(\Sigma PI/w)^2_{it}$			-.023 (.014)			-.033** (.016)
$\Delta\ln(\Sigma DI/w)_{it}$			.021 (.020)			.011 (.016)
$\Delta\ln(\Sigma DI/w)^2_{it}$			-.030* (.016)			.041** (.018)
(Plant) Fixed Effects	yes	yes	yes	yes	yes	yes
(Contract) Time Effects	yes	yes	yes	yes	yes	yes
(Incentive ⊗ Contract) Interaction Effects	no	no	no	yes	yes	yes
R^2	.115	.099	.057	.140	.110	.147
Overall F	4.85***	4.58***	1.72*	4.87***	4.19***	2.88***
Observations	405	405	225	405	405	225

All runs contain AR (2) lags. Heteroskedasticity-robust standard errors in parentheses. (***: significant at .001 level, **: significant at .05 level, *: significant at .10 level, all two-tailed tests)