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**Unions, Wages and Labour Productivity:
Evidence from Indian Cotton Mills**

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**Unions, Wages and Labour Productivity:
Evidence from Indian Cotton Mills**

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Abstract

This paper uses firm level data from all the textile producing regions in India to examine the relation between wages, unionization and labour productivity. We find that fewer workers were employed per machine in the unionized mills in Bombay and Ahmedabad, as compared to non-unionized regions implying that low labour productivity was not due to union resistance to increased work intensity. Our findings suggest that while low wages in India encouraged overmanning, higher wages, prompted by unionization, had productivity enhancing effects. We explore alternative explanations for low labour productivity, arising from the managerial and institutional structure of Indian cotton mills.

1. Introduction

The effect of unionization on labour productivity has been debated in the context of industrialized economies. Freeman and Medoff (1984) argue that unions can increase labour productivity by reducing labour turnover and improving managerial practices. Recent work suggests that presence of unions can increase productivity by making managers more keen to reduce organizational slack. (Metcalf 2003) The empirical evidence is mixed. Research using data from American industries show that unions had a positive effect on labour productivity (Brown and Medoff 1978, Clark 1980, Allen 1986) The evidence from the UK provides less clear cut answers. (Machin 1991). Recent work suggests that multi-unionism has had a negative effect on productivity in the UK (Bean and Crafts 1996), while in Germany cooperative practice through work councils tend to have a more positive effect on productivity. (Metcalf 2003)

The empirical evidence for less developed countries is scarce. Indian cotton mills in early 20th century provide an interesting case of unionization. Labour strife was common in Bombay from the late 19th century, although not always organized by unions. Bombay was one of the two major cotton textiles producing regions and saw early unionization. Wolcott and Clark (1998) attribute the divergent trajectory of wages and productivity between Japan and India after 1910, to the failure to increase labour productivity in Bombay cotton mills. Japanese workers increased their work effort over time and consequently earned higher wages. The presence of a non-unionized female workforce is seen by Wolcott (1992) an important factor in Japanese success. Analyzing firm-level data from Bombay, Wolcott and Clark (1998) attribute the persistence of low productivity to worker resistance to higher effort. Prescott and

Parente (1999) use the Bombay textile mills as an example of inefficient work practice following unionization.

This paper re-examines the effect of unionization on labour productivity using a data set of cotton mills from all the textile producing regions in India in early 20th century. This is the first time such a data set is being analyzed. Labour unions were important in the main two textile producing regions, Bombay and Ahmedabad. Labour strife in these regions provides an interesting contrast with other textile regions, where unions were less important. We do not have evidence on union membership or strikes at the level of the firm. However, as union presence differed from region to region, the regional effect allows us to test if labour productivity was lower in the regions with union activity.

I analyze firm-level data to compare Bombay with the rest of India. My measure of labour productivity is labour- use per machine. This captures total factor productivity if machines are the same in cotton mills across all regions.² My empirical finding suggests that labour productivity was higher in regions where labour unions were important and wages were high. This questions the Clark and Wolcott view that low labour productivity in Bombay cotton mills was a result of worker militancy and is in line with the empirical literature in developed countries that unionization may reduce organizational inefficiency.

The cities of Bombay and Ahmedabad had the largest concentrations of cotton mills in 1910. Both regions were located within the provincial boundary of the Bombay Presidency in Western India. The daily employment figures show that until the mid 1920s, Bombay had three times as many workers as Ahmedabad. By 1930 it the difference had narrowed significantly. (Textile Labour Enquiry Committee, 1937-

² Firms all over India imported their equipment from a few British firms. Clark 1987 also finds this to be the case at the international level in 1910.

38) Both cities saw large wage increases during the First World War, but the two cities had very different experiences of labour movement. In Ahmedabad industrial arbitration and peaceful settlements were the norm after 1922. The Bombay cotton mills saw organized resistance to wage cuts in the 1920s.

If worker resistance prevented an increase in productivity, then the mills of Bombay would have higher labour use per machine in comparison to other textile producing regions, where union activity was lower. An interesting comparison would be with Ahmedabad, where workers and management cooperated to set wages in the 1920s following Gandhi's leadership. The statistical exercise in this paper suggests that Bombay had a lower level of labour use compared to other regions over the period 1910 to 1933, which was statistically significant. Ahmedabad also had a lower labour use per machine, but this was significantly higher than the levels in Bombay in 1929 and 1933. The differences are observed at the end of a decade long conflict between the worker and the management in Bombay cotton mills. Surprisingly the two regions were not very different before the World War, but both had lower labour use per machine compared to other regions. What was common between Bombay and Ahmedabad was relatively higher wages. Thus the empirical finding suggests that higher wages encouraged lower labour use per machine or higher labour productivity. Comparisons of money wages in Bombay, Ahmedabad and Calcutta find that money wages rose sharply in the first two cities after 1914. Although the wages rate was comparable in the three cities before that, by the 1920s money wages diverged with Bombay and Ahmedabad pulling ahead. This trend is also reflected in the real wages although real wage in Calcutta was higher before the war. (See Figure 1) This increase in part reflects the increased demand for cotton textiles as imports fell during the war and the shortage of labour.

Labour militancy is not the only cause of higher wages. Wages can rise in the economy due to other factors. The effect on labour efficiency would be similar. The above argument may explain the productivity differential between India and Japan. Japan saw rapid economic growth after 1870. Rising incomes and wages in Japan compelled managers to raise labour productivity to stay competitive in the international market for textiles. Both comparisons indicate that high wages and worker efficiency are correlated. In this paper, I will argue that causality flows from wages to productivity.

The organization of the paper is as follows: Section 2 discusses the organization of the industry and the factors that may explain high labour use per machinery. Section 3 presents an empirical analysis of firm-level data to quantify labour use in different regions. Section 4 presents a simple model of wage- effort trade off. Section 5 explores the role of institutions in causing organizational slack and inefficient labour use. Section 6 analyzes the link between wages and labour productivity using comparisons with Japan. Section 7 concludes.

2. Organization in cotton mills:

2.1 Background

The cotton textile industry was mainly an import substituting activity, competing with imports from Lancashire. The first cotton mills were set up in Bombay. Initially the main output was yarn for the domestic handloom industry and for export to the Chinese market. Over time, spinning mills bought their own looms and began producing cloth. The advantages the industry enjoyed were cheap labour and local supplies of raw material. The industry had a unique management structure. A managing agent was responsible for organizing production. This agent raised

capital and managed the financial side of the business for a commission. Production was left in the hands of technical supervisors and labour supervisors known as the jobbers, who were locally recruited. The agents mostly came from the merchant class and had little technical training. The majority of the agency directors were Indians, who had made money in the cotton and opium trade and moved into industry as profits in trade began to decline. (Vicziány, 1975) Table 1 shows the background of the directors and of technical staff in Bombay. The managing agents relied initially on the men from Lancashire for the technical side of production. Over the years, Indian technicians filled this important gap. However these technicians knew little about the labour market, which was left to the jobber or the labour recruiting agent.

The process of hiring workers was complicated. India had abundant labour, but mainly concentrated in agricultural activity. The industry had to draw its labour from the rural hinterland. The task was assigned to the jobbers, who typically came from the same social background as the labourers and used their rural connections to recruit workers for the textile mills. The demand for labour fluctuated due to fluctuations in demand in the product market. About one-fifth of the labour in Bombay cotton mills was employed on a daily basis. (Chandavarkar, 1994: 82) The jobbers were given the responsibility of maintaining adequate labour supply to suit the level of demand. The production managers often did not have a common language of communication with the mill workers. It was the jobber who was assigned the task of worker management and supervision and to implement factory discipline.

The system encouraged high labour turnover as the jobber exercised control over a readily available group of casual workers. (Morris, 1965, Chandavarkar 1994) However, it also allowed quick reductions in employment if the need arose.

2.2 Choice of technology and labour productivity

The production process reflected the abundance and cheapness of labour. Although the ring was also more suited to unskilled labour, the Indian cotton mill industry adopted the mule. Saxonhouse and Wright (1984) find that the persistence of the mule in India and Russia was due to the use of short staple cotton, which was the variety produced in India. Japan and Brazil used long staple cotton and adopted the ring much earlier. An alternative view emphasized the lack of technical knowledge of the managing agents and the presence of British technical personnel as the cause of India's failure to switch to ring spinning. (Kiyokawa, 1983) Other research in this field suggests that the Indian entrepreneurs made a rational choice in adopting the mule given the factor endowments. Capital was expensive and the mule was relatively cheaper, at least until 1890. The cost of setting up a cotton mill was 35% higher in India compared to a Britain. Once a mill was set up, the machinery was operated as long as possible and replacement was deferred, with repairs and replacement of parts. The lower rate of scrapping and replacement of machinery delayed the rate of adoption of rings, since rings could be adopted only as mules were scrapped. Consequently mules persisted in Bombay longer than elsewhere.

High labour use was a response to factor prices. Tasks became more labour intensive per unit of capital. Each mill produced a variety of yarn depending on demand. The mule allowed greater flexibility in operation. Short staple cotton broke more frequently. The machines were often operated at a speed higher than the recommended level without introducing the appropriate quality cotton. (BMOA Report 1928) These increased the need to have more men per machine. It was estimated that a ringsider in India had to deal with nine times as many breakages per

100 spindles as his American counterpart. (Chandavarkar, 1994: 284) One survey estimated that in the 1930s, for every worker employed in a month, two casual workers were available. (Chandavarkar, 1994: 296)

The Tariff Board in 1927 saw high labour use per machine as an organizational problem. (BMOA Report 1928):

“We cannot too strongly emphasize that no increase in outturn per operative can be reasonably expected unless they are provided with proper raw material. There undoubtedly exists a tendency in India to spin higher counts of yarn from cotton than the quality of cotton warrant. This reduces production, is injurious to quality and increases the work of the operative in both spinning and weaving by the large number of breakages.”

2.3: The labour movement

The labour movement in Bombay and Ahmedabad were mainly concerned about wages. Spontaneous protests by textile workers in Bombay had been a part of the industry from the beginning. The early protests started in one mill and spread to others. The wave of strikes in 1900-01 came in response to wage cuts in twenty mills when 20, 0000 workers went on strike for ten days. (Morris, 1965) Wages rose dramatically during the war. Two factors contributed to this: The rise in demand for labour and the rise in the cost of living. The mills paid a war bonus of 10% from 1917 to be followed by a “dear food allowance” of 15% from 1918. (Kooiman, 1989: 51-52) As the war-time boom gave way to a recession, firms attempted wage cuts that led to strike action. 150,000 workers struck work for 12 days in 1919 followed by a general strike in 1920 that lasted for a month. (Morris, 1965: 178-79)

This period coincided with economic nationalism in the anti-imperialist struggle. While workers in Bombay adopted a militant approach, with Gandhi's involvement workers in Ahmedabad sought consensual solutions through industrial arbitration. Workers in Ahmedabad struck work in 1923 against an attempt to reduce

wages. Nevertheless, the industry implemented a wage cut of 15% and for the rest of the decade, wages were negotiated through dialogue.(Patel, p32) In 1925 in Bombay, strikes began as the Bombay Millowner's Association (BMOA hereafter) announced wage cuts.(Bombay Labour Office, 1926) The city witnessed a general strike that lasted several weeks. By this time the trade unions had established a strong presence in Bombay cotton mills and coordinated worker resistance. The strikes were coordinated with the involvement of the jobbers. As several cotton mills in Bombay sought to introduce a higher work load, the Communist union organized industrial action in 1928 that lasted for over six months. (Morris, 1965:181-83)

The average wage in Bombay was 20% higher than the average wage in Ahmedabad on the eve of the First World War. Between 1914 and 1921, wages rose by 87% in Bombay city and by 122% in Ahmedabad. (Bombay Labour Office, 1923) The rise in earnings in Bombay city was below the average for Bombay Presidency. The rise in the cost of living in Bombay and Ahmedabad were similar. The fast increase in the average wage in Ahmedabad reflected the increase in demand from the domestic market as supply of British goods was disrupted. At the same time, the workers ready to leave the city due to a plague epidemic when and were paid bonuses to stay on.

Table 2 shows a comparison of wages in the two cities and the rest of India in 1929. Clearly the difference in wages between Bombay and Ahmedabad was marginal, but these figures were higher than what was paid to workers in other textile producing regions.

3. Empirical Analysis:

Did resistance from labour unions prevent an increase in labour productivity? One way to analyze the role of unions in preventing organizational change would be to compare the labour- capital ratio across different regions in India. If organized labour resistance was important in influencing work norms, Bombay should have had a higher use of labour per machine compared to other regions. On the other hand, if union activity mainly increased wages and higher wages forced employers to initiate productivity increases, one should find that Bombay had higher labour productivity and fewer workers per machine. A comparison with Ahmedabad would be of interest as the two regions had different experiences of labour resistance. Did militancy hinder organizational change in Bombay as has been suggested by Wolcott and Clark? Did cooperation rather than conflict lead to efficiency gains?

3.1. The data

My data covers all the textile producing regions in India. The data is at the level of the firm and provide information on the number of workers employed daily in each firm and the machinery in use. The latter is available by category, i.e. mules, rings and looms. The data is for the years 1889, 1910, 1917, 1929 and 1933. Firm-level information for 1889 is being used for the first time and allows us to go back to the period when worker resistance had yet to make an impact on the industry. 1929 and 1933 are of particular interest as these follow a decade of labour strife.

Table 3 shows the use of capital and labour in cotton mills in different regions. My focus is on Bombay relative to Ahmedabad and the rest of India. Bombay had the highest concentration of cotton mills in 1889, while Ahmedabad was still marginal. By 1910 both cities had roughly the same number of mills. Ahmedabad had

a large share of rings as newer were more likely to adopt the ring, while older firms in Bombay with an existing capacity of mules were slow in switching to rings. Ahmedabad also had more looms. These firms produced finer quality yarn and cloth and competed with British imports. Bombay on the other hand produced more of lower count yarn and exported to the Chinese market.

The average size of mills in Bombay was larger. By 1917, the changes in Bombay are noticeable. The switch to rings and looms was well underway. There was also an increase in the average size of the mill. The change that affected Bombay was the loss of the Chinese market and the change in competition after the war. These mills faced increased pressure to reorganize with the changes in the product market. Several mills went out of business by 1929 and more disappeared by 1933. For Ahmedabad, on other the other hand, there is evidence of increase in size as well as new entry and these firms benefited from the changes in the product market.

3.2: The Analysis

From the data we can estimate coefficients of labour use by type of the machine over time. The dependent variable, labour use per day, is regressed on the number of mules, rings and looms within a firm. To allow for the possibility that labour in a particular region, Bombay or Ahmedabad, is systematically less (or more) efficient, a dummy variable for the region is interacted with each of the machinery variables. That is, our regression takes the form:

$$N_{it} = \beta_m (1 + \gamma BD_i + \mu AD_i) Mule_{it} + \beta_r (1 + \gamma BD_i + \mu AD_i) Ring_{it} \\ + \beta_l (1 + \gamma BD_i + \mu AD_i) Loom_{it} + \epsilon_{it},$$

where N_{it} is employment in firm i in year t , $Mule_{it}$ is the number of mules used by the firm in this year, etc., and BD_i is a dummy variable that takes value 1 if the firm is in

the Bombay region and AD_i is a dummy variable that takes value 1 if the firm is in the Ahmedabad region. We estimate this equation for each year separately, that is we allow the coefficients β , γ and μ to vary across years. As this equation is non-linear in the parameters, the estimation is by non-linear least squares. Our interest is in the values of γ , that is, the extent to which labour requirements in Bombay differ from other regions.

Table 4 reports the estimated coefficients from the regression. We see that γ is estimated to be negative in every single year. Although this is not statistically significant in 1889, the coefficient is significant in subsequent years. Indeed, in 1929, labour in Bombay is 48 per cent more efficient than labour in the other regions of India. Labour in Ahmedabad is also more efficient than in other regions, but less efficient than in Bombay. A t-test shows that the coefficient for labour use in Bombay is significantly different from the coefficient for labour use in Ahmedabad for the years 1929 and 1933, but not in the 1889, 1910 and 1917.

This result is striking. The 1920s strikes took place in response to reduction in employment as the industry struggled to maintain profits after the war. In 1929 after a decade of organized labour resistance, the productivity of Bombay textile workers in relation to their Ahmedabad counterparts was high. The difference between the two cities had narrowed by 1933. Clearly in other regions of India where the workers were less militant, the labour- use ratio was higher.

These findings question the Wolcott –Clark view that workers' resistance to increases in labour productivity in Bombay was the main cause of over manning. The results suggest that the relatively higher wages in Bombay and Ahmedabad required higher labour efficiency (See table 2 to compare wages). This encouraged firms to economize on wage costs so as to remain competitive in the product market. Higher

wages forced the Bombay entrepreneurs to increase work intensity in cotton mills and reduce labour use per machine. Several inefficient firms went bankrupt as shown by the decline in the number of firms in the region. This finding though contrary to the work by Wolcott –Clark, is in line with the empirical literature on industrialized countries that suggests that unions can remove managerial slack and increase efficiency.

Although the money wage difference between Bombay and Ahmedabad was marginal, the productivity difference in 1929 was large. This is puzzling. However, a closer examination suggests that the product and factor markets in the two cities were very different. Consequently, the pressure on entrepreneurs in Bombay to reduce inefficiency was greater. Mills in Bombay relied on the export markets in yarn and were hit hard as they lost overseas markets after the war. Ahmedabad on the other hand produced higher quality yarn and cloth and benefited more as Britain lost market share in India. Simple calculations of profits of the firms in the two cities show that profits fell faster in Bombay.(Patel, 1987: 34) Bombay mills had a high turnover of the workforce and a large proportion were casual workers estimated to be about 28% of the workforce.(Chandavarkar, 1994: 296) This made it relatively easier to reduce employment. Evidence from the wage census shows that absenteeism among male and female time and piece-rate workers declined in Bombay between 1923 and 1926, but stayed roughly the same for male workers in Ahmedabad and declined for both categories of female workers. (Bombay Labour Office, 1923, 1929)

There is ample evidence in representations of firms in Bombay to the Tariff Board that increased workload was seen as an alternative to wage cuts. One of the industry leaders, the firm of Sassoon, presented estimated of savings in total wage cost with increased workload even when wages increased. (Bombay Labour Office

1934) Estimates based on my data set show that Bombay saved in total wage cost as number of workers per machine declined. Wage cost per unit of output in Bombay in 1929 was 25% lower than that for the rest of India and 3% lower in 1933, while in Ahmedabad it was roughly 8% and 4% higher. (See table 5) These figures suggest that efficiency gains made by Bombay mills in the 1920s. The figure for 1929 for Bombay is not out of line with estimated savings projected for spinners by Sassoon between 46% and 62% depending on yarn count. Falling profits, older machinery and changes in the product market created additional pressure on firms in Bombay to bring about organizational change. To understand why firms had operated at sub-optimal level and what prompted them to become more efficient, a simple model of wage effort trade off is useful.

4. Wage- Effort Trade off:

Let e denote effort, and let us measure effort so that one unit of effort results in one unit of output. Let p denote the price of output, let k denote the capital requirement per worker, and r the interest rate. Let w denote the wage per unit of effort, so that the profits of the firm per worker can be written as

$$\pi = ep - w - rk \quad \dots\dots(1).$$

Turning to the representative worker, let us assume that the utility of the worker, U , increases with the wage, but decreases with the disutility of effort, and can be written as

$$U(w, e) = w - d(e) \quad \dots\dots(2),$$

where the disutility of effort, $d(e)$, is increasing and convex, so that the marginal disutility rises at higher levels of effort.

Fig. 2A graphs the typical indifference curve of the worker IC, corresponding to a given utility level. Let us now consider what effort choice would be a *Pareto efficient* arrangement, given the preferences of the worker and the production technology. To do this, we can graph the iso-profit curves of the firm. These are straight lines with slope p . An efficient arrangement corresponds to a point of tangency between the worker's indifference curve and the iso-profit curve IP. Thus e^* is the efficient choice of effort in this context.

There are of course many Pareto efficient arrangements, which can be ordered in terms of the extent to which they favour one party, say the worker. Thus some Pareto efficient arrangements give the worker higher wages and higher utility and the firm lower profits than the others. However, given our assumption of quasi linear utility, in all Pareto-efficient arrangements the effort level is the same and equals e^* , and variations in worker utility are achieved entirely through the wage. Thus, even if the worker has some bargaining power, and gets a higher utility level than in a competitive labour market, an efficient bargain would imply that this increased utility is achieved not via reduced effort but solely through a higher wage.

Let us now suppose that existing effort arrangements are inefficiently low, and are at a level e' that is less than e^* . This is indicated in Fig. 2B. Since this is Pareto inefficient, there is a way to make both the worker and the firm better off. This involves an increase in worker effort towards e^* , where the worker is compensated for this by an increase in the wage.

There are two possible explanations for the low effort levels of the worker in the Indian cotton mills. The first explanation, advanced by Wolcott and Clark (1998), is that low effort reflected worker preferences, so that arrangements were Pareto efficient. That is the, actual effort choices were in fact close to e^* , so that it did not

make economic sense to increase effort. Similar views had been voiced by managerial staff in the industry, policy makers and foreign observers from early days of the industry. The increase in effort level of cotton mill workers in Bombay with higher wages question such an interpretation.

An alternative explanation is that actual arrangements were Pareto-inefficient; so that both workers and firms could be made better off by wage-productivity agreements, where the worker agreed to raise work effort in exchange for higher wages. For this latter explanation to hold, there must be a reason why the two parties failed to make a Pareto-improving trade. This failure is could be a failure of initiative, possibly based on a lack of information. For the two parties to make such an improvement, one of them must recognize the potential for mutual gain, and has to *initiate* the improvement. The specific institutional structure of management may have created inefficiencies in the system. Unions in this context may play an important role in moving to a more efficient arrangement.

5: An Institutional Failure?

Hall and Jones (1999) show that institutional differences explain difference in labour productivity across countries. In the Indian context, it may be argued that the managerial structure in cotton mills made for certain inefficiencies. The three tiers of management created self contained spheres of function and resulted in information gaps. Madholkar documents the friction between the men from Lancashire and the managing agents and sees the presence of the jobber as the crucial factor in reducing the managing agent's reliance on the technicians. The agents' distrust of the technicians removed them from the sphere of decision making. The agent made decisions regarding the purchase of inputs and the technician was asked to produce a

certain output per machine. (Madholkar, 1969, ch 3) An additional reason might have been the incentives of the managing agents, who held overall responsibility for the organization. Right up to the turn of the 20th century, the managing agents' returns depended upon the *output* of the firm rather than profits and provided relatively weak incentives to engage in cost reductions. Even when firms switched to commission on profits, the relevant category was total profits and not profits net of depreciation.

The managerial structure and the factor prices also had implications for factory discipline, which is an important aspect of labour productivity. Thompson (1967) documents how new working habits were formed in Britain after the industrial revolution. Clark (1994) finds that greater discipline increased effort by 33% in Britain in the course the 19th Century. The change in length of a working day and increased effort at workplace was a result of a stringent system of penalties. Discipline was also a crucial aspect in the Japanese cotton mills. Hunter (2003) argues that dormitories were crucial in the evolution of factory discipline. The control of the management extended not just during working hours, but for the whole day. Workers were paid by piece rate and remuneration depended on quality and quantity.

The Indian cotton mills did little to develop mechanisms for higher discipline on the shop floor to increase work intensity. A survey conducted by the Bombay Labour Office in 1926 documented the penalties imposed on workers for the first ten months. Information on dismissals is not available, but we do know how many workers were penalized. The table 6 is based on information collected from 45 mills. An overwhelming proportion of the fines for men and women were for negligence in work. This referred to spoilt or damaged material- their value was deducted from the workers wage. Weavers in particular were subjected to large penalties. (Pearse, 1930: 89-90) Late arrival at work or taking time off during working hours were less serious

offences compared to failing to produce the right quality product. It has been suggested that this was a way to reduce the earnings of highly paid weavers. (Tariff Board 1927) Interestingly, the survey showed that in factories other than textiles, 49% of the fines were for breach of discipline. (BMOA Report, 1927) Morris documents the evidence presented to the Factory Commissions and argues that in the textile industry, although the formal system of rules was severe, regulation of work discipline was surprisingly lax. Workers drifted in at the start of work and gradually drifted away as the light began to fade. (Morris, 1965:111-112). Either supervisors were not concerned about work intensity or chose to ignore breaches of it. The latter could arise from the social relation between the worker and the jobber.

The evidence from cotton mills in India suggests that the managers had less concern about factory discipline. Equipment costs were relatively high and the managers chose to economize on capital cost by running the machines as long as possible. The employers responded to worker absences by employing *reserve labour* to step in when needed. The low wages provided a reason for over manning rather than imposing greater discipline.

The Indian entrepreneurs were slow to introduce an organizational change that was a feature of the Japanese industry. Unlike in Indian mills, where there was a separation between technical and managerial activity, Japanese firms had a more integrated approach. (Pearse, 1930) The Japanese entrepreneurs increased labour use per unit of capital through a system of double shift. The Indian mills persisted with of long hours of a single shift system. Arno Pearse, who studied cotton mills in different parts of the world, showed that mills working two shifts would reduce costs by 12%-13% on average. (Pearse, 1930) Longer hours also reduced efficiency.

As early as 1905, the BMOA discussed reduction of the working day to 12 hours. Firms, such as Wadia, Sassoon and Petit, who were the industry leaders in introducing changes in work practices, argued that long hours reduced worker efficiency. (BMOA 1905) In 1919 Wadia moved to introduce two shifts of eight hours. However, BMOA voted against the introduction of double shifts. One of the arguments was that the city infrastructure would not be able to cope with an additional 100,000-150,000 men required for the second shift. (BMOA reports, 1919-21) The reluctance to work double shifts could have been associated with greater costs of supervision and the high salaries paid to European technical staff. (Morris, 1965: 56-7) Several millowners argued that mills on a double shift would bid up the wages and cause labour disputes in mills on single shift. (Chandavarkar, 1994: 353-354) The BMOA passed a resolution in 1920 prohibiting implementation double-shifts. Two firms that introduced a double shift were expelled in 1921. (BMOA, Report 1921) In his statement to the Industrial Disputes Committee, Wadia claimed that the introduction of double shifts had reduced absenteeism. (Indian Textile Journal, January 1922) However double shift did not become the norm until the 1930s. In fact the BMOA rescinded the resolution of 1920 to allow firms to do so. (BMOA, Report 1928)

The agency problems associated with the separation of financial and technical jobs in the cotton mills may explain the absence of organizational change. Consequently, rising wages were instrumental in increasing efficiency if firms were to remain competitive.

6. Wages & Labour Productivity: Cause & Effect?

The correlation between wages and labour productivity can be found in the context of the divergence in productivity levels between India and Japan. Wolcott and Clark (1998) see low labour productivity as a determinant of low wages. However, this view is inconsistent with a competitive labour market, where textile workers were only a small fraction of the total workforce. For example, in India, the entire industrial workforce was less than 10% of the total labour force and cotton textiles had an even smaller share. Thus the wages of cotton textile workers would not have been determined by the level of productivity in cotton textiles, but mainly by the general level of wages in the economy. If textile workers were substantially productive, this would mainly be reflected in higher profits, with only a small effects on wages. Alternatively, rising wages would require rising labour productivity if the firm was a price taker.

GDP per capita in Japan rose faster than in India. In 1870, GDP per capita in Japan was just over 35 per cent more than India's per capita GDP, by 1913 Japan had twice the per capita income of India and by 1950, three times as much Per capita GDP grew by 0.54% per year in India during 1870-1913, almost one-third of Japan's growth rate of 1.48% per year. The corresponding growth rates in India and Japan during 1913-1950 were -0.22% and 0.89% respectively. (Maddison, 200: 264-5, Shivasubramoniam, 2000: 33) Money wages in Japanese cotton mills increased four times between 1903-07 and 1918-22. In Indian cotton mills, wages doubled during the same period. (See table 7)

As wages increased in Japan, sectors producing tradable goods, such as cotton textiles, were compelled to increase labour productivity to stay competitive. On the other hand, the Indian economy stagnated and wages did not rise much until the First

World War. The cotton mill entrepreneur faced little pressure for change and productivity increase. Table 6 shows the differences in wages and capital costs in India and Japan. In India, the relative price of capital goods increased, whereas in Japan the relative price of capital goods declined continuously, creating the momentum for technological change. Wage driven labour productivity growth was not a factor in India until the 1920s. An Indian worker produced 0.75 pounds of yarn per hour in 1890-94, and this remained static at 0.73 in 1915-1919. In Japan, yarn per worker more than doubled, from 0.80 to 1.91 in the same years. (Wolcott & Clark, 1998)

Did India and Japan have similar levels of labour productivity before the divergence in wage trends? Clark (1987) finds that labour productivity in cotton mills in India and Japan was not very different in 1910. I use firm-level data from India and Japan to test the differences in labour use per machine around 1890. Data from 104 Indian cotton mills in 1889 is combined with similar data from Japan, on 32 firms, for the year 1892 to assess how employment norms differed between the two countries very early in the process of industrialization.

To analyze employment norms, we need to take into account the difference in shift work between the two countries. Japanese firms introduced double shifts in the mid 1880s. By the early 1890s, most Japanese firms had adopted double shifts, while Indian firms had only one shift. I therefore divide employment in each Japanese firm by two in order to get the number of workers per shift in each country. I estimate the following regression, which is similar to the one estimated in section 3:

$$N_i = \beta_s (1 + \gamma ID_i) \text{Spindles}_i + \beta_l (1 + \gamma ID_i) \text{Loom}_i + \varepsilon_i$$

where N_i is employment in firm i , Spindles_i is the number of spindles used by the firm, and Loom_i is the number of looms used by the firm. ID_i is a dummy variable

that takes value 1 if the firm is located in India. This equation is estimated by non-linear least squares. Our interest is in the parameter γ , which measures the extent to which firms use more labour in India as compared to Japan.

Table 8 reports the regression results. Indian firms used about 9% more labour than Japanese firms, but this effect is not statistically significant. This analysis is subject to a few caveats. We have relatively few Japanese firms in our sample. We have also assumed that all Japanese firms have switched to double shift – if there were some exceptions, this would imply that we have underestimated employment norms in Japan and thus the difference between the two countries would be less than the estimated 9%. We have assumed that spindles are homogeneous between the two countries although the Japanese firms had a larger share of rings. Subject to these caveats, our analysis indicates that there was at most a small difference in labour productivity between the two countries around 1890, and the divergence came later. By 1910, Japanese productivity levels were higher than the Indian levels, but lower than that in Britain. (Clark 1987) The divergence in productivity levels increased as wages rose in Japan.

7. Conclusion

This paper has argued that unionization and worker resistance cannot be an explanation for low labour productivity in the Indian cotton mills. On the contrary, the militancy of textile workers in Bombay made the cotton mills in this region relatively more efficient by increasing wages relative to other regions. Cotton mills in the cities of Bombay and Ahmedabad used less labour per machine. Both cities had higher wages in 1929 relative to other regions. While Bombay had seen several strikes over the decade, wages were set by arbitration in Ahmedabad cotton mills.

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TABLE 1: SOCIAL ORIGINS OF MANAGERS IN BOMBAY COTTON**MILLS**

	TECHNICAL PERSONNEL		DIRECTORS 1925		
	1895	1925	MERCHANTS	TECHNICAL	LAWYER
PARSI	112	201	30	9	10
HINDU	21	67	74	0	3
MUSLIM	5	6	19	0	0
JEWISH	3	11	6	0	0
EUROPEAN	104	113	20	2	2

Source: Rutnagur, 1927, pp 251-253.

TABLE 2: WAGE DIFFERENTIAL IN BOMBAY PRESIDENCY 1929

(DAILY AVERAGE EARNING IN RUPEES)

	BOMBAY	AHMEDABAD	SHOLAPUR	BARODA	OTHERS
MEN	1.45	1.39	1.00	1.03	1.00
WOMEN	0.78	0.80	0.40	0.57	0.54
ALL WORKERS	1.26	1.24	0.80	0.95	0.87

Source: Pearse, 1930, p109.

TABLE 3: CAPITAL AND LABOUR USE IN COTTON MILLS

	BOMBAY	AHMEDABAD	REST OF INDIA
1889			
SPINDLES	29725	22423	26005
LOOMS	252	212	20
HANDS DAILY	996	779	884
NO. OF FIRMS	53	7	104
1910			
MULES	11133	1494	7888
RINGS	23720	18648	20453
LOOM	296	305	291
HANDS DAILY	955	833	1101
NO. OF FIRMS	79	72	208
1917			
MULES	7591	781	5280
RINGS	29433	20236	22873
LOOM	724	391	480
HANDS DAILY	1562	817	1175
NO. OF FIRMS	77	82	231
1929			
MULES	4637	494	2940
RINGS	39812	21007	26670
LOOM	994	464	584
HANDS DAILY	1423	968	1213
NO. OF FIRMS	75	111	286
1933			
MULES	3636	177	2200
RINGS	41930	24071	28642
LOOM	1014	526	608
HANDS DAILY	1863	1041	1367
NO. OF FIRMS	67	128	298

Source: BMOA Annual Reports for various years

TABLE 4: LABOUR USE: BOMBAY COMPARED TO OTHER REGIONS

	1889	1910	1917	1929	1933
NO OF FIRMS	99	208	231	286	298
LABOUR USE PER MULE	0.03 (21.5)	0.02 (4.4)**	0.01 (4.8)**	0.02 (4.5)**	0.02 (5.2)**
LABOUR USE PER RING		0.04 (9.8)**	0.04 (19.2)**	0.03 (24.1)**	0.03 ((31.0)**
LABOUR USE PER LOOM	0.82 (8.4)	0.7 (4.1)**	1.2 (13.2)**	1.2 (14.8)**	1.2 (15.4)**
DIFFERENCE IN LABOUR USE BOMBAY	-0.41 (0.9)	-0.24 (3.3)*	-0.26 (8.5)**	-0.48 (23.0)**	-0.33 (12.2)**
DIFFERENCE IN LABOUR USE AHMEDABAD ^a		-0.21 (2.3)**	-0.30 (8.4)**	-0.22 (7.08)**	-0.25 (7.7)**
DIFFERENCE BETWEEN BOMBAY & AHMEDABAD		-0.03 (0.3)	0.04 (1.3)	0.26 (.8.9)**	0.8 (2.5)**
R ²	0.96	0.73	0.93	0.94	0.93

Note: *Total spindles. Source: Reports of Bombay Millowners Association.

** Statistically significant at 95 per cent. T- Statistic in parentheses.

^a The coefficient for Ahmedabad is not reported for 1889 as the number of firms is small.

Source: BMOA Annual Reports for various years

TABLE 5: WAGE COST PER UNIT OF OUTPUT

	REST OF INDIA	BOMBAY	AHMEDABAD
1929	1.00	0.75	1.08
1933	1.00	0.97	1.04

Source: Tables 2 and 4.

Note: The index is calculated using wages for men in 1929 and labour productivity coefficients for respective years.

TABLE 6: FINES FOR INDISCIPLINE OR INCOMPETENCE JAN-OCT 1926

CAUSES FOR FINES	NO. OF INSTANCES	% SHARE
BREACH OF DISCIPLINE	21158	6
BAD OR NEGLIGENT WORK	300296	87
DAMAGE TO EMPLOYER'S PROPERTY	12881	4
OTHERS	9771	3
TOTAL	344106	100

Source: Pearse 1930, p89.

**TABLE 7: CHANGES IN WAGES AND COST OF CAPITAL:
JAPAN & INDIA**

YEARS	JAPAN			INDIA		
	CAPITAL GOODS PRICE INDEX	MONEY WAGE INDEX FOR COTTON SPINNERS	RELATIVE PRICE OF CAPITAL- LABOUR	TEXTILE MACHINERY PRICE INDEX	MONEY WAGE INDEX IN COTTON MILLS	RELATIVE PRICE OF CAPITAL- LABOUR
1903- 07	100.0	100.0	1.00	100.0	100.0	1.00
1908- 12	103.7	125.6	0.83	106.2	112.5	0.94
1913- 17	131.8	148.8	0.89	196.3	130.7	1.50
1918- 22	258.74	429.8	0.60	336.6	219.5	1.53
1923- 27	232.0	525.1	0.44	242.1	252.3	0.94
1928- 32	174.8	465.1	0.38	204.9	265.19	0.77

Source: For Japan- Otsuka et al. *Technology-Choice in Development*, table 5.1, p68
For India- Bagchi, *Private Investment in India*, p122

TABLE 8: LABOUR USE PER SPINDLE IN INDIA (1889) AND JAPAN (1892)

No of firms: 104 (India) and 32 (Japan).

WORKERS PER SPINDLE	PERCENTAGE MORE LABOUR USE IN INDIA
0.025 (12.4)	9.4 (1.0)

Notes: $R^2 = 0.96$, T- statistic in parentheses.

Source: Reports of Bombay Millowners Association for India and Cotton Spinners Federation, Japan.

Figure 1 A



Figure 1 B



WAGE-EFFORT TRADE OFF

Figure 2 A

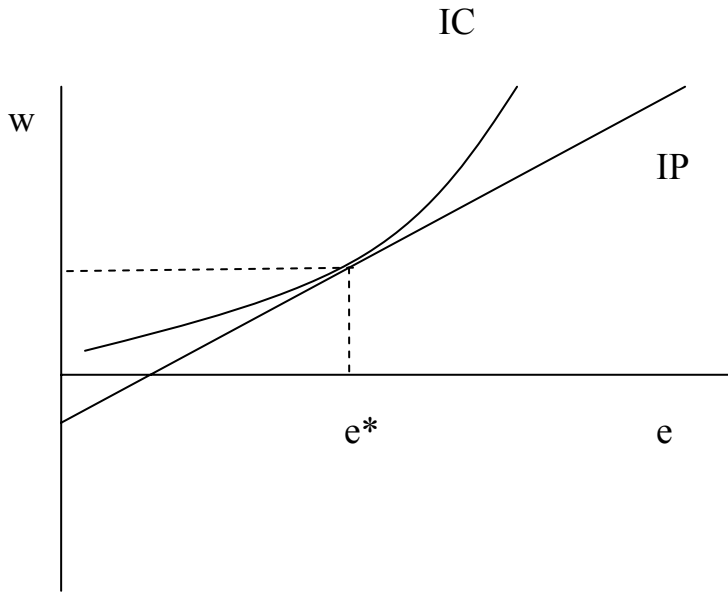


Figure 2 B

