Wages, Unions and Labour Productivity:

Evidence from Indian Cotton Mills

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Abstract

Clark and Wolcott attribute **t**he low productivity of Indian cotton textile workers to their preference for low work effort and suggest that unions resisted changes in working norms. This paper uses firm level data from all the textile producing regions in India to examine the relation between unions and labour productivity, using the variation in unionisation across regions. I find that fewer workers were employed per machine in the unionised mills in Bombay and Ahmedabad, compared to the mills in less unionised regions. The finding suggests that worker resistance kept wages high and compelled managers to increase productivity. We explore alternative explanations, arising from the managerial and institutional structure of Indian cotton mills. The separation of the managerial functions between jobbers, technical and administrative staff in Indian mills created inefficiencies. Low wages due to surplus labour in agriculture provided few managerial incentives to increase productivity and work effort.

1. Introduction

Why are there large differences in labour productivity across countries? Standard economic theory emphasises cross-country differences in capital employed per worker. In his well known paper, Clark (1987) compared labour productivity in cotton mills in different parts of the world in the early 20th century and argued that although capital inputs were comparable, there were great differences in labour productivity. Clark suggests that labour productivity differences determined wage differentials across countries.[2] Developed countries such as the United States and Britain had high labour productivity, which resulted in high wages, while poor countries such as India and Japan had low productivity and low wages. Clark goes on to argue that cultural factors may well explain the differences in work effort.[3] Wolcott and Clark (1999) extend this argument to explain the divergent trajectory of wages and productivity between Japan and India in the subsequent period. They claim that Japanese workers increased their work effort over time and consequently earned higher wages. On the other hand, work norms in the Bombay cotton mill industry remained static. Wolcott and Clark argue that India's lower efficiency was due to worker resistance to higher effort. Wolcott (1992) attributes worker resistance to unionisation of cotton mill workers and lifelong employment contracts. In this view, a labour force of young female workers gave Japanese industry a decisive advantage in pushing through organisational change that increased labour productivity.

This paper takes a critical look at the arguments of Clark and Wolcott and offers alternative explanations. While the observed correlation between wages and labour productivity across countries is clear, the direction of causality is more difficult to understand. Did low wages in industry result from low effort, as Clark argues or

[2] Clark, Why isn't the whole world developed?
[3] See also Clark, A Farewell to Alms, pp 353-365.

did low wages lead to low effort? This paper argues that in India in the early 20th century, the wage rate was determined in agriculture, which employed an overwhelming share of the workforce. In this labour surplus economy, where marginal product of labour in agriculture is close to zero, the industrial wage low as the Lewis model predicts. Low wages in the cotton mills created little incentive for managers to bring about productivity enhancing changes. Consequently, low labour productivity in cotton mills was a consequence of low wage.

A second question is to examine the relation between worker militancy and labour productivity. Did labour unions resist increases in productivity? This paper uses a new data set of cotton mills from all regions in India. Unionisation and worker militancy differed greatly across the regions. I use the regional variation in unionisation to test if the militant workers in Bombay cotton mills were less productive. I find that regions with higher wages had higher labour productivity. These were also regions where the workers were unionised. The presence of unions did not lead to lower productivity. On the contrary, by raising wages the unions contributed to raising labour productivity in the region. This reinforces the argument that the causality may go from wages to productivity.

The organisation of the paper is as follows: Section 2 re-examines the arguments of Clark (1987) and Wolcott and Clark (1999). Section 3 presents a simple model of wage- effort trade off. Section 4 discusses the organisation of the industry and the factors that may explain high labour use per machinery. Section 5 looks at the relationship between unionisation and wages. Section 6 presents an empirical analysis of firm-level data to quantify labour use in different regions. Section 7 analyses the evidence on workers' preference on wage and effort and the role of institutional factors in determining the level of effort. Section 8 concludes.

In 1910, British workers used 3.8 plain looms per worker, New England producers 8.0, the Japanese 1.6 and the Indians 1.9.[4] While these differences can be explained in terms of factor prices, it was not the case that capital productivity was higher in the poor countries. In the 1920s, if we normalise output per spindle-hour in the UK at 100, then output per spindle-hour in the United States was 105, in Japan 115 and in India 99.[5] India employed more workers per machine in India, but did not have higher capital productivity. A spinner in Bombay attended 180-200 mules compared to 500-600 in Britain. A weaver in Bombay operated two looms, while a weaver in Britain was responsible for 4-5 looms.[6] The work rate per hour of Indian doffers was one-sixth that of his US counterpart and one-fourth that of his British counterpart.[7] Other estimates put the productivity of labour in Indian mills at less than half of the British counterpart.[8] Clark claims that worker quality in terms of stature and education cannot explain differences in efficiency across countries. He attributes low labour productivity to a low level of effort that reflects preferences or cultural differences.[9]

Clark sees 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. 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 labour productivity in cotton textiles, but mainly by the general level of

[4] Clark, "Why isn't the whole world developed?"
[5] Clark, "Why isn't the whole world developed?"
[6] Rutnagur, *Bombay Industries,* p323.
[7] Clark, A Farewell to Alms, p 359.
[8] Indian Textile Journal (ITJ hereafter), various issues.
[9] Clark, "Why isn't the whole world developed?"

wages in the economy. If textile workers were substantially more productive, this would mainly be reflected in higher profits, with only a small effects on wages.

The Indian economy in early 20th century had all the characteristics of a labour surplus economy, where marginal product of labour in agriculture was close to zero. The Lewis model of a dual economy suggests that surplus labour in the traditional sector keeps wages low in the modern sector. Over 75% of the workforce in India was employed in agriculture producing just over 50% of national output.[10] Wages in the Indian economy were determined in agriculture. The rural-urban wage gap led to migration. A disaggregated picture of non agricultural employment shows that only 10% worked in industry, 1% in transport and just over 5% in commerce. The wage rate in agriculture was close to subsistence due to the low marginal product of labour. The urban wage was a mark-up on this outside and was therefore constrained to remain close to that level due to surplus labour in agriculture and the relatively small urban economy. This is true not only of wages in the industrial sector, but also in other non- agricultural sectors, such as transport and trade. [11]

Wages in Indian agriculture stagnated over the next few decades. Yield per acre stagnated between 1890 and 1916 and declined thereafter until 1946.[12]. The Japanese economy shows a different picture. Labour productivity in agriculture doubled during 1885-1915 and the increase in agricultural output accounted for 40% of the rise in national income, paving the way for industrial growth.[13] The rising productivity in agriculture increased wages and the rural- urban wage gap was small before 1910 and increased thereafter as the capital intensive sector paid higher

[10] Sivasubramonian, National Income of India, pp33-4, 377.
[11] The low productivity of labour in other urban activities in India, such as, the railways, as shown in Clark (2007) can also be explained in terms of low wages in a labour surplus economy, where the traditional sector employment an overwhelming share of the workforce and transport only 1%.
[12] Blyn, G., Agricultural trends in India, Appendix.
[13] Johnston, B, Agricultural productivity

wages.[14] Output per worker in cotton textiles increased by 180% between 1907 and 1935.[15]

GDP per capita rose faster in Japan relative to 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, about 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.[16] Money wages in Japanese cotton mills increased four times between 1903-07 and 1918-22, while real wages doubled. In Indian cotton mills, money wages doubled during the same period and real wages rose by less than 20 percent. (See table 1A) 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 to increase productivity.

Table 1B shows the trends in the relative cost of capital and labour in the two countries. 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. 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, 1999) As cultural preferences are slow to change, it is difficult to explain the dramatic change

[14] Mosk, Carl. "Japan, Industrialisation and Economic Growth". EH.Net Encyclopaedia, edited by Robert Whaples. January 19, 2004.
[15] Clark, A Farewell to Alms, p347.
[16] Maddison, *The World Economy,* pp 264-5, Shivasubramoniam, *National Income of India*, pp33.

in Japan in terms of sudden changes in effort leading to rise in wages.[17] Wage driven productivity growth is a more plausible explanation.

Wright discusses the identification problem in the context of the relationship between wages and labour productivity. He argues that if exogenous shocks lead to rise in real wages, then wage increases must be cause of productivity increase. This was true in the 1920s in the USA as prices declined and flows of immigration declined and therefore productivity growth was the response of employers to higher labour costs.[18] Huberman argues that cotton mills in Lancashire in the mid 19th century standardised piece rates and forced the inefficient firms to raise productivity with a given technology. If firms had lower wages, workers would lower effort and produce less output.[19] In the Indian context, the First World War constituted such an exogenous shock to wages. As imports were cut off, local production filled the gap and the rising demand for labour increased wages

We can think of two scenarios. First, if cultural preferences determine low effort and low wages, then exogenous shocks to wages will not raise labour productivity. On the other hand, if it reflects inefficiency rather than workers' preferences, then an exogenous shock that increases wages will cause a rise in labour productivity. In the second case, it can be argued that wages determine productivity. To understand why firms operate at sub-optimal level and what prompted them to become more efficient, I set out a simple model of the wage effort trade off.

3

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

[17] Mass & Lazonick, The British Cotton Industry
[18] Wright, Productivity Growth and the American Labour Market.
[19] Huberman, M, Piece Rates Reconsidered.

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

$\pi = ep - w - rk$ ……(2).

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

$U(w,e) = w - d(e)$ …….(3),

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 Clark (1987) and Wolcott and Clark (1999), is that low effort reflected workers' 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. Clark (2007) argues that the failure to raise effort levels in a cotton mill in Madras where automatic looms were introduced is suggestive of worker preference for low effort.[20] Similar views had been voiced by managerial staff in the industry, policy makers and foreign observers from early days of the industry. This could be either due to cultural factors or due to worker resistance to move to a higher effort level. In the latter case unions would have detrimental effect on labour productivity.

An alternative explanation is that actual arrangements were Pareto-inefficient; *e*' is well below *e**. 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 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 recognise the potential for mutual gain, and has to *initiate* the improvement. The specific institutional structure of management may

[20] Clark, A Farewell to Alms, p 362-365.

have created inefficiencies in the system. Unions in this context may play an important role in moving to a more efficient arrangement.

Consider an exogenous shock, such as the First World War. Wages rose due to the demand shock, but when demand fell, as it did after the war, unions resisted wage-cuts. The only way the firms could stay profitable was to raise labour productivity. An exogenous shock in this context would move the firm to a high wage- high effort equilibrium and the unions would play a positive role in moving to a more efficient outcome. Therefore unionised firms with higher wages could achieve higher labour efficiency. To understand if this indeed was the case in Bombay cotton mills, I compare firms in Bombay city with firms in less unionised regions in section 5. Sections 3 and 4 discuss the organisation and institutional structure of cotton mills in India

3

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. While Bombay concentrated on producing low quality yarn, Ahmedabad specialised in higher quality yarn and cloth and competed with imports from Britain. During the war, the substitution of imports gained momentum and the trend continued after the war. One problem faced by the industry was that each firm produced a variety of output and therefore could not benefit from specialisation

The industry had the advantage of cheap labour and local supplies of raw material. The industry had a special management structure, whereby a managing

agent raised capital and managed the financial side of the business. Production was left in the hands of technical supervisors and labour supervisors, known as the jobbers. 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.[21]Table 2 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, who was locally recruited.

The process of hiring workers was complicated. India had abundant labour, but mainly concentrated in agricultural activity. The textile 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.[22] The jobbers were given the responsibility of maintaining adequate labour supply to suit the level of demand as well as the task of worker supervision and maintaining factory discipline. The system allowed quick reductions in employment if the need arose.

The production process reflected the abundance and cheapness of labour. Although the ring was also more suited to unskilled labour, the Indian cotton mill

[21] Vicziany, *The Cotton Trade.*
[22] Chandavarkar, *Origins of Industrial Capitalism,* p 82.

industry adopted the mule.[23] The persistence of the mule in India has been explained in terms of the use of locally grown short staple cotton. [24] The industry in Japan, on the other hand, switched early to the ring. Japan imported raw cotton and introduced a technological innovation by mixing short and long staple cotton.[25] Mass and Lazonick attribute an important role to tariffs in the case of the Japanese industry. It fostered development of *appropriate* technology that made Japanese firms competitive.[26] India, on the other hand, pursued free trade until the interwar period under the colonial government. The effective rate protection in spinning in Japan on the eve of the First World War was 120 per cent and in India zero.[27]

An alternative view has emphasised 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.[28] Mixing of cotton was not adopted in India due to the lack of incentives and also due to the lack of technical knowledge of the managers.[29] Other research in this field suggests that the Indian entrepreneurs made a rational choice in adopting the mule given the factor endowments.[30] Capital was expensive and the mule was relatively cheap in the early period. The cost of setting up a cotton mill was higher in India compared to a Britain due to the cost of transportation of machinery from Britain and the higher cost of power. [31] Each mill produced a great variety of products and the mule allowed greater flexibility in

[23] The ring vs. mule debate in the context in the British cotton mills focused on the question of entrepreneurial rationality in persisting with the old technology. Did British entrepreneurs make the right choice of technology given the factor endowments or was there an organisational failure?
[24] Saxonhouse & Wright, New evidence on the English mule.
[25] Otsuka et al , *Comparative Technology Choice in Development*, p55-57
[26] Mass & Lazonick, The British Cotton Industry.
[27] Otsuka et al, *Comparative Technology Choice in Development*, p70
[28] Kiyokawa, Technical Adaptations and Managerial Resources.
[29] Ibid.
[30] Chandavarkar's work makes an important contribution in this approach.
[31] Buchanan, *The Development of Capitalist Enterprise,* p207. Clark, A Farewell to Alms finds the cost of shipping to the USA to be 25% of value of the machinery.

operation.[32] Once a mill was set up, the machinery was operated as long as possible. The lower rate of scrapping and replacement of machinery delayed the rate of adoption of rings in older mills. Consequently mules persisted in Bombay, the centre of early development, longer than elsewhere.

High labour use was a response to factor prices. Tasks became more labour intensive per unit of capital and entrepreneurs did little to introduce productivity enhancing changes. Machines were often operated at a speed higher than the recommended level without introducing the appropriate quality cotton.[33] It was estimated that a ringsider in India had to deal with nine times as many breakages per 100 spindles as his American counterpart.[34] This increased the number of workers needed to tend to a spindle. One survey estimated that in the 1930s, for every worker employed, two casual workers were available.[35]

The Tariff Board in 1927 saw high labour use per machine as an organisational problem:

> "We cannot too strongly emphasise 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." [36]

4

In the first decades of the 20th century, labour in the cotton mills was still unorganised. Resistance to low wages and working conditions were sporadic and lacked centralised organisation. Industrial action in Bombay and Ahmedabad was mainly against wage cuts. Spontaneous protests by textile workers in Bombay had

[32] Chandavarkar, *Origins of Industrial Capitalism,* p341.
[33] BMOA Report 1928.
[34] Chandavarkar, *Origins of Industrial Capitalism,* p284.
[35] Chandavarkar, *Origins of Industrial Capitalism,* p296.
[36] BMOA Report 1928.

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.[37] By the mid 1920s these protests were coordinated by the trade unions.

Wages rose during the war in response to the increased demand. While money wages in Bombay, Ahmedabad and Calcutta[38] had been comparable before 1914, wages rose sharply in Bombay and Ahmedabad thereafter. (See Figure 1) The average wage in Bombay was 20% higher than the average wage in Ahmedabad on the eve of the First World War. During the war, cotton mills paid a war bonus of 10% from 1917 to be followed by a "dear food allowance" of 15% from 1918.[39] Between 1914 and 1921, wages rose by 87% in Bombay city and by 122% in Ahmedabad.[40] Table 3 shows a comparison of wages in the two cities and the rest of Bombay Presidency 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.

When demand conditions changed at the end of the war, the response of the majority of firms was to reduce wages. It was when firms tried to cut wages that resistance erupted on the shop floor. As early as 1900, a commentator had written in the Indian Textile Journal:

> "The principal reason why people go on strike is that of wage reduction. In the cotton mill industry, mill agents have thought that the reduction in wages is the first remedy against hard times."[41]

The first strike action that affected the entire industry in Bombay city was in December of 1918 and involved 125,000 workers.[42] 150,000 workers struck work for

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[37] Morris, *The Emergence of an Early Indian Labour*.pp178-79.
[38] Calcutta was the other major industrial centre although the main industry here was jute rather than cotton.
[39] Kooiman, *Bombay Textile Labour*, pp51-2.
[40] Bombay Labour Office, 1923.
[41] ITJ, February 1900.

12 days in 1919 followed by a general strike in 1920 that lasted for a month.[43] The disputes continued into the 1920s in response cuts in war-time payments. By this time, trade unions had gained a strong presence in the industry. In 1925 the strike lasted several weeks. As several cotton mills in Bombay sought to introduce a higher work load, the trade unions organised industrial action in 1928 that lasted for over six months and resulted in a massive loss in working days. 1929 saw further industrial action by the communist led union, but this was opposed by the moderates and did not have the same effect as in the previous year.[44]

Worker resistance to a reduction in wages was not specific to Bombay. Wage-cuts in the cotton textile industry in Southern USA in the 1920s had led to resistance even among non-unionised workers.[45] Wright argues that once wages had risen due to an exogenous shock, rational employers were willing to take that wage rate as given and increase productivity of capital and labour.[46] Domenech's work on the non-unionised Catalan cotton textile industry in the late 19th century finds that worker's resisted wage-cuts as in more unionized countries and firms adjusted by reducing output and hours of work in the downturn.[47] In the Bombay cotton mills in the interwar years, attempts at wage- cuts led to industrial action. On the other hand reducing total employment proved easier due to the large number of casual workers employed on a daily basis. Aggregate employment declined in the cotton mills in Bombay from the late 1920s.

There were protests against cuts in wages in Ahmedabad too. With Gandhi's involvement, workers in Ahmedabad sought consensual solutions through industrial

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[42] Buchanan, *The Development of Capitalist Enterprise*, p427.
[43] Bombay Labour Office, 1926.
[44] Morris, *The Emergence of an Early Indian Labour,* pp181-84.
[45] Wright, Cheap Labour and Southern Textiles.
[46] Ibid.
[47] Domenech, The Catalan Textile Industry.

arbitration. This period coincided with economic nationalism in the anti-imperialist struggle. The principle of arbitration was helped by shared interests between the workers and the capitalists in the boycott of foreign goods.[48] However sporadic industrial action continued in the early 1920s and not all firms supported the principle of arbitration. In 1923 the industry implemented a wage cut of 15% and for the rest of the decade industrial arbitration took up issues such as health, education and housing rather than wages.[49] In comparison to Bombay, industrial relations in Ahmedabad remained more peaceful.

In Bombay cotton mills, 42.5% of the workers were in trade unions, 29% in Ahmedabad and only 5% in Sholapur.[50] The textile workers in Delhi did not have a union and the union in Madras had a relatively low key presence.[51] The jute labour union in Calcutta, the other major industrial region, did not succeed in involving the workers in a strike in 1929 and represented only 4% of the workforce.

There is no information on the number of strikes and workers involved in textile mills for the whole of India. However, there is a lot of qualitative evidence that shows that Bombay city was the centre of industrial action in the cotton textile industry. Table 4 shows the incidence of all industrial disputes across different regions of the Bombay Presidency, where the majority of the textile firms were located. Of the 401 strikes in Bombay city accounting for 91% of the working days lost, an overwhelming 79% were in textile mills.[52] Rough calculations show that the number of working days lost account for 12-13% of the total in Bombay.[53]

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[48] Patel, *The Making of Industrial Relations, pp* 54-56.
[49] Patel, *The Making of Industrial Relations*, pp64, 81-84.
[50] Bagchi, *Private Investment in India,* p140.
[51] Ibid.
[52] Pearse, *The Cotton Industry,* p95.
[53] The calculations have been based on a nine year period 1921-29 and therefore do not correspond exactly to the period covered by table 4. The total workers in Bombay city are multiplied by 50 or 52 weeks and assumed to work six days a week.

The effect of unionisation on labour productivity has been debated in the context of industrialised economies. Freeman and Medoff (1984) argue that unions can increase labour productivity by reducing labour turnover and improving managerial practices. Recent work suggests that the presence of unions can increase productivity by making managers keen to reduce organisational slack. (Metcalf 2003) The empirical evidence is mixed. Research using data from American industries shows that unions had a positive effect on labour productivity (Brown and Medoff 1978, Clark 1980, Allen 1986) The UK evidence is less clear cut. (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 tends to have a positive effect on productivity. (Metcalf 2003)

How did the presence of unions in Bombay and Ahmedabad affect labour productivity? Wolcott and Clark argue that in the 1920s, when cotton mills faced the pressure to increase productivity, worker militancy in Bombay cotton mills prevented organisational change.[54] The analysis of Wolcott and Clark does not allow inter regional comparison. Consequently, their estimation does not identify if worker resistance prevented increases in labour productivity relative to other regions in India. With the new data set of cotton mills from all regions in India, I can compare Bombay with the rest of India and empirically test if Bombay mills had lower labour productivity. This allows me to identify the effect of workers militancy on labour productivity in a particular region.[55]I now turn to the empirical analysis.

5

One way to analyse the role of unions in preventing organisational change would be to compare the labour use per machine across different regions in India. In

[54] Wolcott & Clark, Why Nations Fail.
[55] There is some information, although not systematic on strikes in different cities. This again is at the level of the region and not firm and therefore a regional dummy is a good measure.

the absence of firm-level output data, my measure of labour productivity, as in Wolcott and Clark, is labour- use per machine. This captures total factor productivity if machines are the same in cotton mills across all regions.[56]

Given that machines were similar and sold by a handful of machinery producers; this is not a bad measure. If organised 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 prevented wage cuts and/or higher wages forced employers to initiate productivity increases, one should find that Bombay had higher labour productivity and fewer workers per machine. Secondly, Bombay and Ahmedabad, with similar level of wages in the 1920s, should show similar levels of labour use. A comparison with Ahmedabad is also of interest as the two regions had different experiences of labour resistance. Did cooperation rather than conflict lead to efficiency gains in Ahmedabad? If labour resistance explains inefficiency the Bombay should have a higher labour use per machine relative to Ahmedabad.

The data

Wolcott and Clark used firm–level data from Bombay city from the annual reports of Bombay Millowners' Association (BMOA hereafter). The statistical appendix of the BMOA reports also has firm-level information from other regions in India, which I have put together with the original data used by Wolcott and Clark. This is the first time such a data set is being analysed. My data is at the level of the firm and provide information on the number of workers employed daily in each firm and the machinery used. 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

[56] 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.

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. 1910 is a good year to consider, as it is before the war and is also the year used in the international comparison by Clark (1987). 1917 refers to a situation of increased output in the industry as a result of the war. 1929 and 1933 are of particular interest as these follow a decade of labour strife. As stated in the introduction, it is reasonable to assume that equipment was similar across regions and there was not much difference in output per machine of a particular type. Most of the equipment was imported from the same suppliers in Britain.

Table 5 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 mills were more likely to adopt the ring, while older mills in Bombay with an existing capacity of mules were slow in switching to rings. Ahmedabad also had more looms. 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. Several mills went out of business by 1929 and more disappeared by 1933. For Ahmedabad, on other the other hand, there is evidence of an increase in size as well as new entry.

In the absence of information on union membership at the level of the firm, I use the regional difference in labour movement to understand its effect on labour productivity in different regions. Bombay and Ahmedabad were regions with union activity, while the other regions were not. I test the following hypotheses:

1. Bombay is significantly different from the rest of India in terms of my measure of labour efficiency.

2. Bombay is significantly different from Ahmedabad.

3. Labour productivity in cotton mills in Bombay declined during the 1920s due to worker resistance to increase effort.

The Results:

I estimate coefficients of labour use by type of the machine for the five years. 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:

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

$$+ \beta_l (1 + \gamma BD_i + \mu AD_i)Loom_{it} + \varepsilon_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

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 Bombay and AD_i is a dummy variable that takes value 1 if the firm is in Ahmedabad. I 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. My interest is in the values of γ and μ, that is, the extent to which labour requirements in Bombay and in Ahmedabad differ from other regions.

Table 6 reports the estimated coefficients from the regression. We see that γ is negative in every single year. Although this is not statistically significant in 1889, the coefficient is significant in subsequent years. In 1910 and in 1917, before the spurt

of labour unrest, Bombay had significantly less labour use per machine compared to the rest of India. This was also true for Ahmedabad. However the difference between the two cities is not statistically significant.

At the end of the 1920s, the coefficient for Bombay is negative and significantly different from the rest of India and the magnitude of the difference is larger. Further, it is also negative and significantly different in comparison with Ahmedabad. Indeed, in 1929, labour use in Bombay is 48 per cent less compared to other regions. We need to take this result with some caution. The figures for 1929 partly reflect working days lost due to industrial action. Total employment in Bombay mills declined significantly in 1928 and 1929, but even in 1930 was well below the 1927 level. The industry did not go back to the employment level of the mid 1920s until 1937.[57]The difference between Bombay and Ahmedabad persisted in 1933 suggesting that not all of this difference can be explained in terms of closure of cotton mills during industrial action. 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. The results suggest that the relatively higher wages in Bombay and Ahmedabad required higher labour efficiency (See table 3 to compare wages). This encouraged firms to economise on wage costs in order to remain competitive in the product market.

The point estimate on Bombay shows a reduction in labour use between 1910 and 1933. The standard error in 1910 is large, but relatively smaller in 1933 and suggests that the mills were more similar in labour use in 1933 compared to 1910. In other words, less efficient mills reduced labour use per machine or went out of

[57] Morris, *The Emergence of an Early Indian Labour,* p 218.

business. In fact there no evidence of declining productivity of labour in Bombay as a result of labour militancy.

Although the wage difference between Bombay and Ahmedabad was marginal, there was significant difference in labour productivity in 1933. This is puzzling. However, a closer examination suggests that the product and factor markets in the two cities were very different. Firms in Ahmedabad 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. This export market in yarn disappeared after the war. Simple calculations of profits of the firms in the two cities show that profits fell faster in Bombay.[58] Consequently, the pressure on entrepreneurs in Bombay to reduce inefficiency was greater.

Bombay mills had a high turnover of the workforce and a large proportion were casual workers estimated to be about 28% of the workforce.[59] This made it relatively easier to reduce employment. 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 3% lower in 1933, while in Ahmedabad it was roughly 4% higher. (See table 7) These figures suggest that efficiency gains were made by Bombay mills in the 1920s. Falling profits, older machinery and changes in the product market created additional pressure on firms in Bombay to bring about organisational change. There is no evidence that unionisation prevented a rise in productivity. On the contrary, firms in Bombay were more efficient.

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[58] Patel, *The Making of Industrial Relations,* p34.
[59] Chandavarkar, *Origins of Industrial Capitalism,* p296.

Having ruled out the negative effect of unions on labour productivity, let us now go back to the model of wage effort trade off. Did workers' show a preference for low effort? Evidence on indebtedness suggests that majority of the workers earned well below their expenditure levels. A survey conducted by the Bombay Labour Office showed that in 1926, 47% of the families and 45% of single men were in debt.[60] This on average was equal to two and a half month's earnings at an average interest of 75% per year. In Ahmedabad 69% of families were in debt, while in Sholapur the figure was 63%.[61] Most of the workers sent money to families in the village. Many incurred debts due to marriage and other social customs. Whatever the cause, the debt burden would have made higher earning attractive to most cotton mill workers. So it is likely that given the right incentive the worker would be willing to offer a higher effort.

Indirect evidence also suggests that the workers were prepared to increase effort in return for higher wages. The industry in Bombay had a wide differential in wages across firms for the same category of workers. This was noted as early as 1893. The differential increased over time, suggesting that higher effort was rewarded by higher pay. The maximum difference before 1920 was about 30% between high and low wage. This figure rose 33% for one side ring spinners and 34% for 2 loom weavers and 87% for grey winder and 73% for reelers in 1926. The corresponding figures were even higher in 1933: 46%, 90%, 63% and 175%.[62] The weavers, winders and reelers were on piece rates and the widening pay differences reflect differences in

[60] Pearse, *The Cotton Industry,* pp92-93
[61] Ibid
[62] Bombay Labour Office, Wages Census, 1921, 1926, 1934.

effort.[63] The differential in pay among both piece and time workers was significant even within the same district.[64]

The efficient mills attracted better workers by offering them higher wages. Workers tended to compete for jobs in mills that had better pay and better working conditions. In mills that had poor quality machines jobbers had to attract workers by lending them money or standing as a guarantor for the moneylender.[65] Newer mills tried to reduce cost of training by luring away efficient workers from existing employment.[66] Competition for more these workers bid up wages. Mills such as, Sassoon, Bombay Dyeing, Finlay, and Kohinoor were ready to pay more for higher effort.[67]

There are many examples of workers accepting higher work load, when rewarded by higher pay. In general, piece rate workers earned more than time-rate workers. This suggests that the workers did respond to incentives towards higher earnings. (Table 8) Four-loom weavers earned 50% more than two-loom weavers. (See table 9). Workers, who were willing to undertake higher workload, were favoured when chances of promotion appeared.[68] Jobs were highly differentiated in the context of a labour intensive technology. Yet when two jobs were combined as in Tata's Swadeshi mills, the worker was paid more suggesting an efficiency-wage trade off.[69] Absenteeism was lower among piece rate male workers in Bombay, particularly amongst weavers.[70] There is little evidence to suggest that the inefficient equilibrium was determined by worker's preferences.

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[63] Morris, *The Emergence of an Early Industrial Labour Force,* pp157-8.
[64] Morris, *The Emergence of an Early Industrial Labour Force*, p 160.
[65] Chandavarkar, *Origins of Industrial Capitalism,* pp 301-2.
[66] Morris, *The Emergence of an Early Industrial Labour Force,* p161.
[67] Chandavarkar, p351.
[68] Chandavarkar, p323.
[69] Chandavarkar, *Origins of Industrial Capitalism,* p317.
[70] Bombay Labour Office, Wage Census, 1923, p8.

Was the low wage-low effort equilibrium caused by an institutional failure? Hall and Jones show that institutional differences explain difference in labour productivity across countries.[71] 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 technicians were asked to produce a certain output per machine.[72]An additional reason might have been the incentives of the managing agents, who held overall responsibility for the organisation. 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. Sydney Pollard (1965) sees the creation of the *new work discipline* in the emerging factory industry in Britain as a crucial aspect of modern management. Pollard discusses the difficulties faced by the first entrepreneurs in introducing "regularity and steady intensity of work" and argues that this did not "come easily to the new workforce". Absenteeism on St Monday and feast days continued to persist and firms struggled to bring in

[71] Hall & Jones, Why to some countries produce so much more.
[72] Madholkar, *The Entrepreneurial and Technical Cadres of Bombay*, ch 3.

punctuality, fixed hours of work and a ban on drinking. [73]The new industrial organisation developed through a combination of penalty and incentives. For example, there were significant fines for late arrival.[74] Thompson documents the slow change in working habits in Britain after the industrial revolution.[75] Clark 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.[76] Discipline was also a crucial aspect in the Japanese cotton mills. Hunter 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.[77]

For the first generation worker in cotton mills in Bombay and in other Indian towns, this was a transition from the world of free labour working at his/her own pace in the environment of the family and open space of the rural community. The factory compound was a place, where the cotton mill worker spent most of his time: he bathed, washed clothes, ate his meals and took naps. The worker typically arrived earlier than the starting time, took many breaks during the working hours to smoke a cigarette or to drink tea. On average a mill worker was said to pass 10-15% of his working day outside the mill building. A commentator wrote in the Indian Textile Journal: *"The Indian mill to the worker is their home"*[78] and a few months later:

"It is bad for a human being to stay long hours in the atmosphere of a factory, but the chawls[79] have much worse conditions with overcrowding, poor sanitary conditions and lack of light." [80]

[73] Pollard, The Genesis, pp181-6.
[74] Ibid.
[75] Thompson, Time, work discipline.
[76] Clark, Factory Discipline.
[77] Hunter, *Women and the Labour Market,* pp103-110.
[78] ITJ February 1905.
[79] The living quarters.
[80] ITJ October 1905.

The Indian cotton mills did little to develop mechanisms for higher discipline on the shop floor. 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 penalised. Table 10 is based on information collected from 45 mills. Back of the envelope calculations show the there was less than one complaint for every 100 workers during this period.[81] An overwhelming proportion of the fines for men and women were for negligence in work. This referred to spoilt or damaged material and the fine was deducted from the workers wage. Weavers in particular were subjected to large penalties.[82] Late arrival at work or taking time off during working hours were less serious offences compared to a failure to produce the right quality product. Interestingly, the survey showed that in activities other than textiles, 49% of the fines were for breach of discipline.[83] Morris 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.[84] 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. Alternatively, as equipment costs were relatively high, the managers chose to economise on capital cost by running the machines as long as possible and responded to worker absence by employing *reserve labour*. The low wages provided a reason for over manning rather than imposing greater discipline.

[81] This is an underestimate as the data on complaints relates to only 45 mills, where as the labour force data relates to the all the mills in Bombay city. Total employment is calculated by multiplying daily employment by 42 weeks and 6 working days a week.
[82] Pearse, pp89-90.
[83] BMOA Report, 1927.
[84] Morris, *The Emergence of an Early Indian Labour,* pp111-2.

This was a contrast to productivity enhancing measures introduced in Japan as a response to high capital cost. Japanese firms introduced a system of double- shift and shorter working hours in each shift to increase labour use per unit of capital. This did not happen in India and is another example of an organisational failure The Indian mills persisted with of long hours of a single shift system. 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. [85]

As early as 1905, the Bombay Mill Owners' Association discussed reduction of the working day to 12 hours. Firms, such as Wadia, Sassoon and Petit, who were the industry leaders, favoured a reduction in working hours and argued that long hours reduced worker efficiency.[86] In 1919 Wadia moved to introduce two shifts of eight hours. However, the 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.[87] The reluctance to work double shifts could have been associated with greater costs of supervision and the high salaries paid to European technical staff.[88] Several mill owners argued that mills on a double shift would bid up the wages and cause labour disputes in mills on single shift.[89] The BMOA passed a resolution in 1920 prohibiting implementation double-shifts. Two firms that introduced a double shift were expelled in 1921.[90] In his statement to the Industrial Disputes Committee, Wadia claimed that the introduction of double shifts had reduced absenteeism.[91] However double shift did not become the norm until the 1930s. In fact, the BMOA rescinded the resolution of 1920 to allow

[85] Pearse, *The Cotton Industry.*
[86] BMOA 1905.
[87] BMOA reports, 1919-21.
[88] Morris, *The Emergence of an Early Indian Labour,* pp56-7.
[89] Chandavarkar, *Origins of Industrial Capitalism,* pp353-4.
[90] BMOA, Report 1921.
[91] ITJ, January 1922.

firms to do so.[92]The agency problems associated with the separation of financial and technical jobs in the cotton mills and the lack of technical qualification of the managers may explain the failure of organisational change.

The pressure to increase labour productivity in Bombay mills came with the rising wages during the war. There was a move towards organizational change in Bombay cotton mills in the 1920s by standardisation the wage structure. The strike of 1928 in Bombay ended with the promise to look into standardisation of wages based on the Lancashire lists that Huberman refers to.[93] Standardisation of wages and efficiency gain together were seen as a package. However, there was no consensus among firms.[94] On the issue of wage cuts too, there were differences among the mills. In mills that reduced wages, pay had been below the industry average.[95] The more efficient ones, typically did not reduce wages, but tried to raise productivity. In his representation to the Tariff Board in 1927, the firm of Sassoon produced estimates of savings in the total wage bill with increased workload and higher wage.[96] However, the scale of this change remained small. Only 10,000 workers were affected by the efficiency schemes.[97] If standardised piece rates in Lancashire in the mid 19th century was a mechanism to move to high wage- high effort equilibrium as Huberman suggests, then the differential pay structure in Bombay mills could have prevented the industry from moving to a high effort- high wage outcome. The evidence on organisational failure is persuasive.

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[92] BMOA, Report 1928.
[93] Morris, *The Emergence of an Early Indian Labour,* pp170-2.
[94] Ibid.
[95] Bombay Labour Office, Wages and Employment, 1934, p33.
[96] Bombay Labour Office: Wages and Unemployment, p17.
[97] Chandavarkar, *Origins of Industrial Capitalism,* pp275-276.

This paper has revisited the question of unionisation and labour productivity in Bombay cotton mills using firm-level data. The view of Wolcott and Clark (1999) that worker militancy prevented efficiency gains in the 1920s is not borne out by the empirical analysis when the regional variation in unionisation is considered. On the contrary labour productivity was higher in the unionised regions of Bombay and Ahmedabad compared with regions with no little union activity. Cotton mills in the cities of Bombay and Ahmedabad used less labour per machine and paid higher wages in 1929 relative to other regions. Labour- use per machine was low even relative to Ahmedabad and suggests that worker militancy could not have led to inefficient practices. Unionisation through its effect on wages acted as a spur to efficiency gains in Bombay cotton mills.

The paper has proposed a new explanation of why low wages determined low labour productivity in Indian cotton mills in the early 20th century. Contrary to the view of Clark (1987) that cultural preference for low effort explains why wages were low, I argue that low wages reflected surplus labour in a predominantly agricultural economy. As the Lewis model predicts, wages in industry remained low. Given the factor prices, mangers chose to employ more workers per machine. Low wages reduced managerial incentives to make productivity enhancing organisational changes until there was an exogenous shock to wages during the war. The organizational structure of the industry and the separation between the managerial and the technical staff and the jobbers may explain the failure to bring about changes subsequently.

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TABLE 1A: CHANGES IN REAL WAGES: JAPAN & INDIA

YEARS	**JAPAN INDEX OF REAL WAGES FOR COTTON SPINNERS**	**INDIA INDEX OF REAL WAGES IN COTTON MILLS**
1903-07	100	100
1908-12	116	108
1913-17	116	102
1918-22	181	119
1923-27	239	160
1928-32	295	205

Note: Real wage indices have been calculated from the following sources.
Source: For Japan- Otsuka et al. 1988, Technology-Choice in Development, table 5.1, p68
For India- Bagchi, 1972, Private Investment in India, p122

TABLE 1B: 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. 1988, Technology-Choice in Development, table 5.1, p68
For India- Bagchi, 1972, Private Investment in India, p122

TABLE 2: 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, Bombay Industries: The Cotton Mills, pp 251-253.

TABLE 3: 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, The Cotton Industry India, p109.

TABLE 4: INDUSTRIAL DISPUTES IN BOMBAY PRESIDENCY: April 1921-June 1929

	NO OF DISPUTES	NO. OF WORKERS INVOLVED	NO OF WORKING DAYS LOST
BOMBAY	401	1077927	49297817
AHMEDABAD	221	135200	2605087
SHOLAPUR	10	39484	1214434
VIRAMGAM	8	3705	32854
BROACH	22	8966	85022
KARACHI	14	9893	395554
JALGAON	7	4445	56990
SURAT	12	4840	35254
POONA	11	3763	40903
REST	32	21228	181399
BOMBAY PRESIDENCY	738	1309511	53949314
Share of textile mills	612	1233170	52450814
BOMBAY	NA	NA	48259737
AHMEDABAD	NA	NA	2604737
SHOLAPUR	NA	NA	1214434

Source: Pearse, 1930, The Cotton Industry India, p95 , Bagchi, Private Investment in India, p143

TABLE 5: AVERAGE 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	44
1910			
MULES	11133	1494	7888
RINGS	23720	18648	20453
LOOM	296	305	291
HANDS DAILY	955	833	1101
NO. OF FIRMS	79	72	57
1917			
MULES	7591	781	5280
RINGS	29433	20236	22873
LOOM	724	391	480
HANDS DAILY	1562	817	1175
NO. OF FIRMS	77	82	72
1929			
MULES	4637	494	2940
RINGS	39812	21007	26670
LOOM	994	464	584
HANDS DAILY	1423	968	1213
NO. OF FIRMS	75	111	100
1933			
MULES	3636	177	2200
RINGS	41930	24071	28642
LOOM	1014	526	608
HANDS DAILY	1863	1041	1367
NO. OF FIRMS	67	128	103

Source: Bombay Millowners' Association, Annual Reports for various years, Appendix

TABLE 6 LABOUR USE: BOMBAY COMPARED TO OTHER REGIONS

	1889[a]	**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[b]		-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)**	0.08 (2.5)**
R^2	0.96	0.73	0.93	0.94	0.93

Source: Bombay Millowners' Association, Annual Reports for various years, Appendix.

Note: a- total spindles.

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

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

TABLE 7 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.
* The low value here reflects the number of days lost in strike action.

TABLE 8: WAGES OF TIME AND PIECE-RATE WORKERS IN BOMBAY

(Average daily earnings)

WORKER CATEGORY	1921		1923		1926	
	TIME-RATE Rupees	PIECE-RATE Rupees	TIME-RATE Rupees	PIECE-RATE Rupees	TIME Rupees	PIECE Rupees
JOBBER	2.95	3.85	2.93	4.06	2.25 3.96*	4.25 6.7*
REELER (WOMEN)			0.69	0.78	0.49**	0.68
WINDER	1.17	0.79	0.93	0.83	0.93	1.08
SPINNER	1.94	1-98	1.81	2.06	NA	NA

Note: * Only head jobbers. ** Few workers on time rate. NA- The categories were different in the 1926 census and not comparable with the earlier years
Source: Bombay Labour Office, Wage Census, 1921, 1923, 1926.

TABLE 9: WAGES OF WEAVERS IN BOMBAY (1921-1926)

	AVERAGE DAILY WAGE (Rupees)		
	2LOOM WEAVER	3LOOM WEAVER	4LOOM WEAVER
1921	1.64	2.23	2.57
1923	1.70	2.15	2.65
1926	1.83	2.53	2.89
1934	1.38		2.07
	WAGE DIFFERENCE (%)		
1921	100	136	157
1923	100	126	156
1926	100	138	158
1934	100		150

Source: Bombay Labour Office, Wage Census, 1921, 1923, 1926, 1934

TABLE 10: 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, The Cotton Industry India, p89.

Figure 1


Money Wage in the Cotton Textiles Industry
Wages
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
1900
1903
1906
1909
1912
1915
1918
1921
1924
1927
1930
1933
1936
1939
Years
Bombay
Ahmedabad
Jute in Calcutta

90

WAGE-EFFORT TRADE OFF

Figure 2 A

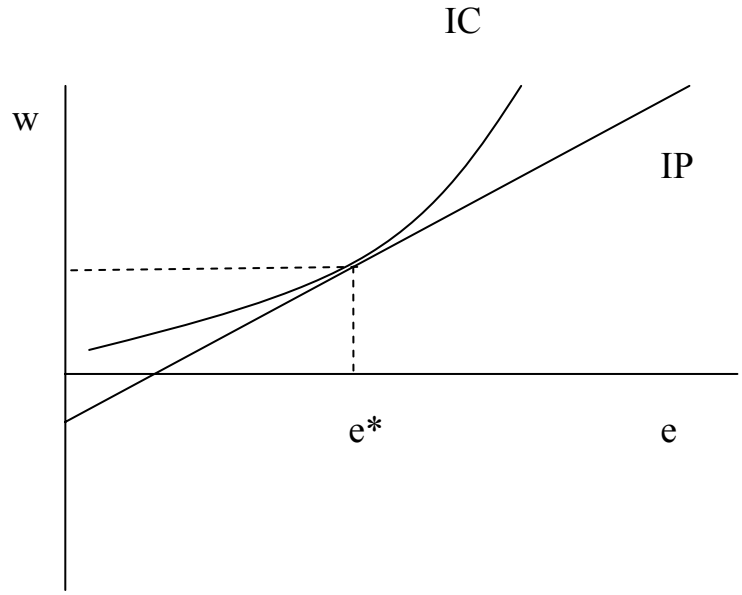

Figure 2 B