Labour Power and Stagnant Industrial Labor Productivity in Late Colonial India

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Sivasubramonian's (2000) data on Indian industrial labour productivity indicate 15 percent growth in the period 1900-1938. However, a detailed examination of these data show that most measured growth in large-scale organized industry can be attributed to the enormous gains made by Tata Iron and Steel (TISCO) after a firm wide 1928 strike. This paper looks for an economy wide explanation of the generally stagnant labour productivity in India by examining India's four largest industries: cotton and jute textiles, TISCO and coal mining. I look for evidence of labour bargaining power, poor nutrition, low taste for effort, and managerial failure. There is evidence that labour had some control over wages in all four industries, and some control over employment in cotton and jute. The ability of TISCO's management to exert control over labour outcomes lends support to hypotheses of managerial failure in other industries.

Sivasubramonian's (2000) data on the productivity of Indian industrial labor indicate only an 11 to 15 percent improvement over the period 1900-1938 (depending on how calculated). And a detailed examination of these data show that most of even this small measured productivity growth in organized industry can be attributed to the enormous gains made by Tata Iron and Steel Company (TISCO) after a firm wide 1928 strike. The post-strike productivity gains made by TISCO stand in marked contrast to the failure to improve labor productivity in the cotton textile or jute textile industries after similar strikes. Since- with the notable exception of TISCO- virtually all organized industries in India experienced stagnant labor productivity from 1900 to Independence, there may be an economy wide explanation.

Indian industry had a very promising beginning. The first modern manufacturing mills were erected in India in the 1850s. By the 1870s, there were profitable cotton textile mills in

Bombay City and profitable jute textile mills in Calcutta. In the years before the First World War the Indian cotton industry had a significant share of the yarn market of China, and the Indian jute industry came to dominate world markets (Morris (1982)). Bengal Iron and Steel was producing pig iron at competitive prices by the turn of the twentieth century, and exporting to, among other countries, Japan (Yonekura (1994), p. 69).

The situation was less promising by the late 1930s. The Indian cotton industry was slowly expanding, but behind significant trade barriers. Exports were insignificant.   India remained dominant in jute textiles, but the industry was in long term decline due to changing international transportation technologies. India had developed a steel industry under the guidance of Rattan Tata, though his remained the only large scale steel producing firm in the country until the very late 1930s. And while TISCO was profitable throughout the period, it relied heavily on trade protection from the late 1920s (Spiegelman (1960)).

Japan provides an illuminating comparison. Japan was India's early 20th century rival much as China is India's early 21st century rival. Japan began to industrialize at about the same time as India. In 1900 the Japanese cotton textile industry was just beginning to be profitable. In 1910, costs in India and Japan were almost identical (Clark (1987) p. 150). A steel industry was in its very early stages. The Yawata Works mades its first very modest sales profits in 1910 (Yonekura (1994) p. 54). Thus India began the industrialization process not too far behind Japan. But the Japanese economy grew very quickly once it began to industrialize. The first year Maddison (2003) reports GDP per capita data for India and Japan is 1884. For that year, in 1990 international Geary-Khamis dollars, Japan's GDP per capita is 836 compared to India's 551; thus Japan's value is 152 percent that of India. By 1900 that ratio was already 217, and by 1938 it had risen to 367. The comparative growth in individual industries bears out this

aggregate pattern. By 1938 while Indian cotton and steel industries survived only behind high tariff walls, the Japanese cotton textile industry came to dominate world markets, and Japan's steel mills were exporting a significant share of output.[1]

While there were many aspects of Indian industries' failure to become internationally competitive under the Raj, low labor productivity must surely have played a significant part since wage costs were such a large share of total costs in all large-scale industries of the period. I will focus this chapter on examining productivity issues both because of its importance and more especially because of the pervasiveness of productivity stagnation in Indian industries. The chapter begins with an examination of the available industrial labor data to give an overview of Indian industrial labor markets. I next discuss potential explanations for the observed pattern of limited productivity growth. Then I move to a more in depth examination of India's four largest industries: cotton textiles, jute textiles, coal mining and iron and steel. I examine the record of these industries to determine if there is support for any of the suggested explanations of low and stagnant productivity.

I.   *Overview of the Indian Labour Market.*

Table 1 gives percentage shares for all occupations in British India from 1901 to 1931. Across these years, the labor force grew very slightly from 131.6 million workers to 139.1 million workers (Roy (2005), p. 33). The structure of the workforce did not change much over these years. The vast majority, 70 to 75 percent, were cultivators or agricultural laborers. The most significant occupational change over the period was the decrease in the share of cultivators, and the increase in the share of agricultural laborers. This important topic is outside of the scope

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[1] See Wolcott (1991) for cotton. Japanese steel exports to non-colonies peeked in 1936 at 547,000 tons out of a total production of 4.5 million tons (Yonekura, table 7.1).

of this essay.[2]   Another 15 percent were in service related industries or construction. Manufacturing, broadly defined, was a bit under 10 percent of the workforce. Plantation labor was less than 5 percent, and mining and quarrying a bit less than 2 percent. These data define manufacturing to include both modern industries and traditional artisanal production. The latter was significantly larger. Roy (2005) gives an estimate of 0.6 million, or 0.4 percent of the labor force engaged in modern mill industries in 1901, growing to 1.6 million, or 1.2 percent of the labor force in 1931 (p. 33). As an example of the importance of artisanal employment, Krishnamurty (Table 6.5) reports 2.9 million workers in Cotton Textiles in 1921. The Industrial Census of 1921, however, reports 350,679 workers in cotton weaving firms (table 4). Clearly, the vast majority of Indian workers were in the informal sector.

Despite this, I will concentrate on the formal sector. One reason is that there is so much more known about the formal sector. These industries were subject to at least minimal government oversight so we have basic figures on production and employment. There were frequent *ad hoc* government reports with additional information. Commodities were standardized and so there is fairly abundant price information. A more salient point is that these industries are ones which are typically important in modernization. India may have taken a different path to modernization. Roy (2005) argues that India's concentration on informal sector production was because the country pursued labor intensive industrialization, and he could well be correct. Still, the organized sectors are those which can be most usefully compared across the developed and developing world and thus are important indicators of how effectively a developing country's markets are functioning relative to developed world standards.

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[2] This topic is dealt with in detail in Roy (2005).

Table 2 presents data on output per laborer in each of the major divisions in India from 1900 to 1938. The primary sector was composed of four subsectors: agriculture, livestock, forestry and fishing. The lowest values per laborer as well as the least growth is seen in the primary sector. When we remember that this sector dominated employment, it is obvious that this lack of growth is of first order importance in explaining the persistent poverty of colonial India. The secondary and tertiary sectors, in contrast, show substantial and consistent growth over the four decades. The tertiary sector consists of the government, government commercial services including the railways and communications, other services and house property. Relative to the primary sector, value-added per worker is high and growth in value-added over the period is strong. Broadberry and Gupta (2010) noted the relatively rapid growth in productivity in the colonial period in services- a sector which also grows relatively rapidly in India today- and discuss several potential explanations. Bogart and Chaudhaury (2012) report data illustrating the rapid labor productivity growth in Indian railways prior to the First World War. They argue this was due to the government takeover of the railways. Thus there are many interesting questions to address concerning labor productivity in both the primary and tertiary sector. But again, my focus in this chapter will be on the secondary sector.

The productivity growth over the four decades in the secondary sector is an impressive 61.26 percent. I argue that that number is in one sense misleading. Sivasubramonian breaks down the secondary sector into three subcategories: mining, organized manufacturing and artisan production. Productivity growth in none of the three subcategories is nearly as rapid as in the sector overall. The overall growth in the secondary sector is primarily due to the large shift in employment within the sector away from artisanal production and toward the much higher

value per worker category of manufacturing.[3] Sivasubramonian estimates that average factory

employment 1930-38 was roughly double the average in1900-13, while average artisanal

employment declined 21 percent across those periods. Mining employment is fairly stable over

the four decades, though productivity falls fairly dramatically and consistently in this sector. The

growth in productivity from a compositional shift is as important for the aggregate economy as

growth in productivity from improved methods in any one sector. However, the distinction

between a compositional shift and actual improvement within a given industry is important if one

is trying to see how successful Indian managers were in increasing efficiency.

Sivasubramonium estimates growth in labor productivity over the four decades in

organized manufacturing is a small but respectable 15 percent. That number could be an

overstatement. He constructed his National Income estimates with enormous care over many

years. The Indian industrial source data, however, are limited. There are fairly extensive data on

production as well as employment in some large industries, but virtually no data on the many

smaller industries which in aggregate constituted the bulk of employment in even the "organized

sector".[4] Thus, to construct his estimates of production in organized manufacturing,

Sivasubramonium relies on production and employment data for just eight industries. These are

cotton textiles, jute textiles, sugar, paper, cement, woolen textiles, iron and steel, and matches.

These eight industries when taken together on average constituted 53 percent of factory

employment over the period 1900 to 1938, and a similar percentage when considering any

individual decade within the overall period. Sivasubramonian computes values for Net Value

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[3] Sivsubramonium derived his figures by assuming that workers in the census category "industry" were the sum of organized manufacturing and artisanal workers. For organized workers, he used workers employed in factories as reported in the Statistical Abstract for British India, and he estimated artisanal employment by interpolating the census years values for "industry" and subtracting factory workers.

[4] For the artisanal sector, Sivasubramonian has to rely entirely on wage data to estimate productivity growth as there are no production data available.

Added per worker for these industries aggregated together, and then assumes that the production per worker in the organized industries for which he has less detailed data followed a similar path.

Given the data constraints Sivasubramonian faced, it is not obvious that there was a more credible way to construct a Net Value Added per worker series for organized industry. That said, there is significant room for error in his estimate especially because labour productivity growth was atypical in the eight industries. Table 3 presents a decomposition of the productivity growth in the eight industries for which there are fairly complete data. The table has separate series for cotton textiles, jute textiles, and iron and steel. The other five industries are aggregated.[5] Cotton and jute were by far the largest industries in terms of employment. Iron and steel employment was smaller; still it was not much smaller than the five other industries combined until the 1930s. Sugar industry employment grew significantly in the 1930s when the industry was given tariff protection. The table indicates that the lion's share of measured productivity growth in the eight covered industries can be attributed to Tata Iron and Steel. TISCO began to operate during the First World War. As it was a relatively high value added industry, just its creation exerted some compositional upward pull to the value per worker series for the eight. Much more importantly, however, TISCO managers effected a 287 percent increase in Value Added per worker between the 1920s and 1930s. The table also indicates the aggregate growth in productivity of the seven industries other than Iron and Steel. That growth is 2.6 percent. Thus, most measured growth in output per worker in the eight covered industries is attributed to TISCO. And because Sivasubramonian estimated the productivity growth of the remaining factory industries based on the series for the eight, TISCO is essentially responsible for approximately three-quarters of Sivasubramonian's estimate of the productivity growth estimate of the secondary sector.

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[5] I have also computed productivity measures for each of these industries separately but the decomposition is not revealing as all five industries have a pattern similar to the aggregated measure

II. *Potential Explanations of Low and Stagnant Labour Productivity.*

The previous section established that no Indian industry for which we have detailed production data experienced significant labour productivity growth over the four decades 1900 to 1938 other than TISCO. The next point we should address is why. The academic literature on colonial Indian labour productivity has concentrated almost entirely on the cotton industry. There are actually two issues which are of interest: low initial labor productivity, and labor productivity stagnancy. Clark (1987) in a widely cited article focusing on cotton textile production across many countries circa 1910 pointed out that though wages varied greatly across countries, labor costs were much more tightly distributed as internationally labor productivity and wages were strongly negatively correlated. Clark included both India and Japan in his analysis. He estimates Indian and Japanese labor costs were approximately the same, and both Indian and Japanese laborers were only 25 percent as efficient as British laborers. Clark argues that differences in productivity reflect differences in effort levels across countries, and suggests that these differences might have been due to cultural norms. Clark (1988), Wolcott and Clark (1999) and Wolcott (1994) suggest that labourers' resistance to increased effort also played a role in the stagnation of Indian labour productivity in the years between the two World Wars.

Recently, Gupta (2010) has offered a different explanation for the low productivity in cotton textiles in the early 20th century. She points out that the Indian economy was dominated by agriculture, and argues that the tiny manufacturing sector would have taken the wage as given and adjusted machine manning levels to the going market wage. Thus, the low wage led to low effort, not the reverse as Clark argued.

Yet another possibility is that workers did resist managements' efforts to increase effort levels, but not because of *individual* preferences. Wolcott (1994 and 1997) argues workers were

acting *collectively* to maintain employment levels. In those articles I compared the successful

labor reorganization in the Japanese cotton textile industry in the 1920s to the contemporaneous

failed attempts at labor "rationalization" among the Indian cotton textile mills. These efforts

were most prominent in Bombay City, but there was a significant movement toward

rationalization in Ahmedabad, and similar trials took place in many other individual mills

throughout India. Workers were collectively opposed to rationalization even when it promised

higher wages for some individuals because it would decrease total employment.[6]

Gupta (2010) correctly recognizes that unions were not associated with absolutely lower

productivity in colonial India. If labour had power to affect labour maket conditions, however, it

is possible that they would have used that power to resist improvements in labour productivity

which would be associated with declines in employment in the face of negative demand shocks.

The trade union movement in India greatly expanded across all industries in the 1920s and

1930s. Following the passage of the Indian Trade Disputes Act of 1926, unions registered with

the government. In 1927, 29 unions registered. By 1930 there were 119 registered unions, and

562 by 1938. Membership in registered unions rose from 100,619 in1927 to 399,159 in 1938

(Singh (1967) Appendix A). The effect of formal union on labour market outcomes is an

important unresolved issue for the colonial Indian economy.

There is a substantial literature suggesting mill workers were able to exert some control

over their wages and effort levels in cotton textiles even without formal unions. Newman (1981)

and (1979) was probably the first to make these claims. In cotton textiles, as indeed in many

industries in India, labor recruitment was entirely in the hands of native foremen. Jobbers, as

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[6] Wolcott and Clark (1999) also analyze these failed attempts, but do not determine conclusively the root cause of
the failure.

they were called in cotton textiles, relied on village and caste ties to secure workers. The links through the jobbers caused each mill to effectively be a separate labour market, facilitating and enforcing cohesion among the work force of each mill. As early as 1892 J. N. Tata suggested expanding recruitment beyond the Bombay Presidency to dilute this cohesion. "A judicious admixture of Bombay men with men from the Upper Provinces would have a most wholesome effect," (Tata quoted in Morris (1965), p. 54). Chandavarkar (1998) and (1994) argues that what began with caste and village ties and work gang links then expanded to co-workers and other tenement neighbors as workers acquired an increased sense of class consciousness. These ties were important in finding a job, sustaining workers before permanent employment, and providing for the worker in any downturn or sickness.

Jute textile workers also exhibited a high degree of cooperation. Basu (2004) ascribes this cooperation to "class consciousness". Chakrabarty (1989) argues that the mill workers did not develop a modern sense of "class". Instead, workers brought their familiar feudal relationships of patronage from the villages to the mills. Habitual patterns of power in the village were thus extended to patterns of power in industry. Just as in cotton textiles, jute workers were recruited by native foremen, though in jute these were called *sardars*. The ties between workers and recruiters were an example of these hierarchical relationships. Another example cited by Chakrabarty is that the jute mill workers sought out and then coalesced behind middle class organizers to formally head their unions. I find Chakrabarty's argument compelling, but I do not think it is inconsistent with cohesive action by the workers. The economic implications of labour force cohesion are very similar whether that cohesion is based on class consciousness as postulated by Chandavarkar and Basu, semi-feudal habits of collective action, as argued by Chakrabarty, or formal unions as argued by Gupta. Chakrabarty himself notes that

while formal labor unions were very limited in jute textiles, there were several very well disciplined strikes (p. 116), and Goswami (1987) claims the jute *sardars* were instrumental in organizing the workers because of the very links Chakrabarty noted. Roy (2008) points out that similar relationships between recruiters and workers were ubiquitous in Indian industry.

The final reason given in the academic literature for low and stagnant labour productivity in colonial India is that Indian labour was physically incapable of greater productivity. One argument is that low wages caused such poor health and nutrition that greater physical exertion was impossible. Another is that the work conditions were such as to make productivity improvements impossible. The first point, the link between nutrition and productivity, and the potential for a "poverty nutrition trap", is a common theme in development economics today.[7] Wages so low as to restrict productivity advance are unlikely to have been a problem among industrial workers in late colonial India. Conditions were not good. British labour representatives as well as Indian observers were appalled at the conditions under which Indian labourers worked (Johnston and Sime (1926) and Kucznski (1965)). Nonetheless, Sivasubramonian estimates that the ratio of urban skilled to unskilled wages averaged two in the period 1900-1930, and rose to 2.5 in the 1930s (table 4.40). Most industrial workers would be classed as skilled urban workers. While these statistics do not speak to whether or not the unskilled workers were caught in a poverty nutrition trap, it is unlikely that workers earning double the wage of the unskilled could have been in a poverty nutrition trap.

The second strand of the argument that Indian conditions precluded productivity advances- the argument that harsh work conditions made productivity improvements difficult to

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[7] Acemoglu and Johnson (2007) reviews some important papers in this literature, and presents an empirical test of the relationship between life expectancy and economic growth. They find no relationship. Other work does find a relationship between "weight for height" measures and labor productivity among agricultural workers, including several studies focusing on India, for example Jha, Gaiha and Sharma (2009) and Deolalikar (1988).

achieve- would seem to have a stronger evidentiary basis. There are two well known cases where this argument might hold. Chadavarker (1994) analyzes the same Bombay cotton textile rationalization attempts of the 1920s and 1930s I mentioned earlier. In his judgment, however, workers resisted rationalization not to maintain employment or due to a preference for low effort levels, but rather because management tried to increase labour productivity without making the requisite investments in capital and organizational structures to facilitate productivity advances. Another example is the coal industry. Seth (1941) and Mukhopadhyay (2005) both claim that mine owners contributed to low productivity through the unhealthy conditions at the mines, and also from failure to provide sufficient tubs to miners. The lack of tubs meant that a great deal of time was wasted between cutting the coal and bringing it to the surface. Note that unhealthy conditions are a different problem than wages so low that workers are in a "poverty nutrition trap" because wages can be high enough to buy sufficient food and yet the environment could still be so unhealthy as to lower productivity.

This discussion has suggested four potential causes of low and stagnant labour productivity in colonial India 1900 to 1938. One is that the dominance of agriculture in the Indian economy and the low level of productivity in agriculture kept wages, and therefore effort levels, low in manufacturing. Another possibility is that there was a culture of low effort levels among individual Indian workers. A third possibility is that there was a widespread pattern of incompetence among entrepreneurs in India. The fourth possibility is that labour was able to collectively resist managements' efforts to improve labour productivity.

How could we distinguish among these causes empirically? We can measure the extent to which the agricultural wage determined the manufacturing wage by examining the time path of both. If the agricultural wage determined the manufacturing wage, the wage ratio will be

constant, and independent of manufacturing product market conditions. The other potential causes have less clear cut empirical implications. It is impossible to "observe" a low taste for effort or managerial incompetence. Incompetence is assumed to have been important if there is no other obvious cause of inefficiencies. Clark (1987) could credibly claim to have identified each country's taste for effort by having a narrow focus on just one industry at one point in time: cotton textiles around 1910. The strength of his argument rests on the homogeneity of the international stock of cotton textile machinery, all of which at that time was manufactured by just a few US and British firms, and the low and clearly defined labour skill requirements in cotton textiles. These factors allowed Clark to place limits on the extent of costs associated with institutional failures, such as credit constraints and managerial incompetence. It was an extremely clever test of the relative importance of inefficient labour in slow development. Unfortunately, it is not obvious how this test could be extended to other industries and times. We can, however, empirically distinguish between causes dependent on labour bargaining power and causes based purely on either taste for effort or managerial incompetence as, in their pure form, both of these hypotheses assume a competitive labour market.

Theoretical and empirical studies of more modern labour organizations suggest where to look for evidence of the existence of labour bargaining power in colonial Indian industries. Theoretically, if labour collectively exerts bargaining power, workers should bargain over both wages and employment levels. Empirically, modern formal unions bargain over both wages and work rules; the latter constrain but do not absolutely determine management's employment choices (Farber (1986)). The bargaining problem with respect to the wage is to set the wage as high as possible so that the firm is still making a profit. Thus, the larger the industry's profit, the larger the wage should be, *ceteris paribus*, and similarly if profits fall the wage should fall. Thus

Salinger (1984) claims that the reason there was so little evidence of monopoly rents in post-war US product markets is that unions were successful in capturing most industry rents.

Begin by considering the Indian industrial wage. In competitive labour markets the wage is determined by workers' opportunity costs and by the hedonic characteristics of the job itself. Assuming job characteristics remain constant or at least are orthogonal to product market conditions, the industry wage will be independent of product market conditions.[8] But if the industry wage is the result of bargaining between firms and labour, the wage will be affected by the extent of rents in the industry. For this reason the wide fluctuations in demand Indian industry experienced 1900-1938 will assist an inquiry into labour bargaining power. Strong evidence of the power of workers to appropriate rent is significant declines in relative wages when an exogenous event causes product market rents to decline. Thus Rose (1987) argues that truckers unions had been able to expropriate the largest share of transportation firms' profits during the regulated era, and so suffered more than owners of capital when the industry was deregulated. Similarly, Hirsch and McPherson (2000) argue that unionized airline employees bore the brunt of the decline in rents when airline were deregulated. There are less clear predictions concerning the path of employment levels, but if employment drops sharply during downturns, or fails to rise in upturns, that is suggestive of limited labour bargaining power.

A difficulty, however, with examining any of these issues on an All-India level is that there was no one agricultural wage, nor one manufacturing wage or employment level or demand state. To carry out the empirical analysis, I move away from the economy overall, and look more carefully just at India's four largest industries. I also consider tea plantations incidentally.

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[8] One can imagine that job conditions would be affected by product market conditions. But it seems likely that if product market conditions deteriorate, job conditions would also deteriorate. Thus, to the extent that wages reflect hedonic characteristics, wages should move inversely with product market conditions.

III. The cotton, jute, coal and iron and steel industries.

Colonial India's four largest industries were cotton textiles, jute textiles, iron and steel and coal mining. Table 4 presents some summary statistics on these industries drawn from the Industrial Census of 1921. Collieries dominated mining and quarrying in terms of employment, which is why I have included coal mining in the analysis. Tea plantations used family groups, and thus there is almost a one-to-one ratio of male to female workers. Coal mining had some family labor, but was predominantly male. Females were even less common in cotton, jute or iron and steel mills. Iron and steel, cotton and jute mills had a relatively high proportion of skilled workers, much higher for example than coal mining or the all India average. There were virtually no skilled workers on the tea plantations. The ratio of supervisors to workers is somewhat similar across all of the industries. The ratio of European and Anglo-Indian supervisors is noticeably higher in tea and jute.

Though I chose these four industries because they are India's largest organized industries, serendipitously, they are also useful for comparative purposes as they had very different management compositions, locations, and faced different product market conditions. The cotton textile industry was largely, though not entirely, owned by Indian entrepreneurs. There were cotton mills in all parts of India, but the main concentration was in the Bombay Presidency in Western India. The jute textile industry had been the preserve of European entrepreneurs until after the first World War; there was significant entry of Indian entrepreneurs at that time, though they remained in the minority. The jute industry was completely contained within a 40 mile strip along the Hooghly River, centered around Calcutta in Eastern India. Though there were collieries in many parts of India, by far the largest mines were in Bihar, also in Eastern India. Colliery entrepreneurs were a mix of Europeans and Indians. The larger mines

tended to be European owned and managed, but Tata owned a large colliery. The only steel industry in India until the late 1930s was TISCO. But there were other iron mills. Due to lack of data, I will focus my attention only on TISCO.[9]

The most interesting years in terms of labor issues are 1920 to 1938. TISCO did not begin producing steel until the war. Jute, cotton and coal mining all experienced steady growth in production and employment between 1900 and 1913. Over the period 1914 to 1938, however, all of these industries were subject to wild fluctuations in demand occasioned by the first world war, the slump in world trade in 1930 and finally the industrial buildup preceding the second world war. But the impact of these events differed across industries. Cotton textiles was an import substitution industry. At the turn of the 20th century, Indian factories primarily produced yarn for export and domestic consumption. Britain was the main supplier of cloth to India, and the Japanese industry barely existed. Gradually Indian production of cloth grew. The cotton weaving industry received a major stimulus during the first world war due to the limited ability to ship goods across the oceans. However, the Japanese industry received a similar stimulus. The 1920s saw booms and busts, and a movement of the industry out of Bombay city. From 1925, the industry received trade protection in the form of tariffs. In the early 1930s, the tariffs were increased. At that point, Japan had become the main competitor in the Indian low quality cotton cloth market while England remained a competitor in higher quality cloth. Tariffs were found to give insufficient protection, and restrictive quotas were placed on Japanese cloth to protect the markets for both Indian manufacturers and England. The protection caused a rise in the real price of cotton cloth in India which allowed the Indian industry to grow throughout the

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[9] Morris (1982) summarizes the literature on Indian factory industries existent at the time of his article. This article reviews most of the recent literature on cotton and jute textile labour. There is a separate literature on the cartel among jute entrepreneurs. Important works here include Gupta (2005), Stewart (1998) and Goswamy (1991). The most complete analysis on coal remains Seth (1941). There is an extensive literature on TISCO. Recent works on labor include Datta (1986) ,Bahl (1995) and Simeon (1993a and 1993b).

1930s, albeit slowly. Bombay City lost employment slightly as the industry shifted to the "up-country".[10] Trade protection was not an option for any of the other three industries. Jute manufacture was almost entirely dependent on export demand. Moreover, jute bags and cloth were used to package goods for transport. India was the sole world supplier of raw jute and the chief supplier of manufactured jute. Thus the industry rose and fell with the extent of international trade. Demand for manufactured jute was completely outside of the government's control, and it was especially vulnerable to the slump in world trade in the 1930s. Negative shocks to demand, however, were somewhat mitigated because there was a reasonably well functioning cartel of jute manufacturers. Collieries exported a relatively small share, about 10 percent, of their product. Most coal mined in India was consumed in India. Demand was not strong in the interwar period because of the slow industrialization of the Indian economy.

Product price and output time paths reflect the differential demand conditions these industries faced over these decades. Figure 1 plots the movement of prices in cotton manufacturing, jute manufacturing and coal mining 1900-1938, and TISCO steel prices 1920 to 1938. All prices rise in the early 1920s, but then declined by differing degrees. The fall in the nominal price of jute bags was so severe that by the end of the period the nominal price of jute was significantly lower than the pre-war average. Bombay cotton cloth, on the other hand, ended the period with a nominal price significantly above the prewar average. This reflects the trade protection given to domestic cotton textiles.

Figure 2 displays production indices for the four industries. Jute production climbs strongly to 1914, and then was roughly stable until it plunged in 1930. In cotton, there were

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[10] I give the outlines of these events in Wolcott (1991), but there is a much more thorough discussion of Indian trade policy and the cotton textile mill industry in Chatterji (1992).

fairly steady production increases over the entire period. TISCO output increased by approximately a factor of ten. Coal output rises to 1920, and then is variable around a stable mean, experiencing a sharp rise only in 1938.

These industries' labourers contrast in interesting ways in regard to their attachment to industry. Most contemporary observers believed that the main purpose of factory labor was to add to the families' land holdings in the village.[11] Many of these same observers blamed the workers attachment to their villages for the lack of discipline and low effort levels workers seemed to exhibit in industrial occupations. The strong version of the non-attachment argument is that workers were agriculturist first and factory workers second. Morris (1965) argues that this strong view is almost certainly wrong. Colonial India was an agricultural economy, and so it is not surprising that the bulk of Indian workers came from agricultural villages. In the case of Bombay, the workers were predominantly from the Konkan and Deccan plateau in the southern part of the Presidency, within two hundred miles of Bombay City. The jute mill workers were also from agricultural villages, in their case from villages in Bihar, Orissa and the United Provinces, 300-500 miles east of Calcutta. There is only limited evidence, however, that millhands in either cotton or jute came from families with landholdings (Morris (1965) p. 85-86 for cotton, Das Gupta (1976) p. 312-317 for jute). Further, in cotton where there is monthly data on absenteeism and production, there is no evidence that either was affected by the agricultural calendar. And what evidence is available suggests that while the majority of millhands did go for extended stays to their native place, these visits were not typically an annual occurrence. Even Myers (1958) who was quite critical of Indian labourers long absences from industrial work, suggested that Indian workers "are partially committed to factory jobs in that they regard

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[11] For an example, see Myers (1958), pp. 43-48, or Gilchrist (1924).

them as more or less permanent jobs which can be interrupted (but not lost) by periodic visits to the village" (p. 45). While the strong version of the "agriculturist first" argument is too strong for cotton and jute, the evidence suggests that the millhands did maintain their village ties. In fact, while established workers in cotton textiles, at least in Bombay, were likely to have brought their wives to the city, even though employment for these women was limited (Mazumdar (1973)), jute workers wives were typically left in the village where they continued to be engaged in agricultural work (Sen 1999). And there is at least anecdotal evidence that both cotton and jute workers did retire to their native villages, and were replaced in the mills by their own sons and nephews. This "circular migration" created mutigenerational links between rural villages and urban mills (Patel (1963) for cotton and De Haan (1997) for jute). As late as the great Bombay cotton textile strike of 1982, workers were using their still strong village ties to sustain them when they were unemployed (Van Wersch (1992)).

There is an intriguing contradiction between Census results on birth place and a survey conducted by the Bombay Millowners Association which bears on worker attachment to their rural villages even after generations in urban industry. The Census of 1931 indicates approximately 40 percent of the workers came from the Konkan or Deccan. By 1931 the share born in Bombay- which rose every decade- had reached 26.33 percent. The Bombay Millowners Association conducted a survey of 35,577 millhands in 1940, a large share of the total. In the survey more than 70 percent of the workers listed either the Konkan or Deccan as their "native place". A tiny fraction, 3.47, listed Bombay as their "native place". The discrepancy between the Census data of 1931 and the BMOA survey of 1940 could be because the Census asked where an individual was born, and the survey asked what was the individual's native place

(Morris (1965), App. IV).   It would not be culturally surprising if individuals born in Bombay would still list their ancestral village as their "native place".

The attachment to native place is important for understanding cotton and jute workers ability to cooperate in industrial actions. Roy (2002) claims that "response to risk" is the link between historical and current economic analyses of India. India was and is a poor country dependent on a variable monsoon. Risk is the dominant factor shaping economic life. Village culture mitigated risks through patterns of cooperation and established methods of punishing deviation from social norms. The strong village links of industrial workers facilitated cooperation first as workers were culturally inclined to cooperate, and second, they had a template to punish deviants (Wolcott (2009) for cotton, Datta (1993) for Calcutta region strikes).

Unlike jute and cotton, the "agriculturist first" depiction of labour in the mining industry was accurate. The poorest coal miners were landless. At some mines workers were given land nearby to supplement their mining wages and to tie them to firms (Simmons (1976). This was not generally true, however. The largest coal field by far was the Jherria coal field. It produced almost 70 percent of India's coal. There, only 25 percent of workers were permanently settled. The rest were migrants.   The settled workers wives and daughters worked alongside the males. The transient workers wives remained in the village (Seth (1941)).   While managers may have complained of absenteeism in the cotton mills, absenteeism was a well documented phenomenon in coal. Monthly coal production varied inversely with the need for labour in agriculture. Coal production peaked in February, was fairly strong until April, but then fell off sharply during the harvesting and sowing period. In Jherria, between 1929 and 1936 the average fall between February and May was 15 percent. And labour supply varied year-to-year based on the quality of the harvest. "The better the harvest the smaller the labour supply and vice versa. In other

words, the adversity of agriculture is the opportunity of mining, as the coal-fields get sufficient labourers in the case of crop failure," (Seth, p. 34).[12]

Workers attachment to their home village and agriculture was not reported to be a problem at TISCO. Tata was careful in recruitment for TISCO. He had a deliberate strategy of recruiting from a wide area "to make the threat of combination and dear wages less likely … and to prevent large strikes," (Wacha quoted in Simeon (1993a), p. 138). And he established a labour bureau in 1923 at TISCO. Two cards were kept for each employee: one listing among other things any punishments the employee had incurred; the second listed the employee's dependents, if any. For many years, TISCO was able to get almost all necessary recruits from the "dependent card" of workers with good records (Datta (1986), p. 88).

The last point to establish concerning these industries is what constituted the workers' opportunity wage. It has long been claimed that the opportunity wage for Bombay cotton textiles was the Konkan field labour wage (Mazumdar (1973)). I will argue that Assam tea plantation wages are a reasonable opportunity wage for jute textile, coal and TISCO workers. The Assam tea plantations relied entirely on labour recruited elsewhere, primarily from the North Western Provinces, Oudh, Bihar and Bengal. The most important recruiting districts in Bihar were Ranchi and other districts on the Chota Nagpur plateau as well as the Santal Parganas. In Orissa, Sambalpur and Koraput were important, and in Oud, Bilaspur dominated (Tea Districts Labour Assoc. Annual Report, various years). Though the jute industry initially employed residents of

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[12] The Royal Commission on Labour claimed that even when at the mines, miners would not necessarily work. "The mines do not work on Sunday. On Monday very few miners put in an appearance, many are still absent on Tuesday and it is not till Wednesday that a good attendance is secured." According to data Seth collected at the mines himself, the median days worked by each miner per week was 5, while the average was 4.3. But Seth argues this was partly the mine owners choice, and partly due to the weak condition of the workers (Seth, pp. 74-77).

districts nearby Calcutta, the bulk of jute workers were migrants by the 20th century. Coal

mining relied on a mix of resident and migrant labour. The districts supplying the bulk of tea

labour were also among the districts listed by Das Gupta (1976, p. 291) as supplying the bulk of

migrants to Calcutta and by Seth (1941, p. 32) as supplying the bulk of coal workers. And the

coal mines were located in the districts of Bihar from which tea and jute were drawing labour.

Consequently the "resident" coal mining labour was from the same districts as the migrant jute

and tea labour. Similarly, TISCO was located in Jamshedpur on the eastern edge of the Chota

Nagpur plateau. According to the 1921 Census 85 percent of the unskilled workers- 14,584 of

23,823 workers- were from the surrounding districts. Even approximately 50 percent of the

skilled workers were from these districts. The remaining skilled labour came from all over India

(Das Gupta (1976), pp. 307-08).

There were caste divisions across these labour streams. The tea plantations largely drew

from tribal groups. Kar (1984) lists the following groups which were recruited to the plantations:

> The Munda and Gond from Bihar; Santal, Tanti, and Bhumij from Bengal and
> Bihar; Oraon from Bihar and Orissa; Savara from Bengal, Bihar and Orissa;
> Goalo from Bengal, Bihar, Orissa, and Madhya Pradesh; Lohar from Bihar,
> Orissa, Madhya Pradesh, and Uttar Pradesh; Khond from Andhra Pradesh; and
> Boya from Tamil Nadu (p. 14).[13]

The Tanti were a weaver caste, the Lohar a blacksmith caste and the Goala were herders. But all

other groups listed were tribals. (Das Gupta (1981)) claims that mining also depended largely on

tribals, while the jute textile industry had no tribals. The 1911 Census gives a detailed list of the

castes distribution in the jute labour force (Das Gupta (1976) App. B). Tribals did constitute a

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[13] Kar (1984) gives the castes of actual families at two Assam plantations in 1981. Tribals dominated, but there
were many other castes represented, suggesting any family in distress might seek plantation work.

very small percentage. Goala were 2.42 percent; the Bhuiya and Barui, at .22 and .19 percent, were even less well represented. There were no other tribal groups listed. But tribal groups did not dominate the coalfields. Seth (1941) drawing on the 1921 Census notes that "aboriginals", including Santals, Bhuiya, Munda, Bauri, Turi, Kora and Rajwar, constituted only 15 percent of the coal workforce in Bihar and Orissa. The remainder was drawn from a wide group of castes. Among the largest groups were the Chamar, Munchi, Goala and Jolaha, all groups which were also well represented in jute textiles. At TISCO the aboriginal groups of the Hos, Santals and Bhumijes were well represented among the unskilled labourers (Das Gupta (1976), p. 307).

The extent of similar castes across the major East Indian industries is important because it bears on the degree to which the labour streams overlapped. For jute, Das Gupta (1976) writes that the wide range of castes represented suggests, "it would not be wrong to argue that migration to jute mill centres- be it from nearby places in Bengal or from distant Eastern U.P. or western Bihar or Orissa- represented a sample of the rural population in the emigrating areas" (p. 314). This seems very reasonable to me. I would argue further that something similar could be said about the sources of labour for coal mining and TISCO.

The outlier is the sources of labour to the tea plantations. These workers were overwhelmingly drawn from the lowest socioeconomic strata of the sending areas population. Das Gupta (1986, p. PE-3) argues that the workers coming to work in the coal fields and jute and steel factories were migrants, while many of those going to the tea plantations were immigrants, with no intention of returning. Foley, a government official who conducted a study of labour in Bengal in 1905 reported the following theory:

> I was informed by one gentleman that the cooly who emigrated to Assam was a
> perfectly different person from the cooly who went to the coal mines. The one as

a rule had no property and generally wished to escape from his past, whereas the other generally had property and land which he wished to supplement by his earnings (quoted in Simmons (1976), p. 472).

At the time of the 1930 Royal Commission on Labour 600,000 ex-tea garden labourers had settled on government land in Assam (Das Gupta (1986), p. PE7). That is large given that the size of the workforce of Assam according to the 1921 Industrial Census was 516,000.

To summarize, there was a pool of loosely attached labour in a relatively small section of Bihar, Orissa and the United Provinces. This area supplied all of the important East Indian industries- tea plantations, coal mining, jute and steel. The evidence suggests that the group with the lowest opportunities in their native places migrated to the tea plantations. Thus, the tea plantation wage gives us a natural "opportunity wage" for all other East Indian industries.[14]

IV. Examining Time Series Patterns.

In this section I try to identify the cause of the stagnant labour productivity in Indian industry from 1900-1938 by examining patterns in the time series data for individual industries. First I want to examine the linkage between the agricultural wage and the industrial wage. Figure 3 plots the nominal value of wages for each of the four industries I am examining. Most cover 1900-38; the TISCO wage data begin in 1912. There is a great deal of similarity in the industrial wages before the First World War. The patterns after the war vary. Bombay cotton wages rose significantly immediately after the war and remained high throughout the period. TISCO wages start much higher than the other industries, but then have similar levels to the Bombay cotton industry until TISCO's wage levels rise even higher in the late 1930s. Jute and

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[14] Das Gupta (1981) argues that the wage in jute textiles would be unaffected by the plantation wage while the mining wage would be closely tied. But that is due to his incorrect assumption that coal mining relied primarily upon a tribal workforce, and also the assumption that tribal labour is not substitutable with other labour.

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Jherria miners' wages never rose very high in the 1920s and began falling almost immediately. The jute wage remained above the prewar level, but Jherria miners' wages fell to about two-thirds of the prewar level in the 1930s.

Figure 4 plots the nominal value of wages for Assam male tea plantation workers and Konkan field labourers from 1900 to 1938. These are the only two long series of agricultural wages than I am aware of. Tea was primarily exported, while the agricultural output of the Konkan- food products and cotton- was consumed domestically. Thus it is not surprising that tea garden wages fell during the war. But in the first decade of the period as well as the last the nominal values of these two agricultural wage series from opposite sides of the Indian subcontinent were remarkably similar both in level and trend.

Finally Figure 5 plots manufacturing wages relative to agricultural wages. As I only have complete series for Bombay cotton and Calcutta jute textiles, I plot the ratio of these industries' wages relative to the appropriate agricultural wages. The cotton series is the ratio of money wages in the City of Bombay cotton textile mills relative to the agricultural money wage in the Konkan. The jute series is the ratio of money wages in jute mills relative to the money wage in tea gardens in Assam. Both ratios are fairly steady before the First World War. In Calcutta the mill wage was about two and a half times as great as the competing agricultural wage, and in Bombay the ratio was a bit lower at about twice the agricultural wage. The Bombay cotton ratio rises a bit in the 1920s relative to its prewar levels, and then rises significantly in the 1930s. Throughout the 1930s the ratio suggests Bombay cotton mill wages were three times the agricultural wage. In contrast, the Calcutta jute mills ratio falls steadily through the 1920s until it almost reaches one, and then gradually rises again. At the end of the period, the ratio is still significantly below its prewar level. Thus there was significant

movement in the mill wage relative to the agricultural wage. Such movement is inconsistent with the hypothesis that the manufacturing wage is determined solely by the agricultural wage and was unaffected by market conditions in individual manufacturing industries.

Next I look for evidence of labour bargaining power. As discussed earlier, organized labour should bargain over employment and wages. Thus I compare the time paths of employment and productivity as well as total production. To determine if labour had bargaining power over wages I want to compare the time path of the ratio of individual industry wages and the opportunity wage, to the time path of individual industry profit measures. Profit measures for some firms in these industries exist. But there is a better measure at hand. In the late 19th and early 20th centuries in the West, the dominant structure of unionized wage bargaining was to connect the workers wage to a measure of the output good price. This was especially common in iron and steel and coal. The agreements usually adjusted the product price for materials costs and adjusted the wage demand for outside options (Hanes (2010), p. 53). In cotton textiles in England, wages were set depending on the margin between the price of cloth and the price of cotton (Turner (1962)). Thus, in these industries which were known to have strong unions, the wage rose and fell with the margin between the output and the input price. The Indian data on product and input price will have minimal measurement error relative to the more incomplete profit data. I have constructed a measure of the relative movements of the prices of cotton cloth vs. raw cotton, gunny bags vs. raw jute, steel vs. iron bars, and coal vs. a market basket of wholesale goods. I will use these "margin" measures to proxy for the relative profitability of the industry in a particular year. To measure the wage premium in cotton textiles, I use Konkan field labor as the reservation wage. For jute, TISCO and coal, I assume that tea plantation wages are the reservation wage.

Figures 6 through 9 illustrate the patterns of labor productivity and employment in the top panel, and movement in the wage premium and the product margin in the bottom panel. First consider the top panels. Labor productivity falls in both textile industries after the First World War. In cotton textiles, the fall in productivity in the 1920s is slight, and average labor productivity in the 1930s is similar to that in the first decade of the 20th century. In jute mills, on the other hand, the fall in labour productivity in the 1920s is more significant and while labor productivity increases in the 1930s relative to the 1920s, it remains below the average level of the first decade of the century. Employment growth over the entire period is substantial in both industries. However, in the 1930s, average jute employment is about 14 percent *lower* than that of the 1920s, while cotton employment *grows* about 14 percent between the 1920s and the 1930s. (It is worth noting that Japanese labor productivity in cotton textiles increased more than 50 percent across the interwar period, while employment remained flat after the late 1920s (Wolcott (1994), p. 312).) Both coal employment and productivity grow until the First World War, and then stagnate before falling sharply in the early 1920s. Productivity then resumes an upward trend. Employment falls over most of the post war period of rising productivity. Ther relationship between labour productivity and employment at TISCO is similar. Employment peaks in 1925, and then collapses while productivity advances rapidly until 1932. Employment then resumes an upward trend, though one less steep than that of labour productivity.

Next consider the relative movement of the manufacturers' product margin and the workers wage premium for the four industries illustrated in the bottom panels of figures 6 through 9. If Indian workers and management were bargaining similarly to contemporaneous Western unions, we would expect the wage premium to rise with the product margin. If there was no bargaining, the premium would be unrelated to the margin. No industry fits neatly into

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either predicted scenario. The cotton industry has a positive relationship until the 1930s. But after 1931 the wage premium rises while the product margin falls. The TISCO wage premium also goes up in the 1930s while the TISCO product premium remains fairly stable. There is an important difference in the employment trends for cotton and TISCO. These cotton wages are for Bombay. In the 1920s, Bombay constituted a bit less than 1/2 and in the 1930s about 1/3 of total cotton textile employment (Morris (1965), Appendix 1). Employment in Bombay for most of the 1930s was below its 1925 peak. Bombay cotton textile wages remained high in an absolute and relative sense even though Bombay was a declining center. We have limited wage data for TISCO; there are data only for 1932, 1933, 1936 and 1937. Due to the data breaks, it is not certain, but it appears that employment dropped very sharply between 1925 and 1932 while nominal wages continued to rise at least until 1929, and then from 1933 on wages and employment both rose approximately 25 percent. The coal wage premium collapses after the First World War along with the deflated coal price. That pattern is consistent with the prediction of labour power. In most years, however, the coal wage premium appears most affected by the rate of change in employment. The premium is almost two in the years of rapidly rising employment preceding the war, but then sinks throughout the period of falling employment, and finally picks up again with employment in the late 1930s. The jute series behave in an especially odd manner. The wage premium moves down in the late 1920s and early 1930s when there is some upward movement of the product margin, and the wage premium moves up in the latter part of the 1930s when the product margin falls down. That pattern is consistent with neither the predictions of labour bargaining power nor with predictions of its absence.

The odd behavior of the jute product margin and jute wage premium is worth exploring. The jute product margin itself moves in a very tight range for most years between 1 and 1.5

despite several large swings in the product price and the precipitous drop in production in 1930.

In most industries, the entrepreneur takes the input and output price as given by world prices.

But Calcutta jute textile manufacturers were the dominant international manufacturers of jute

textiles as well as the dominant purchasers of raw jute, and Indian jute cultivators, largely in

Bengal, were the sole international producers of raw jute. In this period, mill consumption

averaged 57 percent of cultivators' total production of raw jute; exports averaged 40 percent

(Ahmed (1966) p. 65). And raw jute loomed large among cultivators output. The ratio of the

value of raw jute to the value of total marketable agricultural production in Bengal ranged from

25 percent to 85 percent (Ahmed (1966) p. 56). If jute textile manufacturers could adjust

production more readily in the face of negative demand shocks than could jute cultivators, a high

manufacturing margin would perversely occur in times of relative depression in the jute

manufacturing industry. To see this, suppose there is a negative shock to world demand for

gunny sacks. The cartel of jute manufacturers responds by lowering production and shifting in

supply. Decreased production mitigates the fall in product price, but exaggerates the fall in

quantity produced. Jute cultivators were small independent farmers. They could not act

collectively and adjust production in the face of a fall in demand for raw jute. The price of raw

jute would fall more than proportionally to the fall in the price of gunny sacks. One piece of

evidence in favor of this hypothesis is that the period of especially low jute manufacturing

margins, 1921 to 1923, was actually a time of great optimism among jute manufacturers

(Ahmed, p. 47). And the period when the jute manufacturers' margin is highest is in the early

1930s, a period when we know from anecdotal reports as well s the sharp drop in output that the

industry was in dire trouble. I can test this hypothesis in aother way. Ahmed writes that a

Bengali cultivator balanced the profitability of growing jute against that of growing rice. A high

ratio of the raw jute to rice price implies strong demand for raw jute, and vice versa. If a high

manufacturing margin in jute perversely indicates a state of low demand for manufactured jute,

then a high manufacturing margin should be associated with low raw jute demand, or a low ratio

of the price of raw jute to rice. Figure 10 shows a scatter plot of the jute manufacturers' product

margin (gunny bag price relative to the raw jute price) against the jute cultivators' margin (the

price of raw jute relative to the price of rice). There is an obvious negative relationship. A

simple regression of the manufacturers' margin on the cultivators' margin yields a coefficient of

-0.32 with a p-value of 0.015. I conclude that for jute, the product margin is high when demand

for manufactured jute is low, and the product margin is low when the demand for manufactured

jute is high.

Simultaneously considering trends in employment and the relationship between the

product margin and the wage premium, I would argue that there are clear indications of labour

bargaining power in jute and cotton. That the jute wage premium falls significantly during

unprofitable periods is evidence that labour had been able to appropriate at least some of the

product market rents during the previous profitable periods just as had the truckers studied by

Rose (1987) or the airline workers studied by Hirsch and McPherson (2000). This finding is

complimented by the ability of jute workers to increase employment in mild downturns such as

during the First World War, and mitigate employment declines in deep downturns such as the

1930s, when employment dropped 13 percent as production dropped 20 percent. Bombay cotton

workers appear to have been able to appropriate rents not only in profitable periods as indicated

by the wage premium rising with the product margin in the 1920s, but also hold onto those rents

even during unprofitable periods as suggested by the stability of the cotton textile wage in the

1930s while the profit margin declined. The indicators of labour bargaining power for coal and

TISCO are weaker. In both industries, management is able to achieve employment declines and productivity increases. That suggests limited bargaining power. On the other hand, the wage premium in coal is high before the First World War. The product price is not high then, but employment is growing very rapidly. The relatively high wage premium at TISCO in 1920 also came after a period of strong employment growth. These high premiums could indicate labour bargaining power, though it could also indicate labour demand pushing against relatively inelastic labour supply curves in competitive markets. Some degree of bargaining power seems more likely. First the size of the labour forces in these industries was small relative to the overall labour market. Skills were primarily learned on the job. And in both industries, the wage premium falls with production margins after the First World War, consistent with labour bargaining power. And finally, when employment picks up at the end of the period, the wage premium starts to rise, even though in absolute terms employment was significantly below peak levels. In fact, it is noteworthy that in all four industries wages and employment rise in the 1930s immediately after production trends turned upward. The expansion caused by the Second World War translated into more employment at higher wages instead of more productivity at constant wages.

Another indication of the power of labor is the ability to strike. Table 5 presents data on strikes in India. While it is unlikely that these data cover all strikes, contemporaries believed that these data represented the most important strikes (Mukhtar (1935), p. 80). Strikes are disaggregated for cotton and wool textiles, jute textiles, and mining. The first point to notice is the high percentage of strikes which ended in an outcome indicating a full or partial labor success. These measures compare favorably to strikes in the United States cotton textiles (Wolcott (2009)). This degree of success is consistent both across regions and across industries.

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The workers in cotton textiles showed a singular ability to strike. Days lost to strikes per year per worker in cotton and wool textiles according to these data averaged 10.5. Much of the academic discussion on the jute industry suggests the workers were unable to organize effectively. The average days lost to strikes per year per worker in the jute mill industry was a much lower 3.5. And in coal, where the careful observer Seth claims the workers are almost perfectly quiescent, the average is a still much lower 0.17. But we need to put these numbers into perspective. One can construct a similar measure for British industries (data are from Mitchell (1962), and are reported in Wolcott (2009)). The average days lost to strikes per worker in textiles in the UK between 1921 and 1938 was 1.75. Indian jute workers may have been less strike prone than Indian cotton workers, but they were not quiescent. On the other hand, each UK mining and quarrying workers lost approximately 10 days to strikes on average each year, similar to Indian cotton, but much, much more than Indian mining and quarrying workers. Still, UK metal manufacturing workers lost only 0.7 days to strikes per year, and they would not be described as quiescent. Indian coal miners were effectively a seasonal labor force. For a seasonal labor force, they exhibited remarkable organization.

Though we do not have an official published series of strikes at TISCO, there are many anecdotal accounts of strikes (see for example Datta (1986) and Simeon (1993a and 1993b)). There were three strikes in the 1920s. The first was in 1920. A deputation of workers went to the managers and asked for a wage increase to compensate them for the post war price rise. The strike lasted for 24 days, and demands were partially granted. The second strike also centered around demands for increased wages. It occurred in 1922 and lasted for 33 days, after which the workers returned to work unconditionally. The general strike of 1928 actually began with a series of short department strikes in 1927. Among the demands were a stop to the employment

reductions which had been instituted following reorganizations in 1925. The 1927 strikes were all unsuccessful. Tension built. On 18 April 1928 several departments went on strike and were subsequently locked out by the management. On May 25 a one day *hartal* in support of the locked-out workers was called. Virtually all workers stayed away from the factory. Management responded by calling a general lockout on June 1. The strike officially ended on September 12. The settlement allowed management to continue an across-the-board reorganization which as proposed would decrease the workforce by 25 percent, though subsequent reductions were in some cases even greater. On the positive side, the settlement gave the retained workers a raise and a severance bonus to the retrenched workers. Management established that it had control over employment, but was willing to be generous with wages. Simeon argues, in fact, that management had stoked labour unrest in 1927 and 1928 to precipitate a general strike so that the company could implement a more thorough going reorganization. There were no further strikes at TISCO until the late 1930s. There was much greater productivity growth in TISCO than in any other industrial endeavor in colonial India. This history of strikes at TISCO suggests that the difference was management. Workers were as determined and cohesive as in other industries, but management more successful in achieving its goals.

The comparative aggregate record of Indian and Japanese strikes is also informative. The average annual days lost to strikes in India 1924-1938 was 6,886 while in Japan the average was 561. India had approximately twice as many non-agricultural workers on average in the interwar period as Japan. Adjusting for the relative size of the non-agricultural economically active population, India lost seven times as many days to strike every year as did Japan (Mitchell (2007), tables B1 and B3).

Conclusion.

This essay has investigated reasons for the limited growth of labour productivity in the organized industrial sector in colonial India. Four arguments have been put forward in the literature. One is that the dominance of agriculture in the Indian economy caused the manufacturing wage to be determined by the agricultural wage. Management adjusted staffing levels accordingly. A second is that Indian labour was physically incapable of greater effort due to low nutrition or unhealthy conditions at the workplace. Another hypothesis is that labour was unwilling to exert greater effort either due to preferences or to preserve employment. And the fourth hypothesis is that management was ineffective in eliciting greater effort. In this investigation I have considered the four largest colonial industries: cotton textile, jute textile, iron and steel and coal mining.

Data indicate industrial wages relative to agricultural wages moved in response to industry demand conditions. As the manufacturing wage was affected by conditions in manufacturing, the overall dominance of agriculture in the economy did not preclude productivity advances in manufacturing.

Nor is there evidence that poor health caused low effort and stagnant productivity in organized industry. In the modern period, research in India shows that better nutrition would lead to more productive workers only for the very lowest paid agricultural workers. Wages were relatively high in cotton textiles, jute textiles and iron and steel. In cotton textiles in Bombay, even when the wage rose to three times the competing agricultural wage, productivity remained flat. Productivity rose rapidly at TISCO where the average wage was for most years similar to cotton textile. Thus, this hypothesis is unlikely to explain the relative pattern of productivity in these two industries. In jute textiles, productivity fell in the 1920s when the nominal wage rose.

Thus again, there is limited support. Wages were lower in coal mining, and conditions almost certainly worse. But the pattern of productivity and wages in coal mining is similar to that in jute. Productivity in the first part of the century when the underground miners wage was twice the competing tea wage was not very different than productivity in the 1930s when the tea wage was approximately the same as the coal wage, and the nominal coal wage had fallen below its prewar level. Thus, there is limited support for the nutrition argument even in coal mining.

Next we can consider the possibility that Indian workers had a strong preference for low effort. If this were the case the workers would never be willing to increase effort unless appropriately compensated. TISCO workers increased their effort levels and their wages were increased, thus lending some support to this hypothesis. On the other hand, Bombay cotton workers saw an increase in wages and still refused to increase effort levels at least in aggregate. And it is noteworthy that TISCO workers struck both for higher wages and an end to employment reductions. The Bombay cotton textile strikes of the late 1920s were primarily over employment reductions even though higher wages were on offer for those who remained employed (Wolcott and Clark (1999)). At the very least one would have to say that labourers consistently expressed a concern with employment levels suggesting that effort levels were not the sole consideration. Note also that the wage premium varies in all of these industries more with profit margins than productivity. That also indicates high wages were not solely compensation for effort levels.

Even if labourers were concerned with employment levels, and thus reluctant to exert greater effort, did they have the power to resist labour productivity improvements? There is evidence of labour bargaining power in all four of the industries considered. Relative wages responded to shifts in the margin indicating high and low profit states. There were long and well

supported strikes in all four industries. The biggest difference across industries was the ability of workers to forestall employment declines. Cotton textile workers showed the greatest ability to maintain employment, followed by jute textiles. TISCO workers and coal miners were forced to allow substantial employment declines. Thus, to varying degrees, labour could potentially have held off productivity improvements.

The last hypothesis to consider is managerial incompetence. Managerial incompetence is not independent from labour bargaining power. Freeman and Medoff (1984) and more recently Freeman (2005) argue that strong labour organizations can be good or bad for firms depending on union/management interactions. There are two "faces" of unions: monopoly power and voice. The exertion of monopoly power by organized labour is generally viewed as bad for management in that it leads to monopoly wages as well as low productivity and profits and thus limits investment (Hirsch (2004)). Voice, on the other hand, can improve firms' economic outcomes if union leaders accurately convey worker preferences, and management and the state listen. In this case organized labour and management achieve a Pareto optimal bargaining outcome. This view of management-labour relations is similar to Gandhi's, who was known to advocate a non-antagonistic relationship between management and labor, and claimed capital must take responsibility "not only looking to the material welfare of the labourers but their moral welfare also – capitalists being trustees for the welfare of the laboring classes under them," (Gandhi quoted in Datta (1986), p. 221). Gandhi had been instrumental in establishing the well functioning Ahmedabad Textile Workers' Union (Patel (1987)) which operated very much as Freeman and Medoff advocated in that it was a reliable conduit for information between management and labour. The worst case scenario, according to Freeman and Medoff, is a union which has power but which is undisciplined by market forces and also has an antagonistic

relationship with management which precludes effective communication. In this case, labour organizations focus on extracting rent rather than acting cooperatively with management for the long run health of the industry.

It might have been through incompetence that capitalists neither managed to control the labour force and restrain labour bargaining power, nor engage workers in a cooperative manner. Japanese cotton textile managers restrained the labour power of their young female workers and became dominant in world markets by dramatically raising labour productivity while holding compensation constant. No industry in India managed this. But TISCO was able to simultaneously raise profits and wages through a similar surge in labour productivity, though here the largely male labour force was compensated. And the Ahmedabad cotton textile owners under Gandhi's influence for many years managed both cordial labour relations and profits. These two examples, unfortunately, were the exceptions rather than the rule in colonial India.

A potential cause of low labour productivity in colonial India which is consistent with all data presented is that labourers achieved bargaining power but never achieved effective voice. I have argued elsewhere (Wolcott (2009)), that Indian cotton textile workers were organized but leaderless. They could strike, but they could not negotiate, leaving management and labour at an empasse. Datta (1986) claims that in the 1920 TISCO strike, which was before the workers had established a union, "the absence of trained negotiating personnel and of organization was strongly felt," (p. 217). On the other hand, that strike was partially successful. It was the 1922 strike, when Dewan Chaman Lall, the Secretary of the All Indian Trade Union Congress, was called in to negotiate for the workers that ended with no labour gains. This brings up the central problem of formal unions in colonial India. They were most often spearheaded by middle class politicians. In too many cases these organizers used the workers and their genuine economic

grievances for political ends, or at least for political posturing. Goswami (1987) writes of the two educated reformers leading jute unions that Krishna Chandra Raychaudhuri was well-meaning but given his own upbringing unable to understand and articulate the needs of individuals of a different class, and for Prabhaati Dasgupta Goswami, "Being glorified was her greatest pride," (p. 567). Seth (1941) has similar views of the educated leaders of coal unions. "There are no trade unions worth the name. Though there are three Unions, they are too small, divided and resourceless. Men who are at the helm of their affairs are more ambitious to go to Geneva as labour representatives than to organize the colliery labourers into strong unions" (p. 98). Even at TISCO the record was mixed. Datta (1986) characterizes the years 1920 to 1946 as a period of "balance of power in bargaining". But Bahl (1995) and Simeon (1993a and 1993b) claim that the educated reformer leaders of TISCO's workers, Manick Homi and Subhash Bose, had political goals which at times interfered with negotiating the economic goals of the workers and gave the balance of power to management.

Given the paucity of detailed production data throughout and the political and economic upheavals of the period from 1920 to independence, it is probably impossible to definitively claim to isolate the single cause for the lack of productivity improvements in Indian industry outside of TISCO. What this essay has achieved, however, is to bring together a large set of information on labour issues. And while this information may not explain the pattern of productivity from 1900 to 1938, it is remarkable that the workers of such a poor country could at least assert so consistently, across all industries, claims to power.

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Table 1. The Industrial distribution of the workforce in undivided India, 1901-1931

		1901	1911	1921	1931
Cultivators	m	53.2	53.5	56.1	49.8
	f	43.6	41	48.1	30.4
	p	50.3	49.6	53.5	44.3
Agricultural	m	14.3	15.4	14.4	19.5
Laborers	f	30.2	32.5	28	43.8
	p	19.1	20.8	18.6	26.3
Livestock, forestry, fishing,	m	4.2	4.9	4.1	4.9
hunting & plantations, orchards	f	2.9	3.2	3.2	3.8
& allied activities	p	3.8	4.4	4	4.6
Mining & quarrying	m	0.1	0.2	0.2	0.2
	f	0.1	0.2	0.3	0.2
	p	0.1	0.2	0.2	0.2
Manufacturing	m	9.5	9.1	9	8.4
	f	11.4	10.9	8.4	8.8
	p	10.1	9.6	8.8	8.5
Construction	m	1.1	1.3	1.1	1.2
	f	0.8	0.8	0.8	0.9
	p	1	1.2	1	1.1
Trade & commerce	m	5.8	5.5	5.9	5.9
	f	3.5	5.3	5.2	4.8
	p	5.1	5.4	5.7	5.6
Transport, storage &	m	1.5	1.7	1.3	1.4
communications	f	0.2	0.2	0.2	0.1
	p	1.1	1.2	1	1.1
Other services	m	10.2	8.3	7.8	8.6
	f	7.2	5.9	5.7	7.1
	p	9.3	7.6	7.2	8.2

Source: Krishnamurty, Table 6.2

Table 2. Real Product per Worker (Rs.) by Sectors at 1937-38 prices

years	primary	components of 2nd			secondary	tertiary	all
		mining	*Manufac-turing*	*artisan*			
1900-1 to 1904-5	102	*537*	*661*	*144*	172	271	138
1905-6 to 1909-10	102	*478*	*645*	*141*	178	291	140
1910-11 to 1914-15	107	*428*	*594*	*160*	198	324	150
1915-16 to 1919-20	109	*462*	*550*	*129*	174	322	149
1920-1 to 1924-5	107	*422*	*484*	*152*	196	350	152
1925-6 to 1929-30	109	*493*	*581*	*214*	267	401	167
1930-1 to 1934-5	112	*404*	*647*	*239*	293	406	174
1935-6 to 1939-40	111	*355*	*760*	*196*	278	406	173
percent change over period	8.22	*-33.79*	*14.98*	*36.20*	61.26	50.00	25.78

Source: Sivasubramonian (2000), Table 7.19, and Appendix Table 6(g).

Table 3. Average Net Value Added per Worker in Eight Industries , 1937-38 prices

	Cotton textiles	Jute textiles	TISCO	Other 5 Industries	All 8 industries	8 industries less TISCO
1900-01 to 1913-14	920.24	455.65		916.62	725.36	725.47
1914-15 to 1919-20	798.52	432.28	880.11	995.70	641.88	637.30
1920-21 to 1929-30	747.30	355.78	1226.00	1022.98	604.88	587.54
1930-31 to 1938-39	947.04	375.37	3403.88	966.53	802.19	744.54
percent change over period	2.912	-17.62	286.76	5.44	10.59	2.63

Note: Sivasubramonian created Net Value Added series for eight industries: cotton textiles, jute textiles, TISCO, sugar, paper, cement, woolen, and match. These are the industries covered in this table.

Source: Sivasubramonian (2000), Tables 4.8, 4.10, 4.25 and 4.27.

Table 4. Main Results of the Industrial Census in India, Taken in 1921

	Total employment	number of females per 100 males	share Europeans & Anglo-Europeans among supervisors	ratio supervisors to all employees	ratio skilled workers to unskilled
I. Growing of Special Products	820,868	89	0.24	0.02	0.02
tea plantations	*747,661*	*94*	0.22	0.01	0.02
II. Mines	266,743	36	0.13	0.04	0.36
collieries	*181,594*	*39*	0.10	0.04	0.41
III. Quarries of hard rocks	27,234	33	0.04	0.04	0.24
IV. Textiles and connected industries	773,065	25	0.07	0.04	0.82
cotton weaving	*350,679*	*26*	0.04	0.04	1.06
jute mills	*287,336*	*20*	0.20	0.02	0.79
V. Metal Industries	169693	6	0.18	0.07	0.94
iron and steel works	*39,449*	*16*	*0.09*	*0.08*	*0.72*
TOTAL INDIA	2,681,125	36	0.12	0.05	0.40

Source: *Statistical Abstract for British India*.

Table 5. Strikes in India, 1921-38, by Province and by Industry

I. Trade Disputes by Provinces for the years 1921-1938

province	no. of strikes	men involved	days lost	Success rate
Ajmer-Merwara	4	7,307	433,180	25.0%
Assam	120	62,107	265,161	44.2%
Bengal	1131	2,340,772	30,134,181	32.2%
Bihar & Orissa	96	177,447	5,642,111	44.7%
Bombay	1480	1,990,882	66,581,771	33.2%
Burma	112	123,774	1,535,259	48.2%
Central Provinces	92	135,568	2,732,014	38.0%
Delhi	33	37,523	244,749	30.3%
Madras	323	342,436	5,911,053	52.0%
Punjab	59	34,567	791,742	59.3%
United Provinces	124	234,542	4,842,010	37.9%

II. Classification of Disputes by Industries for the years 1921-1938

cotton & woolen	1562	2,152,007	74,761,241	34.2%
jute mills	420	1,495,949	19,552,867	21.9%
engineering	171	153,062	5,311,901	38.0%
railways	113	368,509	9,501,146	28.3%
mines	55	62,918	954,817	38.2%
others	1240	732,728	9,215,523	46.6%

Source: Mukhtar (1935) and *Indian Trade Journal*, various years.

Figure 1. Prices of Indian Goods, January 1900-1938 (Average 1934-38=1.00)
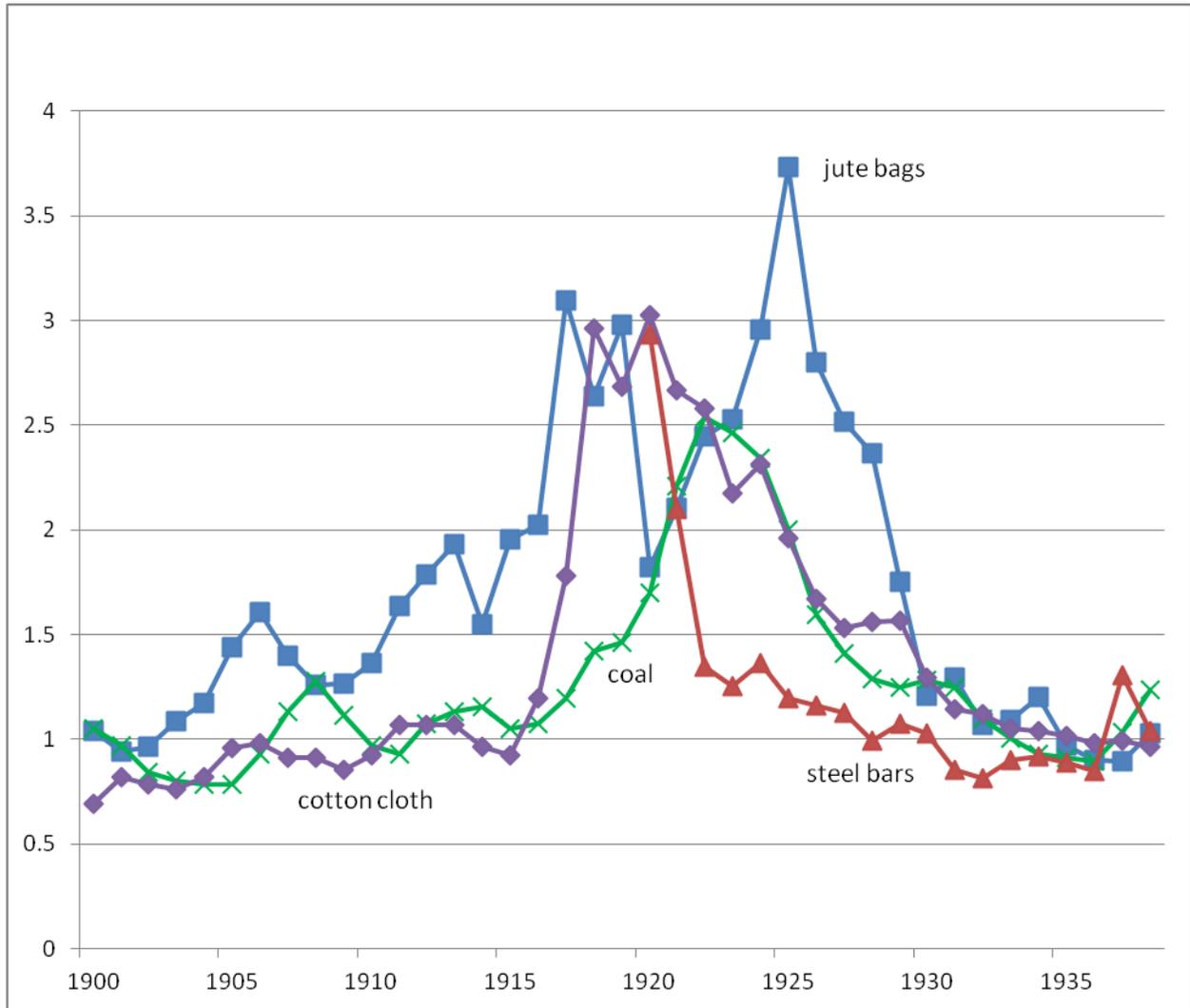
Note: Cotton cloth, jute bags and steel bars are quoted prices. Coal is the unit value of all coal mined in India. Quoted prices for Jherria coal are only available in the 1930s; Bengal coal prices are available 1900-31, but as an exported good are quite different than other coal prices.

Source: *Index Numbers of Indian Prices* for jute and cotton to 1931, then *Statistical Abstract for British India*; Chief Inspector of the Mines Annual Report for coal; Spiegelman (1960) for TISCO.

Figure 2. Cotton and Jute Textiles, Coal, and TISCO Output, 1900-1938 (1934-38=1.0)
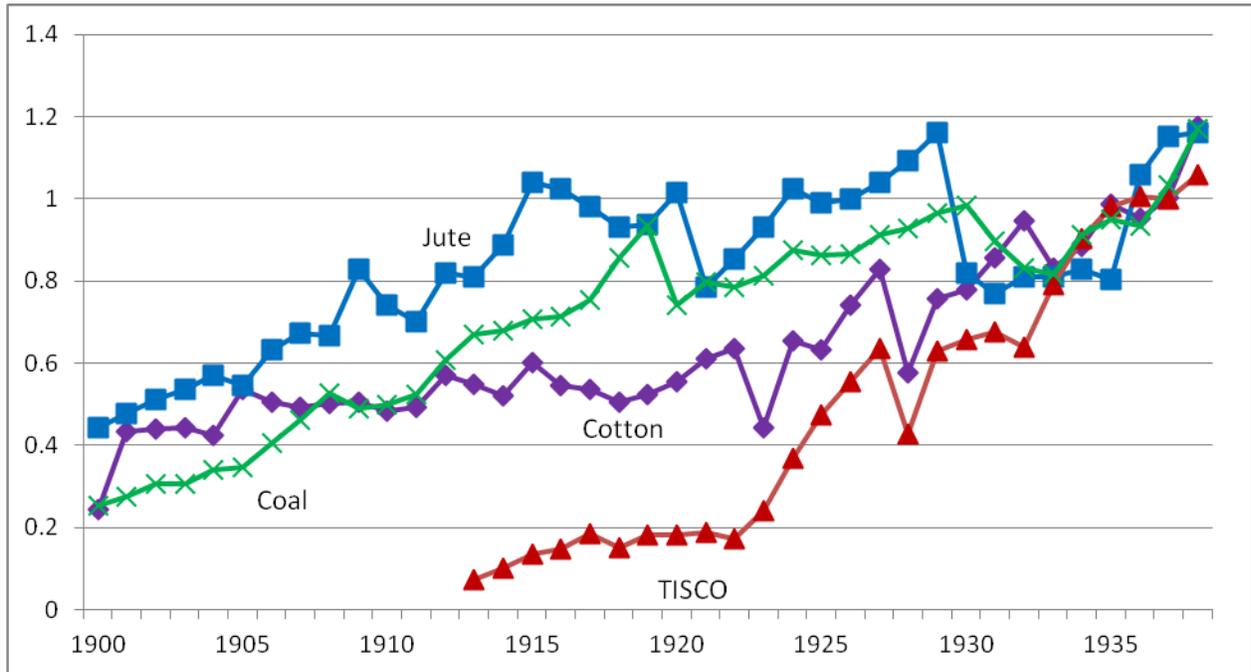
Source: Sivasubramonian (2000).

Figure 3. Monthly Male Wages (Rs.) of Bombay Cotton Textiles, Jute Textiles, and Jheria Coal Miners, 1900-1938, and TISCO 1912-1938
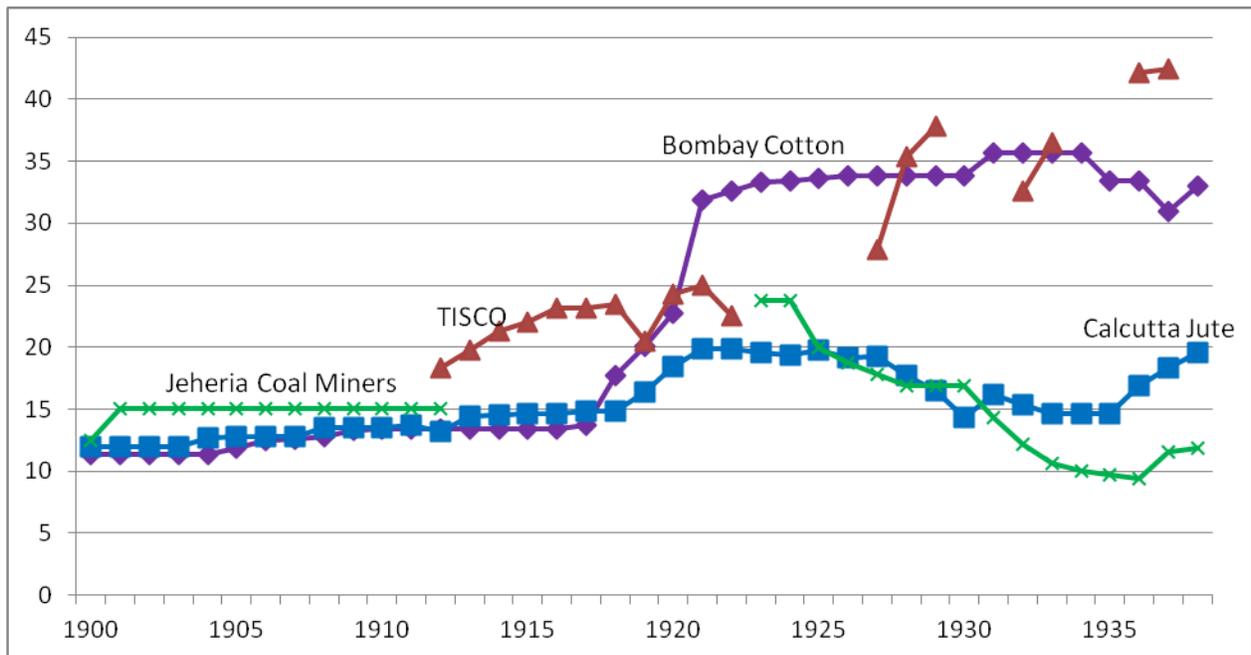
Source: Jute, Mukerji (1960); Cotton, Muckerji (1959); TISCO, Datta (1986); Coal, Datta (1914) vol. 3, and Seth (1941).

Figure 4. Male Konkan Field Labour Wages (Rs. Per month of 26 days) and Male Wages in the Assam Tea Gardens (Rs. Per month), 1900-1938
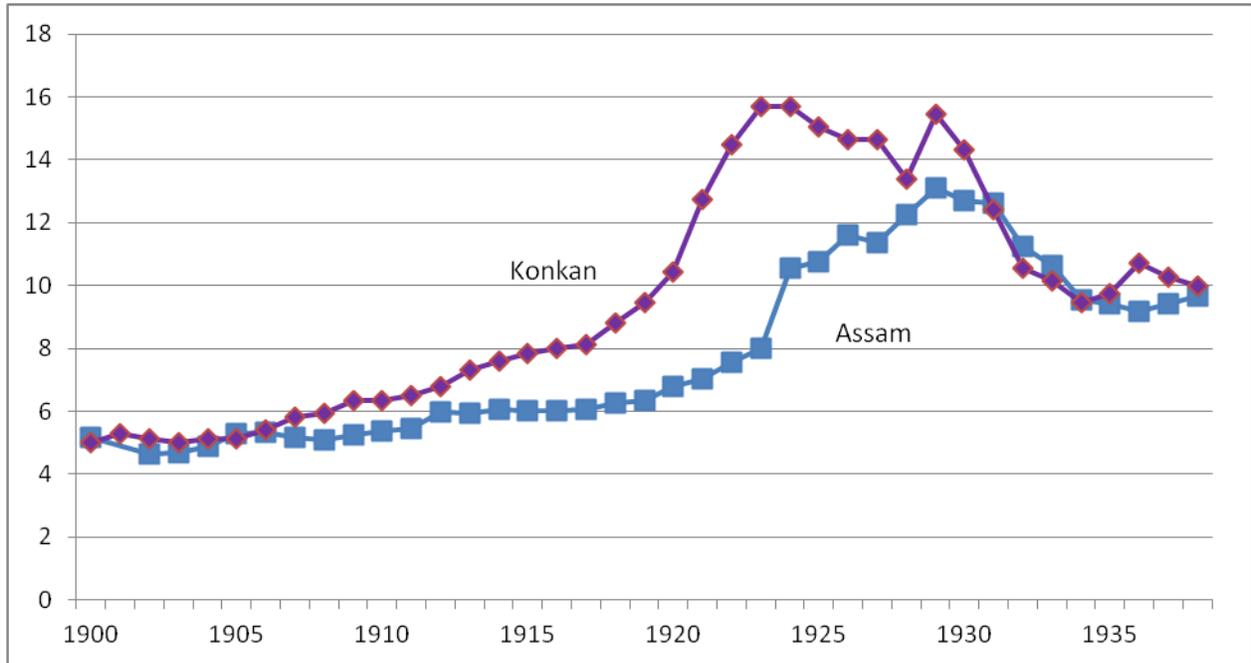
Sources: Indian Tea Statistics, various years, and Mazumdar (1973).

Figure 5.   Jute and Cotton Mill Wages Relative to Agricultural Wages, 1900-38
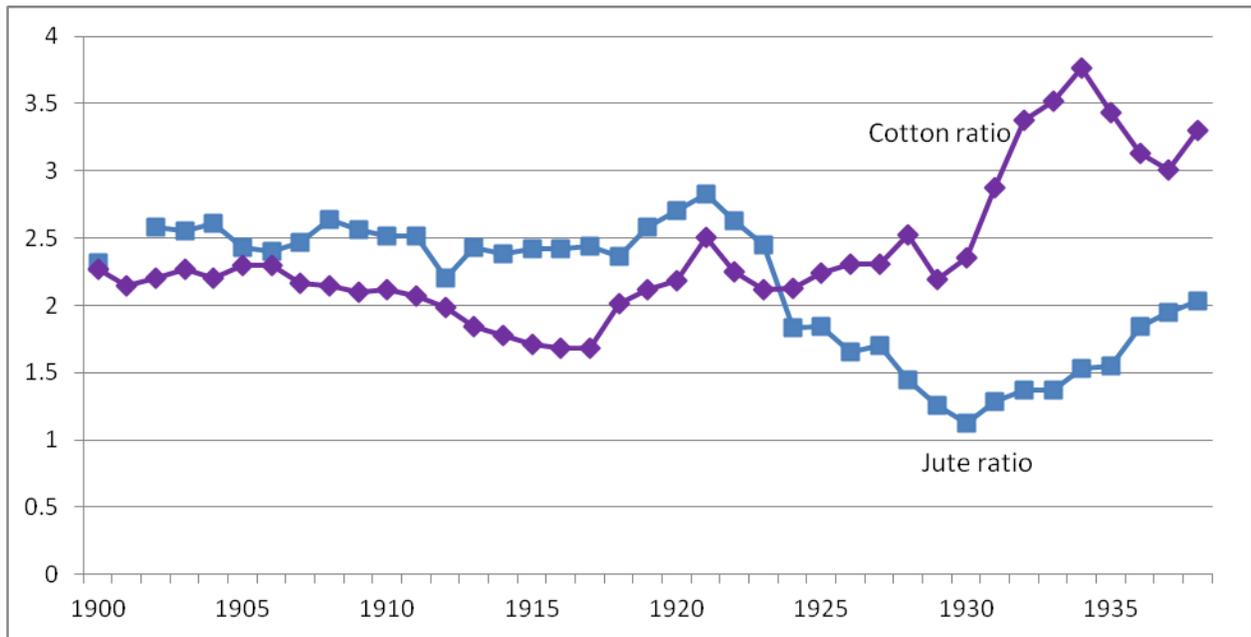
Sources. See figures 3 and 4.

Figure 6. Jute Textiles.

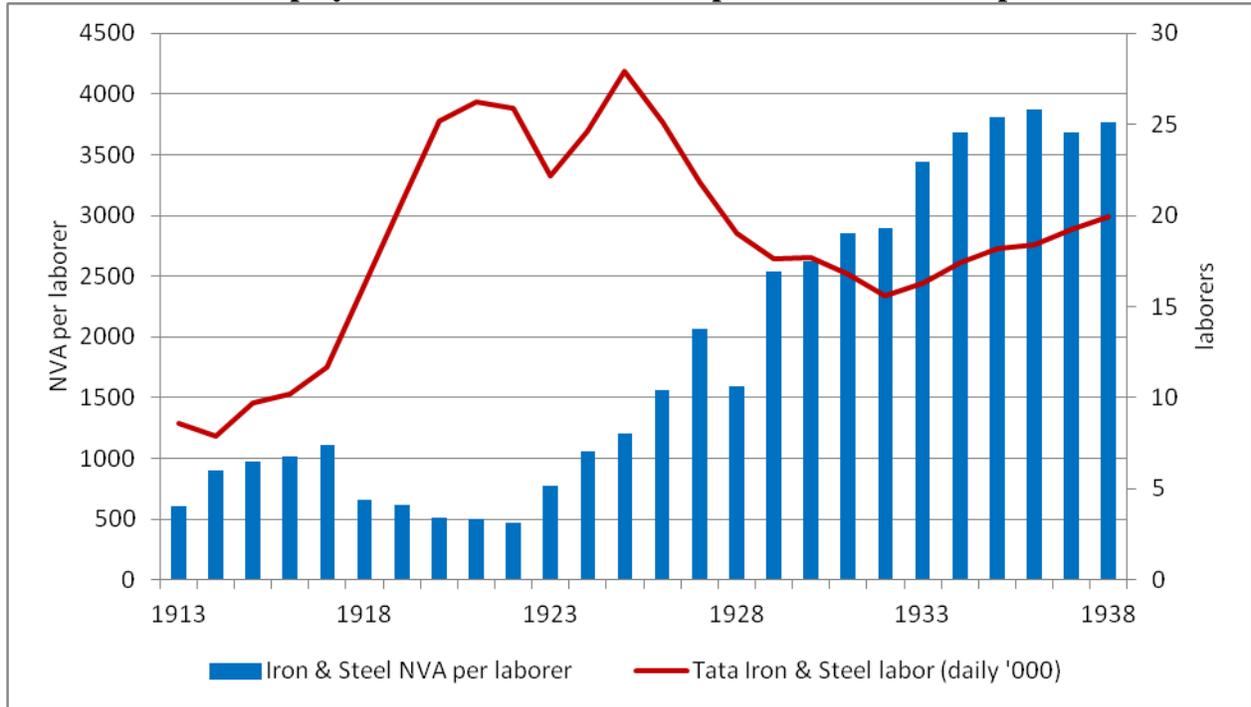**Panel A. Jute Employment vs. Net Value Added per Laborer at 1938 prices, 1900-1938**
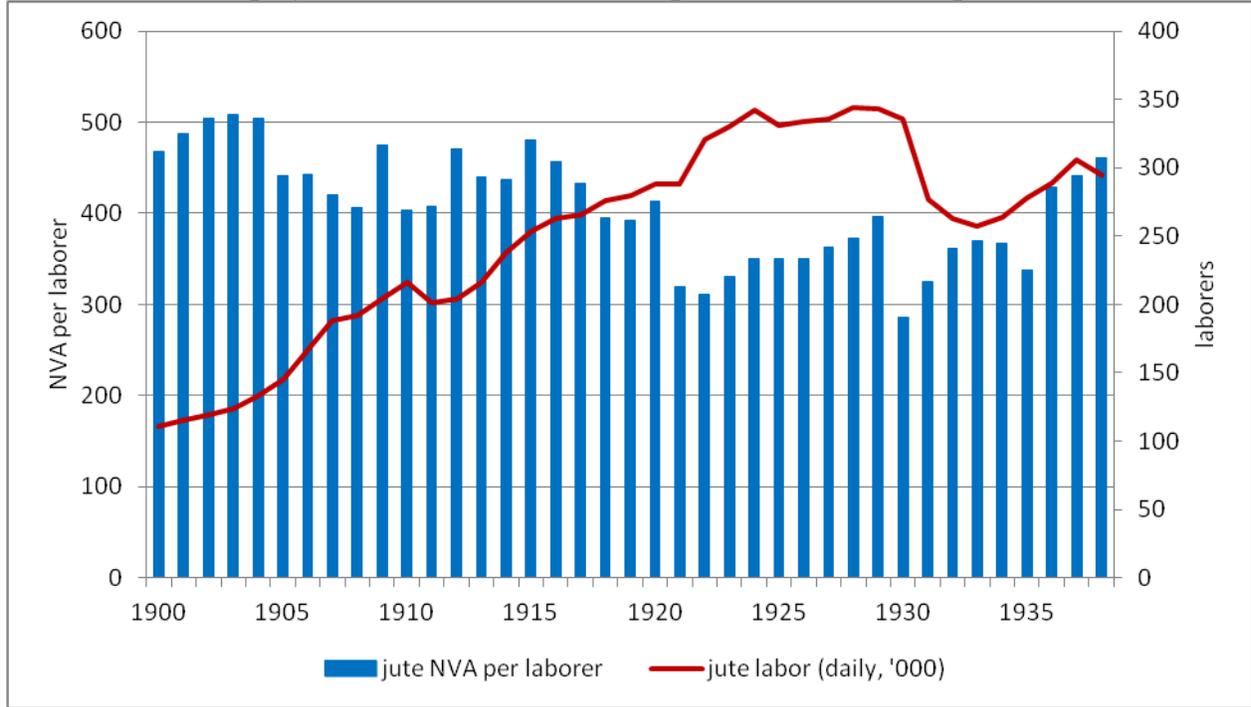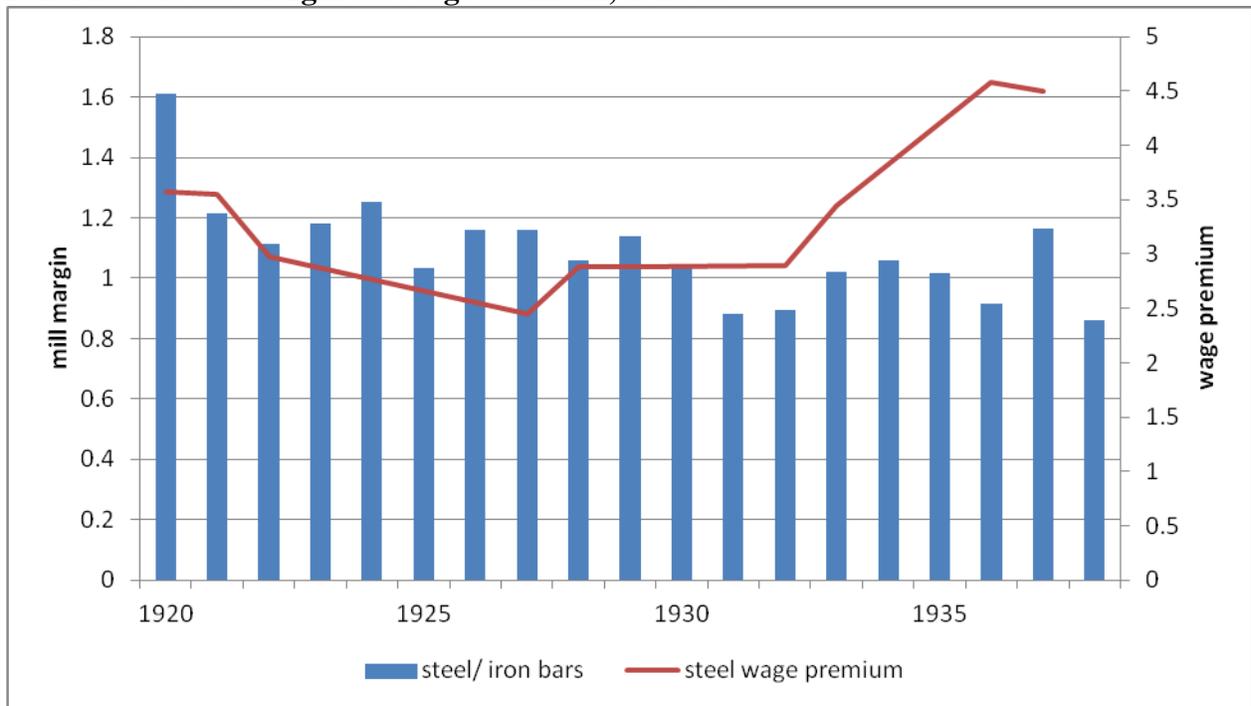

Panel B. Jute Mill Margin vs. Wage Premium, 1900-38
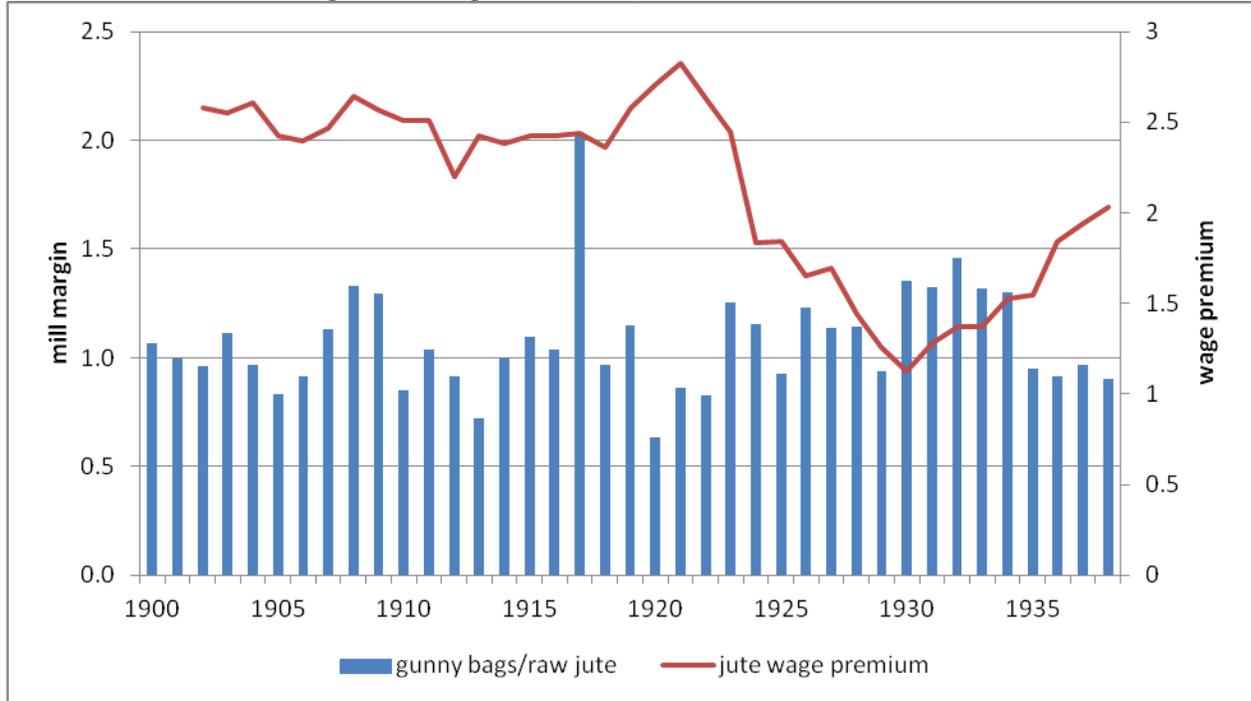
Sources: Sivasubramonian (2000) for production, employment and raw jute price. Gunny bag prrice and wages, figures 1, 3 and 4.

Figure 7. Cotton Textiles.

Panel A. Cotton Employment vs. Net Value Added per Laborer at 1938 prices, 1900-1938
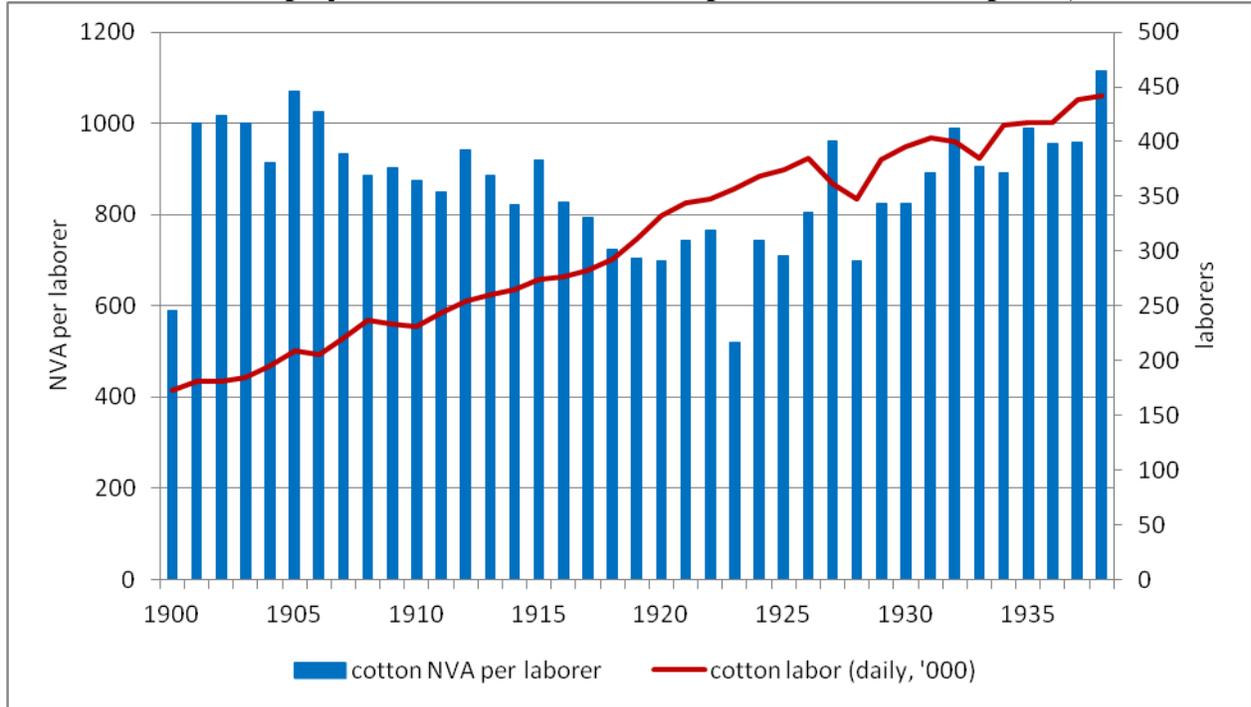
Panel B. Cotton Mill Margin vs. Wage Premium, 1900-38
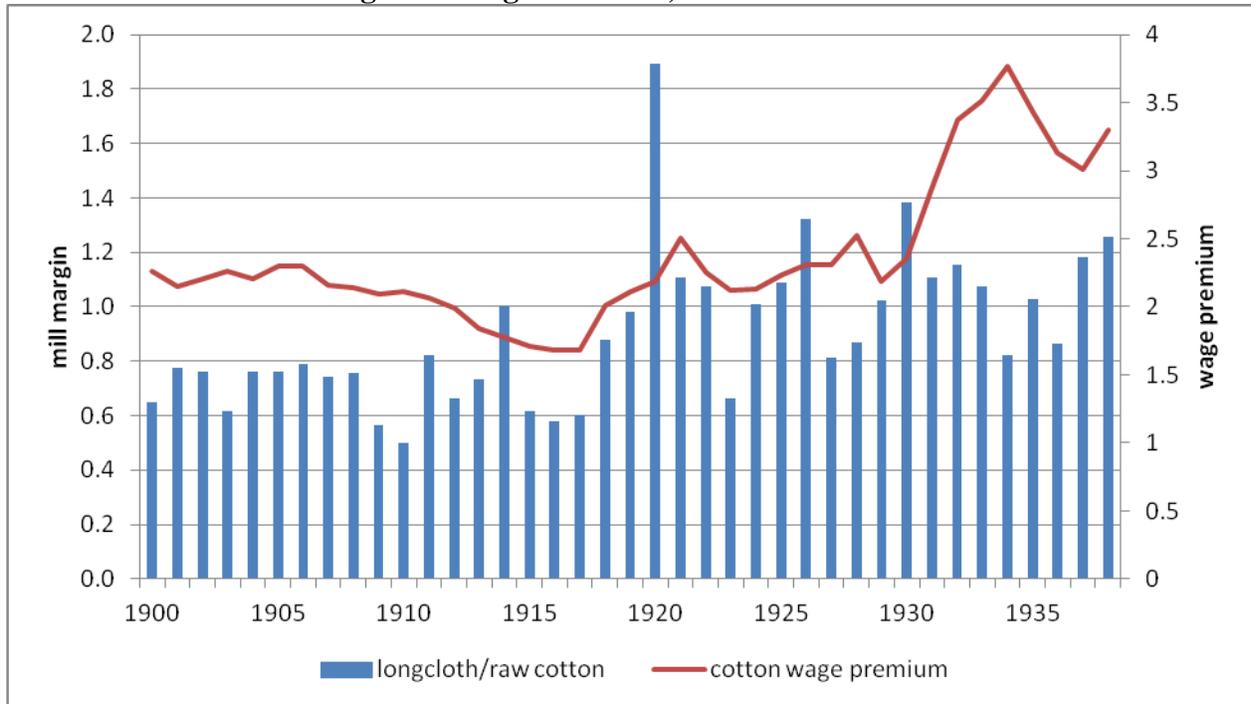
Sources: Sivasubramonian (2000) for production, employment and raw cotton price. Longcloth price and wages, figures 1, 3 and 4.

Figure 8. TISCO.

**Panel A. TISCO Employment vs. Net Value Added per labourer at 1938 prices**

**Panel B. TISCO Margin vs. Wage Premium, 1920-38**

Sources: Sivasubramonian (2000) for production and employment. Steel price and wages, figures 1, 3 and 4. Iron bar price, *Index numbers of Indian Prices* and *Statistical Abstract of British India*.

Figure 9. Coal Mining.

Panel A. Coal Mine Employment vs. Value of Coal per Laborer at 1938 prices , 1900-38
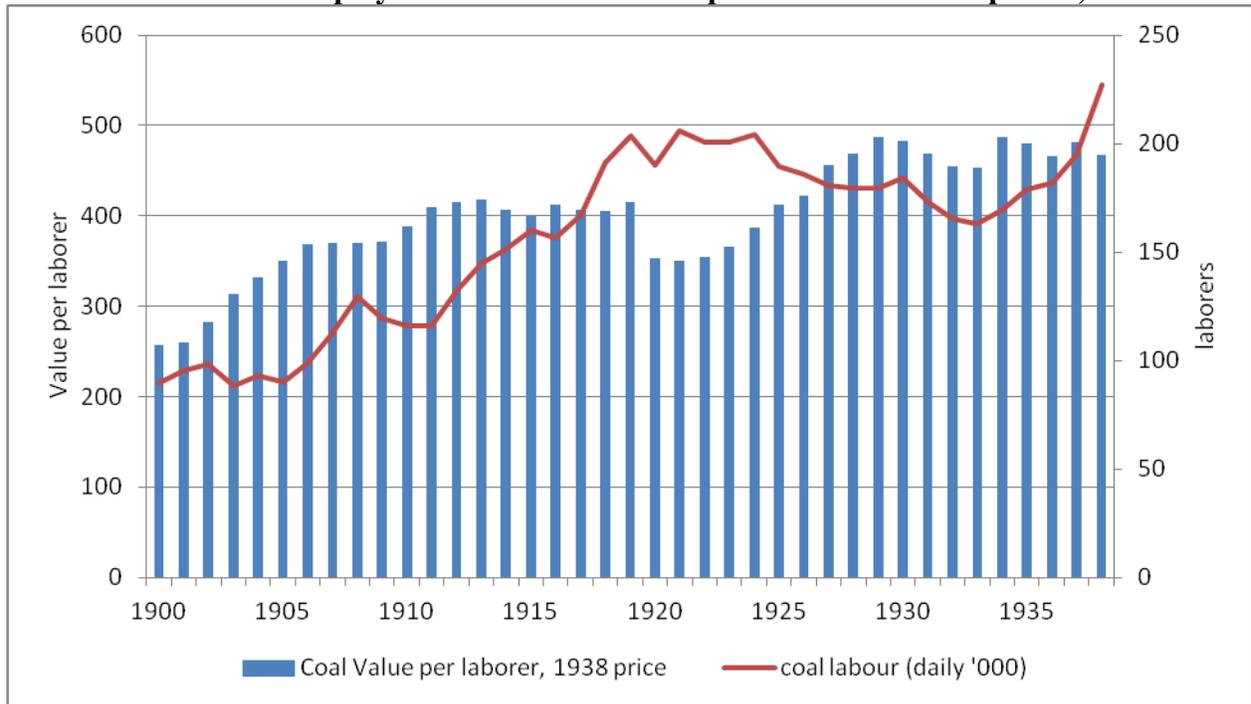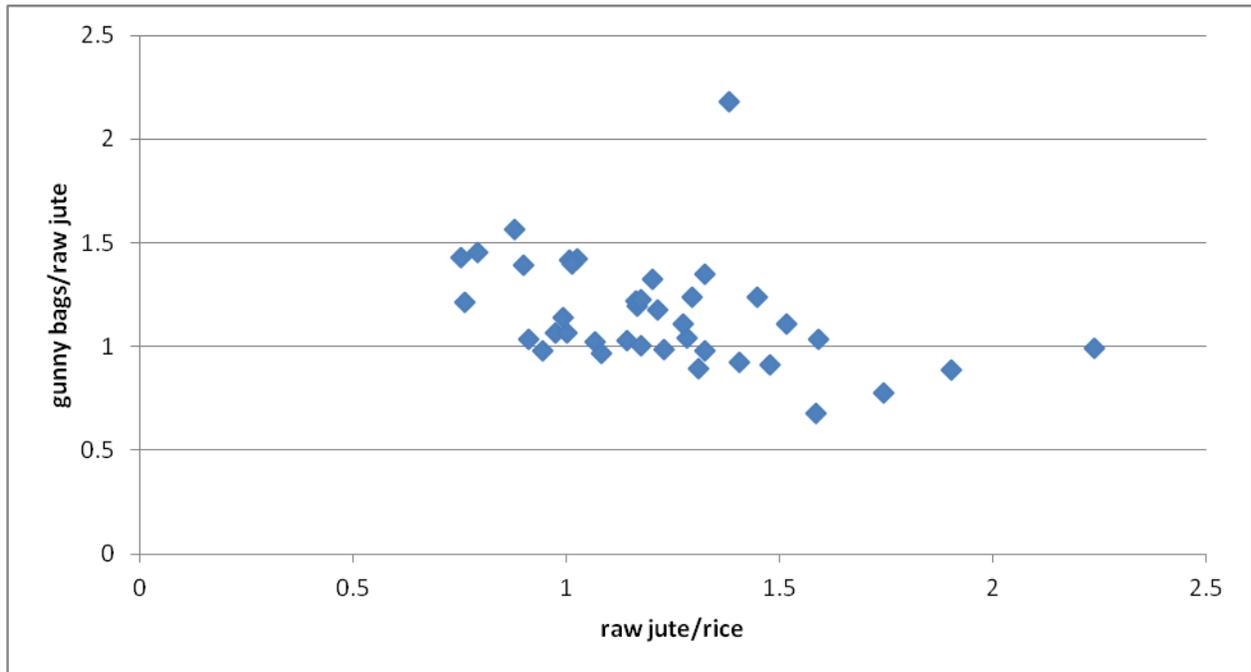

Panel B. Coal Margin vs. Wage Premium, 1900-38
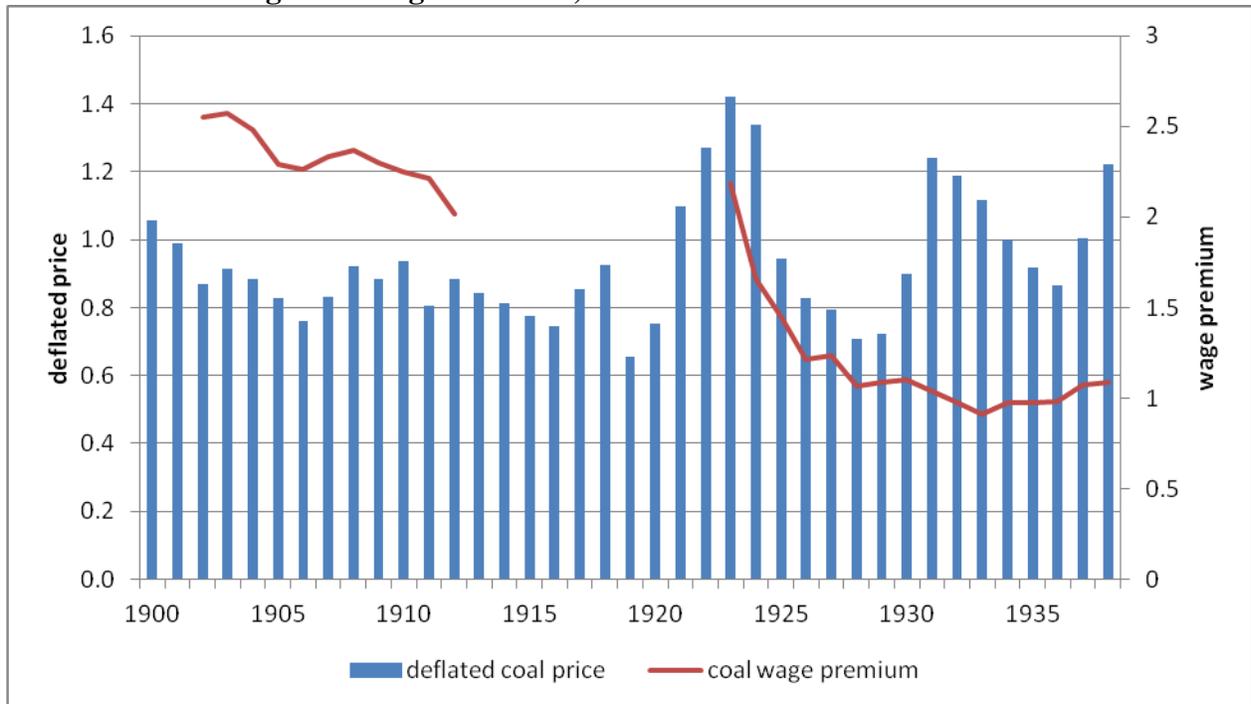
Sources: Sivasubramonian (2000) for production and employment. Coal price and wages, figures 1, 3 and 4. Indian WPI, Thingalaya (1969).

Figure 10. Jute Mill Price Margin vs. Jute Cultivators Price Margin

Sources: Gunny bag price, see figure 1; raw jute and rice, Sivasubraminian (2000), Appendix table 3(d).