

# Diversity and Institutions: Theory and Evidence from the Spread of Industrialization

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Job Market Paper<sup>†</sup>

## Abstract

Why may social diversity be bad for growth? In this paper, I argue that diversity affects the extent of information asymmetries that determine the design of contracts and institutions. Because information asymmetries generate information rents, these contracts and institutions foster lower economic growth and persist over time. I proceed as follows: First, I model the impact of workforce diversity on the design of contracts and the shape of the firm. I find that diversity decreases the incentives given in principal-agent interactions and multiplies the number of layers bureaucracies need. Furthermore, the relation between diversity and productivity is institution dependent. Second, I compare the spread of industrialization in Japan and British India; and I provide new evidence of the organization, managerial beliefs, and workforce diversity of the three biggest textile centers in Bombay province. I find that workforce diversity was pervasive in British India, but not in Japan, allowing the latter but not the former to introduce organizational improvements and develop. In British India, centers with higher workforce diversity had more supervisors per worker and their managers were the most likely to believe that their workers were lazy.

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<sup>†</sup>November 1, 2009

# 1 Introduction

Since Easterly and Levine (1997) first documented the negative correlation between per capita GDP growth and social diversity, the economics literature on the topic has mushroomed.<sup>1</sup> Why is social diversity inversely related to economic growth? What is the role of institutions in this relationship? Understanding these questions has important implications for economic development policies. These are relevant for the implementation of foreign aid policies, the management of globalization, and the design of institutions at the supranational level, among others.

Inspired by Robert Putnam's (1995) emphasis on the role of social capital, a vast empirical literature has documented that more diverse communities foster lower levels of social capital. Why is this so? Two main arguments have been proposed in the literature. Members of different groups may have different preferences (Alesina et al., 1999) over economic outcomes or may dislike interacting with each other (Alesina and La Ferrara, 2000). These can decrease their willingness to pay for common goods or hamper the enforcement of social norms, among others. In short, the current wisdom is that

Social diversity  $\rightarrow$  preferences  $\rightarrow$  social capital  $\rightarrow$  quality of institutions  $\rightarrow$  economic performance.

In this paper, I explore the relation between diversity and economic productivity assuming none of the former. That is, I assume that individuals have identical and standard preferences. Yet, I show that diversity matters. This is so because it imposes a cognitive challenge on societies, which shape their institutions accordingly. I rely on social psychology insights about stereotyping phenomena to argue that diversity affects the extent of information asymmetries in economic interactions.<sup>2</sup> I analyze how these information asymmetries affect the design of contracts and institutions. In short, I argue that

Social diversity  $\rightarrow$  information asymmetries  $\rightarrow$  design of contracts and institutions  $\rightarrow$  economic performance

To analyze the implications of my hypothesis, I proceed as follows: First, I build an organization theory model to study how workforce diversity affects the design of contracts and the shape of organizations. I then present evidence about the spread of industrialization in British India and Japan that is consistent with the model's implications. The emphasis on workforce composition and information asymmetries along the hierarchy sheds light on why low labor productivity persisted in the British India cotton textile industry but not in the Japanese.

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<sup>1</sup>They measure social diversity as ethnolinguistic fractionalization.

<sup>2</sup>While the economics literature has borrowed insights from social psychology regarding identity and prejudice (Becker, 1957) and Akerlof and Kranton, (2000), little has been said about how stereotyping affects economic outcomes. Stereotyping is a form of categorization that applies to the physical and social environment and attributes group characteristics to individuals.

The paper is structured around the following three core questions:

**1. *How does workforce diversity affect the design of contracts and the shape of organizations?***

In the first part of the paper, I model the effect of workforce diversity on the design of contracts, the shape of the firm and labor productivity. The model extends a static principal multiple-agent model to encompass the possibility that workers belong to different groups. I merge this extension with the literature on hierarchies and the role of collusion *à la* Tirole (1986). I assume that managers hold stereotypes over their workers, while supervisors, who spend more time with workers, do not. Relating the extent of informational asymmetries along the hierarchy to the composition of the workforce allows me to derive the shape of the organization endogenously. I find that diversity decreases the incentives given in flat organizations and multiplies the number of layers that bureaucracies need. Furthermore, the relation between diversity and productivity is institution dependent. This has important implications for institutional policies. It may explain why identical institutions perform very differently in different countries and why transplanted institutions often fail.

**2. *Why did Japan and British India cotton textile industries productivity diverge in the interwar period?***

In 1910, one Indian textile mill worker produced as much output as a Japanese worker and one fourth of what a British worker did (Clark, 1987). By 1938, labor productivity had improved dramatically in Japan, but very little in British India; where, by then, workers produced one fourth of what Japanese workers did (Wolcott and Clark, 1999). To understand this puzzle, I analyze the role of labor-market institutions in explaining the divergence, using Greif's (2006) methodology. I show that at the onset of industrialization both countries shared essential structural features and that their managers faced similar initial challenges. Namely, how to attract, retain, and control an originally rural labor force. Two key distinctive features stand out: the diversity of their population and labor force and their state ideology (nationalism versus colonialism). British India society was very diverse. On the contrary, "At the time of Restoration, in spite of internal dissensions, the people of Japan possessed an underlying sense of national unity which was the product of her geographical position, of linguistic uniformity and of her long history," Allen (1946). I argue that these features determined the extent of information asymmetries in both economies. These affected the design and evolution of labor-market institutions. In British India, labor-market intermediaries were given recruiting and supervisory powers, which persisted over time, preventing managerial improvements. In Japan, intermediaries were only given a recruiting role and were replaced during the interwar period by productivity enhancing institutions. That is, labor market intermediaries were a *reinforcing institution* in British India and an *undermining institution* in Japan. Information asymmetries lie at the root of their different design and dynamics.<sup>3</sup> Finally, the colonial state in British India was a *complementary institution* to labor-market intermediaries while the

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<sup>3</sup>They are a quasi-parameter in terms of Greif (2006).

contrary was true in Japan.

I then review alternative existing explanations of the puzzle that emphasize cultural (e.g., workers' preferences, religious dispositions, etc.) or political (e.g., state-led Japanese development, British colonial exploitative policies, etc.) differences between Japan and British India. These explanations are unsatisfactory for the following reasons. Cultural-based explanations fail to account for the timing of the divergence as cultural dispositions are slow to change. Furthermore, consider the fact that, in 1903, the American missionary Sidney Gulick observed that many Japanese "give an impression of being lazy and utterly indifferent to the passage of time" while by 1930 Arno Pearse refers to Japanese textile workers habits saying that their "punctuality is ingrained." Regarding the role of the state, I discuss the role of trade and industrial policies in both countries. Note that in both countries the expansion of the cotton textile industry materialized in private hands (Saxonhouse, 1974).

Acknowledging the limitations of cross-country comparisons, I next provide within India evidence on the relation between workforce diversity and the organization of the three main textile centers in the province of Bombay.

### *3. Was low productivity in British India textile industry an institutional failure?*

In the third part of the paper, I compare the labor force diversity, organization structure, managerial policies and beliefs of the three main textile centers within the Bombay Province from 1857 to 1947. Namely, the cities of Bombay, Ahmedabad, and Solapur. To do so, I collect and digitize evidence from census data, parliamentary papers, and the labour office. I construct new measures of diversity along religious, ethnic, caste, and linguistic lines.<sup>4</sup> I quantify the extent of supervisors within the mills and their evolution over time.<sup>5</sup> Finally, I analyze managerial policies (housing provision, health policies) and beliefs.<sup>6</sup>

I find that (1) information asymmetries were pervasive in British India as a result of colonization and of India's high population diversity, (2) diversity permeated the mill walls, (3) supervisors persisted over time and (4) centers with higher workforce diversity had more supervisors per mill operative and worse managerial policies. Furthermore, managers of highly diverse workforce were inclined to believe that the reasons behind low productivity were exogenous. Consequently they were the less likely to undertake changes in the recruitment and management practices and the more likely to continue relying on intermediaries. The study of British India industrialization sheds light on the relation between social diversity and economic development and the essential role of organizations in shaping this relation and its persistence.

These findings suggest that the reason why social diversity is bad for growth is not necessarily a fundamental conflict of interest arising from diverging preferences. Rather, diversity imposes a cognitive challenge on societies, which shape their institutions accordingly. In highly diverse societies, categorization

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<sup>4</sup>Probability that two randomly chosen individuals belong to a different group.

<sup>5</sup>The share of mill operatives that are supervisors, also called jobbers.

<sup>6</sup>I systematize managerial comments expressed in Parliamentary papers.

processes such as stereotyping are pervasive, increasing the extent of information asymmetries with which their members have to deal. Because information asymmetries generate information rents, institutions provide lower incentives and persist over time, generating lower economic growth.

This paper contributes to several strands of the literature. First, it proposes an alternative to the current emphasis on social capital.<sup>7</sup> Under my hypothesis, diversity matters not only for public goods provisions (Luttmer, 2001, Miguel and Gugerty, 2005) or collective decisions (Alesina and LaFerrara, 2000), but also in standard economic interactions. Second, this research places the firm at the core of the relation between diversity and economic development, as in Bloom (2009). While the organizational behavior literature has focused on the role of diversity in the performance of teams (Kurtulus, 2008, Lazear, 1999) it has taken the shape of the firm as given. The model I present derives the shape of the firm endogenously, and as a function of social factors. Third, it contributes to the research that studies the firm as information processor and metering device by considering the impact of agents cognitive shortcuts when processing information.<sup>8</sup> I draw on insights from the study of hierarchies and the role of collusion between informed parties to derive the optimal structure of the firm as a function of the distribution of social knowledge along the hierarchy.<sup>9</sup>

Making the shape of the firm endogenous to the distribution of social knowledge and the diversity of the workforce contributes to understanding two historical episodes: first, the divergence of Japanese and British India cotton textile industries during the interwar period; second, the organization of textile mills in British India at the turn of the last century. I provide a rationale for the emergence and persistence of labor-market institutions as a function of the social environment in colonial India.

More broadly, this work contributes to understanding the origin of institutions and their role in explaining the puzzle of underdevelopment. I follow the view that institutions are equilibrium outcomes (Greif, 2006) and are a function of not only technology or initial endowments (Engerman and Sokoloff, 1994) but also of the social world. I depart from the artificial dichotomy between good and bad institutions (Acemoglu, et al., 2001) and from attributing to culture (Tabellini, 2008) an essential role in understanding the differential performance of identical formal institutions. Institutions are a human-devised response to technological *and* social needs. Understanding these needs is essential when trying to improve their performance and to understand why transplanting institutions is more often than not a failed enterprise.

The paper is organized as follows: Section 2 presents the theoretical model that analyzes the impact of workforce diversity on the design of contracts and

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<sup>7</sup>Costa and Kahn (2004) provides a summary of the vast empirical literature on this topic.

<sup>8</sup>Aghion and Tirole (1997), Milgrom and Roberts (1988) and Radner (1992), among others, view the firm as an information aggregator and processor, while Garicano (2000), argues that coordination and information transmission are the rationale for knowledge-based hierarchies.

<sup>9</sup>Calvo and Wellisz (1978) model the supervision problem and Tirole (1986) studies the role of collusion in three-tier organizations. Prendergast and Topel (1996) model a supervisor who has favorites among workers and the effect that has on incentives and job assignment.

the shape of organizations. Section 3 discusses the spread of industrialization in Japan and British India and the reasons behind the divergence of their textile industries during the interwar period. Section 4 examines the organization of textile mills and its relation to workforce diversity in the three main centers in the Bombay Presidency from 1857 to 1947. Section 5 concludes and discusses follow-up questions for future work. All results not derived or proved in the text are proved in the appendix.

## 2 Social determinants of hierarchies: A model

How does workforce diversity affect the design of contracts, the shape of organizations and labor productivity? In this section I extend the standard static principal multiple-agent model with the possibility that workers belong to different groups. I merge this extension with the literature on hierarchies and the role of collusion *à la* Tirole (1986). Relating the extent of informational asymmetries along the hierarchy to the composition of the workforce, I derive endogenously the shape of the organization. I find that (1) workforce diversity decreases the incentives given to workers in flat organizations, (2) multiplies the number of layers bureaucracies find necessary and (3) the relation between diversity and productivity is institutionally dependent and non linear.

### 2.1 Basic Assumptions

1. Social groups are defined on the basis of observable characteristics such as language, religion, ethnicity and birth-place.
2. I fix the size of the workforce,  $N$ , and let  $K$  be the number of subgroups. That is,  $N = N_1 + \dots N_k + \dots N_K$ .
3. Groups are equal sized such that  $K = N/N_k$ . Each worker  $i$  belongs to only one group  $k$ . The bigger the number of groups the more diverse the workforce is.
4. Workers have identical preferences regardless of the social group they belong to. Workers have constant absolute risk aversion (CARA) preferences, defined over monetary wages ( $w$ ) and effort ( $a$ ), and represented by the following negative exponential utility function:

$$u(w, a) = -e^{-\eta[w - \tau(a)]} \quad (1)$$

where  $\eta > 0$  is the agent's coefficient of absolute risk aversion. For simplicity, I assume that  $\tau(a) = \frac{1}{2}ca^2$

The reservation wage is equal to  $w_o$  for all  $i$ .

5. Worker's effort is unobservable, although both manager and supervisor observe a noisy signal of it. The manager's signal is noisier than the supervisor's signal in a way specified in the next section.

6. The manager and the supervisor are risk neutral.

7. Manager's expected profit is

$$\sum_{k=1}^K \sum_{i=1}^{N_k} (a_i - w_{ik}) \quad (2)$$

8. There is an ex-ante competitive supply of supervisors. I assume that it is not efficient to divide the supervisory job among several supervisors.<sup>10</sup> The supervisor exerts no effort in the supervisory function. He is an information conduit between workers and manager. His choice is whether to report truthfully or to manipulate the signal he observes to the manager. In order to manipulate the signal he needs the collaboration of workers.

9. The supervisor reservation utility for the supervisory task is zero.

10. The supervisor lacks either the time or resources required to run the vertical structure. For example he may lack a link with capital markets and government.

## 2.2 Information Structure

While Tirole (1986) assumes that the principal (manager) lacks either the time or the knowledge required to supervise the agent, I assume that he may devote part of his time or have some knowledge if he decides to supervise the workforce. A further difference between my information structure and the one in Tirole (1986) is the following. In Tirole (1986), there are two states of nature (high and low productivity) and the supervisor observes the state in some cases while the manager never observes the state of nature. My construction differs in that both supervisor and manager observe a noisy signal of each worker's effort. The noisiness of the signal increases as one moves up in the hierarchy.

In particular, the manager observes a noisier signal than the supervisor's signal. Manager's signal is

$$S_{ik}^M = a_i + \epsilon_i + \mu_k \quad (3)$$

The supervisor's signal is:

$$S_i^J = a_i + \epsilon_i \quad (4)$$

where

$a_i$  is worker  $i$  effort choice

$\epsilon_i$  is an individual specific noise term such that  $\epsilon_i \sim_{iid} N(0, \sigma_\epsilon^2)$

$\mu_k$  is a group specific noise term such that  $\mu_k \sim_{iid} N(0, \sigma_{\mu_k}^2)$

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<sup>10</sup>This can be due to duplication costs in the supervisory task or due to potential collusive behavior between supervisors.

This information structure captures circumstances in which the supervisor is a local citizen who knows about local cultures while the manager is a foreigner.<sup>11</sup> Alternatively, it reflects the fact that the supervisor spends more time supervising the workforce while the manager multitasking prevents him from knowing group-specific characteristics. Under both interpretations, the manager is more likely to rely on categorization processes such as stereotyping. Stereotyping is a process by which individuals assign information about the group to the individual. It is a way of simplifying the world and making perceptual and cognitive processes more efficient (Allport,1954). Categorization processes are widely used when individuals deal with new environments or when they spend limited time interacting with each other.

It follows that the composition of the workforce determines the decision of the Manager to rely on a supervisor. Depending on contracting a supervisor or not, the manager will either observe  $S_{ik}^M$  for all  $i$  and  $k$ , or will rely on supervisor's communication of his signal,  $\hat{S}_i^J$  for all  $i$ . The manager cannot observe both signals simultaneously because if he hires a supervisor he fully externalizes supervision and spends no time with workers. Either of the signals is verifiable and can be the basis of the contract. Figure 1 summarizes the structure of the game.

I take the extreme assumption that supervisor's signal is not contaminated by group noise and workforce diversity to illustrate the key tensions at work. The distributional properties of the signals are common knowledge.

### 2.3 Contract space

The Manager can only offer workers linear contracts of the form:<sup>12</sup>

$$w_{ik} = \kappa_k + \delta S_k \tag{5}$$

where  $\delta$  is an  $N_k$ -dimensional row vector and  $S_k$  is an  $N_k$ -dimensional column vector.<sup>13</sup>

$S_k$  is equal to  $S_k^M$  if the manager relies on a flat organization and equal to  $\hat{S}^J$  if he hires a supervisor and operates under a hierarchical organization.

### 2.4 Perfect Information Benchmark

I derive the first-best effort level under the assumption that the manager perfectly observes individual effort and that it is verifiable by third parties. In

<sup>11</sup>For example in the case of an expatriate CEO in a subsidiary abroad.

<sup>12</sup>Under these assumptions, it has been proved that, if the principal can impose extreme punishments, linear contracts are not optimal. Nevertheless, their simplicity and intuitive closed-form solution, together with Holmstrom and Milgrom(1987) result (linear contracts are optimal under dynamic model with CARA preferences of principal and agent), justify my focus on the linear case.

<sup>13</sup>I already impose the fact that the compensation of a worker in group  $k$  will depend on workers signal of his same group but not on the signal of workers from other groups. This is because of the assumption that group noisiness is independent of each other.



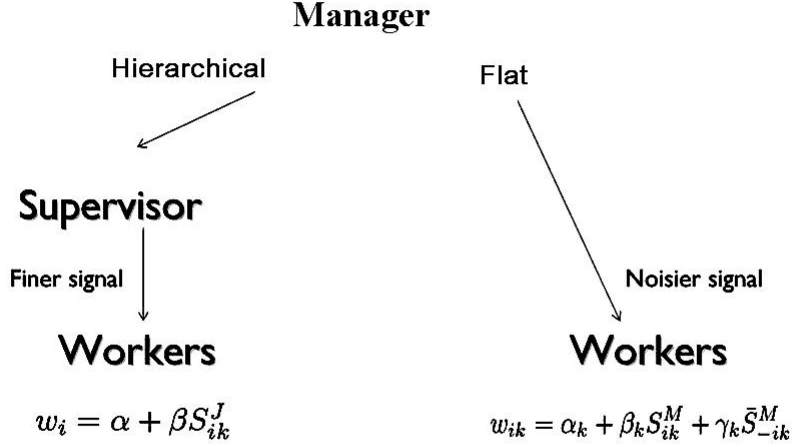


Figure 1: Structure of the game

this case, the manager can contract upon first-best effort,  $a_i^* = \frac{1}{c}$  offering a flat wage that ensures the worker's participation constraint is satisfied. In particular,  $w^* = w_o + \frac{1}{2c}$ .

Manager's payoff per worker in the first best scenario is:  
 $\Pi^{FB} = \frac{1}{2c} - w_o$

## 2.5 Flat Organization

In a flat organization the manager does not rely on a supervisor and observes the signal  $S_{ik}^M$  for all  $i$ . In that case, he chooses  $(\kappa_k, \beta_k, \gamma_k)$  to maximize expected profits subject to worker participation (IR) and incentive compatibility (IC) constrains:

$$IR_{ik} : E(-e^{-\eta[w_{ik} - \frac{1}{2}ca_i^2]}) \geq u(w_o); \quad (6)$$

$$IC_{ik} : a_i \in \operatorname{argmax} E(-e^{-\eta[w_{ik} - \frac{1}{2}ca_i^2]}); \quad (7)$$

The solution to the manager's problem under the flat organization is to

offer:<sup>14</sup>

$$w_{ik} = \alpha_k + \beta_k^F S_{ik}^M + \gamma_k^F \bar{S}_{-ik}^M \quad (8)$$

where  $\bar{S}_{-ik}^M$  is the average signal of worker i coworkers that belong to his social group k. The average signal of his group coworkers is a sufficient statistic of the sample under normality assumption.

$$\gamma_k^F = \frac{-\sigma_\mu^2}{\sigma_\epsilon^2 + \sigma_\mu^2} \beta_k^F$$

$$\beta_k^F = \alpha [1 + \frac{\sigma_\mu^4}{(\sigma_\epsilon^2 + \sigma_\mu^2)(N_k - 1)}]$$

$\beta_k^F$  is positive and depends negatively on the cost of effort, c, the degree of risk aversion,  $\eta$ , and the noisiness of the worker's effort signal,  $\sigma_\epsilon^2 + \sigma_\mu^2$ .  $\gamma_k^F$  is negative, as typical in relative performance evaluation with positively correlated common shocks.

**Proposition 1: In flat organizations, effort is a decreasing and concave function of workforce diversity.**

The intuition behind this result is the classical trade off between incentives and insurance. When diversity is high managers are less able to filter group cultural noise and infer the cultural characteristics (language, religious practices and festivities, eating habits, etc) of a given worker. In that case, workers are exposed to higher risk. Because workers are risk averse, it is more costly to provide incentives and the manager optimally decreases the steepness of the wage function. The intuition behind the concavity of the function is the following: When diversity is very high, decreasing diversity provides very valuable new information on group characteristics. This decreases worker's risk exposure and allows the manager to increase incentives significantly. On the contrary, when diversity is very low, the added value of decreasing it further is very small because the manager is already able to filter group noise to a big extent.

Manager's profit in a flat organization is:<sup>15</sup>

$$\Pi^F = \beta_k^F \frac{1}{c} - w_o - \eta \beta_k^F \tilde{\sigma}_f$$

where  $\tilde{\sigma}_f$  is the risk to which workers are exposed in a flat organization and is increasing in workforce diversity.<sup>16</sup>

## 2.6 Hierarchical Organization

I now derive the optimal contract when the manager decides to rely on a supervisor. Doing so, the manager has access to better information, but needs to ensure this information is truthfully revealed. Because the supervisor can

<sup>14</sup>F stands for flat organization

<sup>15</sup>Per worker of group k.

<sup>16</sup>In particular,  $\tilde{\sigma}_f = (\sigma_\epsilon^2 + \sigma_\mu^2) + \frac{\sigma_\mu^4}{(\sigma_\epsilon^2 + \sigma_\mu^2)^2} \frac{1}{N_k - 1} (\sigma_\epsilon^2 + \sigma_\mu^2 - 2)$

collude with the workforce and manipulate the signal, ensuring truth-telling is costly.

I first discuss the benchmark case, in which the supervisor reveals the signal he observes at no cost. Second, I present the solution when the manager needs to take into account supervisor's incentives.

### Benchmark case

In the benchmark case the supervisor reveals the signal he observes at no cost. That is,  $\hat{S}_i^J = S_i^J$ . In that case, the optimal linear contract is  $w_i = \alpha + \beta^{HH} S_{ik}^J$  where  $\beta^{HH} = \frac{1}{2\eta c\sigma_\epsilon^2}$ .<sup>17</sup>

**Proposition 2.** **In a hierarchical organization, if the supervisor truthfully reveals his signal to the manager, effort is higher than in a flat organization.**

That is, the wage function is steeper and effort is higher when the manager relies on a hypothetically honest supervisor. This results from the fact that the supervisor's signal of workers effort is less noisy, decreasing the cost of insuring workers and allowing the manager to give higher incentives.

### Incentive compatible contract

In reality, the supervisor can collude with the workforce and send a distorted signal. With probability  $p \in (0, 1)$  there is an external inspection of the factory and the manager learns if collusion took place. I assume it is bounded below and above.<sup>18</sup> I also assume that players cannot influence this probability. If the manager could do so, he would try to push  $p$  towards its upper bound to mitigate the informational problem.

Let  $b$  be the bonus per worker that the manager offers the supervisor conditional on not being found colluding with workers. I assume that the manager can give bonuses not penalties. If he could impose penalties, he would be able to ensure truth-telling at no cost by imposing a high enough penalty in the event that untruthful behavior is discovered.

Let  $\theta$  be the amount of distortion in the event of collusion such that the signal sent is  $\hat{S}_i^J = S_i^J + \theta$ . I assume  $\theta$  is an exogenous constant and is costless. Some types of manipulation can be considered exogenous without much controversy. For example, whether or not a worker attended work. Other instances

<sup>17</sup>HH denotes the solution under hierarchical organization and honest supervisor. The signal of worker  $i$  is independent of the signal of the rest of the workforce therefore  $\gamma_k^{HH} = 0$  is optimal.

<sup>18</sup>In particular, I assume

$$\frac{\sigma_\epsilon^2(\sigma_\epsilon^2 + \sigma_\mu^2)c\lambda\theta}{\sigma_\mu^2 + \sigma_\epsilon^2(\sigma_\epsilon^2 + \sigma_\mu^2)c\lambda\theta} > p > \frac{\sigma_\epsilon^2(\sigma_\epsilon^2 + \sigma_\mu^2 + \sigma_\mu^4)c\lambda\theta}{\sigma_\mu^2 + \sigma_\mu^4 + \sigma_\epsilon^2(\sigma_\epsilon^2 + \sigma_\mu^2 + \sigma_\mu^4)c\lambda\theta}. \quad (9)$$

of manipulation may be costly and/or endogenous. For example, how late did the worker arrive or how many hours he worked. The appendix extends the model to this latter case.<sup>19</sup> If the supervisor colludes with workers and he is not discovered doing so, the extra revenue generated is equal to  $(\beta + \gamma)\theta$ . Let  $\lambda$  be the bargaining power of the supervisor such that he appropriates  $\lambda(\beta + \gamma)\theta$ . The workforce appropriates  $(1 - \lambda)(\beta + \gamma)\theta$ . To ensure truth-telling the bonus offered by the manager must satisfy the supervisor's truth-telling constraint (SIC):  $pb \geq (1 - p)\lambda(\beta + \gamma)\theta$

The Manager chooses  $(b, \alpha, \beta, \gamma)$  to

Max  $E(\sum_{i=1}^N (a_i - w_i) - b)$  subject to  $IR_i, IC_i, SIC$  for all  $i$ .

The solution is

$$\begin{aligned} \gamma^H &= 0, \\ \beta^H &= \frac{1}{2\eta c \sigma_\epsilon^2} - \frac{(1-p)\lambda\theta}{p2\eta\sigma_\epsilon^2}. \end{aligned}$$

When relying on the supervisor's signal, the manager has a better signal and can provide higher incentives. Because higher incentives imply a greater temptation to collude, the manager will not take full advantage of the informational advantage and optimally revise incentives downward. How much he does so depends positively on the bargaining power of the supervisor with the workforce,  $\lambda$ , on the probability that manipulation is not discovered,  $1-p$ , and on the extent of manipulation,  $\theta$ .

**Trade-off 1: In a hierarchical organization, the manager faces a trade-off between providing incentives and ensuring truth-telling from the supervisor.**

**Proposition 3: In a hierarchical organization, effort is unrelated to workforce diversity. Furthermore, when the Manager has to design an incentive compatible contract, incentives are revised downwards.**

Manager's profit in a hierarchical organization is

$$\Pi^H = \frac{\beta^H}{c} - w_o - \eta\beta^{H^2}\sigma_\epsilon^2 - \frac{1-p}{p}\lambda\beta^H\theta$$

## 2.7 Diversity and the Shape of Organizations

**Trade-off 2: When deciding whether to rely on a supervisor, the manager balances the benefit of relying on better information and the cost of preventing collusion between the supervisor and the workforce.**

The manager optimally decides whether to rely on a supervisor or not by comparing  $\Pi^H$  and  $\Pi^F$ . Let  $\Delta\Pi \equiv \Pi^F - \Pi^H$  and  $\Delta\beta \equiv \beta^F - \beta^H$ . Then,

<sup>19</sup>The manager's problem is fundamentally unchanged.

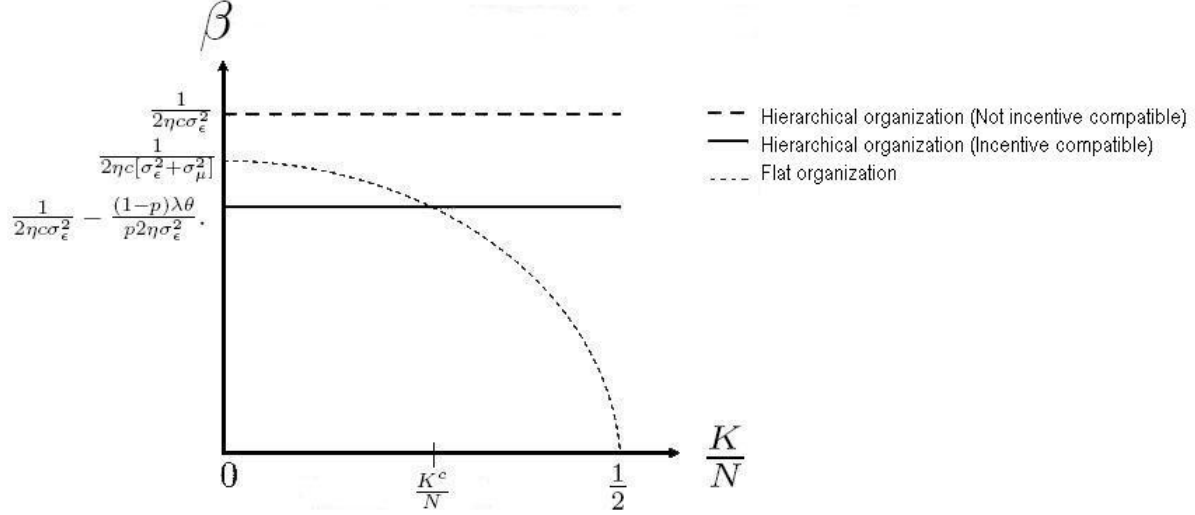


Figure 2: The incentive effect

$$\Delta\Pi = \underbrace{\frac{\Delta\beta}{c}}_{\text{Incentive}} - \underbrace{\eta(\beta^{F^2}\tilde{\sigma}_f - \beta^{H^2}\sigma_\epsilon^2)}_{\text{Insurance}} + \underbrace{\frac{1-p}{p}\lambda(\beta^H)\theta}_{\text{Supervisor}},$$

The sign of  $\Delta\Pi$  depends on the interaction of three effects. Namely, the incentive, insurance and supervisor effects.

As Figure 2 depicts, the sign of the incentive effect can be positive or negative and depends on the degree of diversity. When diversity is high, relying on the supervisor's finer signal is very valuable and compensates the need to account for collusion.<sup>20</sup> Consequently, the incentives given in a flat organization are lower than those given in a hierarchical one. That is, the incentive effect is negative. On the other hand, when workforce diversity is low, the incentive effect is positive. The reason is that in that case the supervisor's informational advantage is less valuable and does not compensate the need to account for collusion.<sup>21</sup> To sum up, as diversity increases, the incentive effect decrease and the manager will be more likely, ceteris paribus, to rely on a supervisor.

The insurance effect captures the cost of insuring workers against the risk-

<sup>20</sup>Technically, diversity is high when  $\frac{K}{N} > \frac{K^c}{N}$  and it is low when  $\frac{K}{N} < \frac{K^c}{N}$

<sup>21</sup>The boundary condition (9) and the fact that  $\beta^F$  is a continuous and monotonic function ensures that there exists a unique  $\frac{K^c}{N}$  in the domain of  $\frac{K}{N}$  such that  $\Delta\beta = 0$

ness of their wages. *Ceteris paribus*, this cost is higher in a flat organizations because  $\tilde{\sigma}_f > \sigma_\epsilon^2$ . Furthermore, the relative exposure to risk, holding incentives constant, increases with diversity as  $\tilde{\sigma}_f$  is increasing in workforce diversity.

Finally, given that the manager has to give a bonus to ensure truth-telling, relying on a supervisor cost has an added cost. This is what the supervisor effect captures.

Depending on this three considerations, the manager will decide the structure of the organization. Higher diversity pushes the manager to rely on a supervisor and viceversa.

**Proposition 4: The optimal organization structure is a function of workforce diversity. Higher diversity increases the value of relying on a hierarchical organization.**

## 2.8 Diversity and Labor Productivity

**Proposition 5: The relationship between diversity and effort is non linear and depends on the organization structure**

**Corollary: Transplanting a flat organization into a highly diverse society will decrease productivity (and viceversa)**

The relation between diversity and effort is institutionally mediated. In flat organizations, higher diversity leads to lower effort. In hierarchical organizations, diversity and effort are unrelated. The non linearity results from the fact that as diversity changes the institutional optimal choice may also change. Finally, although empirically one may observe that hierarchical organizations are less efficient than flat organizations, transplanting less bureaucratic organizations to a highly diverse society may decrease efficiency substantially. In general, this shows how understanding the social determinants of institutions is essential and how damaging can transplantation of institutions be.

## 2.9 Conclusion

Workforce diversity decreases optimal incentives in flat organizations and multiplies the number of layers that firms and bureaucracies find necessary. Informational asymmetries resulting from cognitive processes such as categorization and stereotyping are behind this result. These have not only organizational effects but economic consequences as well. Studying the social determinants of organizations and institutions is essential to understanding the role of institutions in economic development. This model constitutes a first step towards this understanding and is extended in the appendix to consider, among other issues, the impact of diversity on the size of the firm.

The extent of information asymmetries between managers and workers was certainly very high in British India, and determined the heavy reliance on supervisors, also called jobbers, and, I will argue, subsequent failure of the industry to improve productivity. The next sections discuss this historical case study and compare Japanese and British India labor market institutions design and evolution.

### 3 The Spread of Industrialization in Japan and British India

By mid-19<sup>th</sup> century it became efficient to build cotton spinning mills in low-wage economies (Allen, 2009), such as India and Japan. The first cotton spinning mill in Bombay was set up in 1854 and, a decade later, the first was erected in Isonohama, Japan. In 1910, one Indian textile mill worker produced as much output as a Japanese worker and one fourth of what a British worker did (Clark, 1987). By 1938, labor productivity had improved dramatically in Japan but very little in British India where, by then, workers produced one fourth of what Japanese workers did (Wolcott and Clark, 1999). Why was the spread of Industrialization successful in Japan and not in British India? Why did their textile industries diverge during the interwar period, not sooner or later? And why did British India textile industry low productivity persist?

To answer these questions I compare Japan and British India (1) economic structures, managerial challenges and labor market institutions at the onset of industrialization, (2) diverging experiences during the interwar period, (3) social and workforce diversity. I find that Japan and British India were at a similar development stage, that managers in both countries faced similar initial challenges and relied on intermediaries to a varying degree to address them. The interwar period saw the replacement of these intermediaries in Japan but not in India. My explanation of the divergence is the following: in British India, workforce diversity and colonization implied high information asymmetries between workers and managers. Consequently, managers externalized both recruitment and supervision on labor market intermediaries. Effectively separated from each other, information asymmetries were maintained implying the persistence of intermediaries and of low productivity. In Japan, low workforce diversity and nationalism implied low information asymmetries between workers and managers, which only externalized recruitment. Direct contact between managers and workers reduced information asymmetries over time and allowed Japanese managers to replace intermediaries and achieve higher productivity in the interwar period. I apply Greif's (2006) methodology to understand the disparate design and evolution of labor market institutions in both countries. I argue that labor market intermediaries were a *self-reinforcing institution* in British India while an *undermining institution* in Japan. Information asymmetries, at the root of this difference, were a *quasi-parameter*. I also discuss alternative explanations, based on cultural or political arguments, and why they provide unsatisfactory answers to explain the nature and timing of the divergence.

#### 3.1 Japan and British India at the onset of industrialization

At the onset of industrialization, Japan and British India were at similar developmental stages. Both were agrarian economies that had developed a traditional hand spinning and weaving industry over the centuries. In 1888 Japan,

the contribution of manufacturing to GNP was 12 percent and by 1938, industry provided 28.7 percent of total employment (Hunter, 2003). In 1911, 13 percent of all working classes in Bombay Presidency were industrial workers (British India census, 1911). The following table compares essential features of both economies at the onset of industrialization.

|                           | <b>Japan</b>              | <b>British India</b> |
|---------------------------|---------------------------|----------------------|
| Agrarian economies        | ✓                         | ✓                    |
| Hand weaving and spinning | ✓                         | ✓                    |
| First textile mill        | 1867                      | 1854                 |
| Urban large scale         | ✓                         | ✓                    |
| Transport network         | Developing and incomplete | idem                 |
| Female participation      | high                      | low                  |
| Literacy                  | low                       | low                  |
| Unionization              | 1920s                     | 1920s                |
| Main imports from         | Great Britain             | Great Britain        |
| Use of tariffs            | low                       | low                  |
| State resources           | small, land revenues      | small, land revenues |
| <b>State</b>              | Nationalism               | Colonialism          |
| <b>Social diversity</b>   | low                       | high                 |

Table 1: Japan and British India at the onset of industrialization

In both countries managers faced similar fundamental challenges, namely how to *attract, retain, and control* an originally rural labor force.

To attract workers to the mills, managers initially relied on labor-market intermediaries jointly with informal channels of recruitment. Expanding, but incomplete, transport networks, and illiteracy among potential workers were factors shaping this initial institutional response to the recruitment struggle in both countries. The recruiter acted as a channel of information and communication.<sup>22</sup> Frequent abuses of his position generated complaints from the authorities and the public. As early as 1890, abuses were highlighted in the Japanese press and by authorities (Hunter, 2003) as well as in British India.

The rural connection of their workforce meant that workers went back to their villages regularly, resulting in low retention rates. Turnover rates in Bombay and Osaka mills were very high in the 1890s.

The third challenge managers faced was how to control their workers. Although many have argued that Japanese workers were better by nature of their preferences and by virtue of their nationalist pride (Pearse, 1930), in 1898 Japanese employers perceived them as being illiterate, uneducated, and undisciplined (Hunter, 2003). Similarly, in 1903 American missionary Sidney Gulick

<sup>22</sup>As Morris points out “in Bombay there was an immediate linguistic problem arising from the fact that owners, managers and the first skilled workers spoke either Gujarati or English but not Marathi and thus were rather effectively cut off from efficient communication with the workforce.”



observed that many Japanese “give an impression of being lazy and utterly indifferent to the passage of time”. In 1907 the majority of British India managers believed that low effort was a cause of low productivity, as an analysis of managerial opinions from Parliamentary Papers reveals. These beliefs influenced early managerial policies: poor working conditions and long hours of work were paramount in both countries’ incipient textile industries. The labor force was unprotected with respect of these conditions. In fact, unionization movements were slow to appear. In Japan, the first union appeared in 1916, while in the province of Bombay unionization emerged in the 1920s.

### 3.2 Japan and British India diverging experiences

While labor market intermediaries persisted in British India they did not in Japan. In Japan, the cotton textile industry took the lead in implementing managerial changes during the interwar period (see Hunter, 2003, for a description). These changes addressed each of the three basic labor-related challenges, and reduced the reliance on labor-market intermediaries in favor of more direct labor management policies.<sup>23</sup> In what follows, I describe these new policies and compare them with the state of affairs in British India.

In Japan, direct recruitment efforts spread during the interwar years and the number of registered recruiters decreased over time. Furthermore, managerial changes that improved retention and control of workers implied lower turnover rates, thus decreasing the need to recruit new workers. Better retention rates were also achieved, by increasing the involvement of women workers in contractual matters, and the use of monetary and non-monetary incentives. Turnover decreased substantially in Japan during interwar years while it persisted in Bombay.<sup>24</sup>

The development of the dormitory system in Japan was another innovation that contributed both to decreased turnover and to increased control over workers. It became a key element in the relation between employer and employee. It was the cotton spinning industry that most consistently promoted the dormitory system as an integral part of its labor management policies. In 1914, 76 percent of Japanese female cotton spinning workers were housed in company dormitories, an increase from 50 percent in 1890s. The percentage was 86 in 1948. By contrast, British India textile industry managers provided limited housing to their workforce. Jobbers did provide housing to newly recruited workers.<sup>25</sup> In Japan, absentee rates decreased among workers housed in dormitories. After World War I, integrated cotton spinning and weaving mills also improved their conditions. Dormitories improved living conditions and helped to reduce absenteeism and improve workforce satisfaction.

Managerial changes were also aimed at improving the education of workers.

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<sup>23</sup>The three basic challenges were how to recruit, retain, and control workers.

<sup>24</sup>In 1931 the Royal Commission on Labour in British India pointed out “continuous turnover of employees, many of whom may be entirely new to the particular factory and to its machines and methods of working”

<sup>25</sup>Report on an Enquiry into working class family budgets in Bombay City 1933

While skill requirements were not very high for average textile operatives, they were seen as an element of labor control both by managers and by the state.<sup>26</sup> By 1924 a labor force survey documents that two out of three Japanese female factory workers completed the standard six years of primary education (Hunter, 2003). The highly educated workforce that Arno Pearse observed in his trip to Japan was not the result of improvisation, but rather of managerial and state efforts. In British India education efforts remained limited.

The interwar period also saw the improvement of worker health and safety as well as shorter hours of work in Japan. “By 1930 the large cotton firms had an estimated one doctor and five nurses per 1000 workers” (Hunter, 2003) Finally, organizational changes came hand in hand with changes in attitudes and opinions regarding the quality of workers. These managerial changes surely account for part of the productivity divergence between British India and Japan industries. In 1929, Arno Pearse noted that

essential necessity for welfare work as a means for attracting labour from the country districts to the mills...The Japanese employers, **by skillfull organization**, have turned it into an advantage to themselves and to their operative. (emphasis added)

### 3.3 Explaining the divergence: information asymmetries and labor market institutions

In this section, I argue that workforce diversity and state ideology are essential pieces to explain the productivity divergence. To do so I apply Avner Greif’s (2006) framework to the study of institutions. I then briefly discuss alternative explanations of the divergence and why they fail to account for the timing and nature of it.

In Japan, the focus on the gender, age and agricultural background of workers acted as a homogenizing factor in employers’ perception of their workforce.<sup>27</sup> According to Takahashi Kamekichi (1937), Japanese women workers “were an organic whole, consisting of the existence of many young, unmarried farmers’s daughters working.” On the contrary, British India managers faced a highly diverse workforce in terms of caste, birthplace, religion and language.

Why did managers in British India not hire a single group of workers? The need for a continuous labor supply in a very diverse society, the practical impossibility of discriminating workers in large scale factories, the high search costs involved in finding workers and managers fear of workers cooperation limited their practical ability or willingness to discriminate workers. Consequently, the diversity of the population permeated the mill walls.<sup>28</sup> Social diversity of the

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<sup>26</sup> “a tool for inculcating disciplined behavior and desired social values” (Hunter, 2003).

<sup>27</sup> “Textiles employers, while sensitive in some respects to the different local backgrounds of their workforces, seem in some respects to have completely ignored it, assuming that all workers from agricultural backgrounds acted and thought the same” (Hunter, 2003)

<sup>28</sup> Why did supervisors in British India not run the vertical structure? The lack of resources, the need to deal with the colonial power, and the need to have access to capital markets meant that the locally developed skills and information were of little use to manage the mills.

Japanese population was much smaller: “at the time of Restoration, in spite of internal dissensions, the people of Japan possessed an underlying sense of national unity which was the product of her geographical position, of linguistic uniformity and of her long history” (Allen, 1946) Furthermore, Japanese mills focused their recruitment on particular regions leading to “very high concentrations of workers from the same region in individual mills” (Hunter, 2003).

Japanese managers heavily and increasingly relied on young female workers. In the 1880s, 70 percent of cotton spinning workers in Japan were female and a few decades later, in 1914, their share reached 80 percent (Hunter, 2003). In contrast, British India textile workers were mainly young adult men. In 1901, female workers were 25 percent of cotton spinning, sizing and weaving workers. A decade later they were still less than a third of the workforce. In 1921, only 21 percent of cotton spinning factory workers in Bombay city were female (British India Census, 1921). This state of affairs persisted, as the following quote from 1933 illustrates:<sup>29</sup> “Unlike such important textile centres as Lanchashire and Japan, the bulk of the labour employed in the cotton mill industry of Bombay City continues to be male labour and only about 20 per cent of the total labour force is female.” One of the reasons behind such a disparate gender composition of factory workers is the female labor force participation in both economies. Women participation in manufacture and agriculture was higher in Japan than in British India. While 57 percent of spinning and weaving workers in the traditional home industry were female, only 23 percent were so in factories in Bombay city in 1921. Japanese workers were also younger than their British India counterparts. They were mainly in their teens and early twenties. In 1921, Bombay city cotton textile workers younger than 18 represented only 11 percent of the workforce.<sup>30</sup>

While Japanese managers perceived their workforce as an homogeneous group, British India managers often relied on stereotypes to note the existence of differences among the different groups they employed. For example, an inspector in Calcutta in 1907 was informed that “the up-countryman was a more careful worker.”<sup>31</sup> This is to be expected given the highly diverse British India society, as social psychology insights predict, (Stangor, 2000):

social categorization is more likely to occur in situations that demand our cognitive resources, for example, when there is a lot of information about others available to be processed, **a lot of different people to learn about**, or are other things that need to be done at the same time (emphasis added)

In addition to the disparate labor force diversity in both countries, state ideology contributed to increase information asymmetries in British India. The contrary was true in Japan. In particular, the colonial state was a *complementary institution* of jobbers, as it crystalized social diversity in the systematic categorization undertaken in population census and its laissez-faire policies. These

<sup>29</sup>The Report on an Enquiry into working class family budgets in Bombay city, 1933.

<sup>30</sup>Report on an enquiry into the wages and hours of labour in the cotton mill industry, 1921.

<sup>31</sup>Parliamentary papers 1907

policies relied on establishing close relations with high castes in India at the local level, reinforcing its effective diversity. On the contrary, Japanese state policies fostered nationalism and reduced the reliance on labor market intermediaries. In 1750, Japan was a patchwork of baronies, militarily at peace but economically at war. Two hundred sixty separate domains were united under the suzerainty of the Tokugawa Shogun. During the middle of the 19th century, western powers established commercial treaties with Japan, opening its market to imports. The traditional Japanese warrior-elite, the samurai, rose to challenge. The new regime converted the alliance of competing fiefdoms into a unified industrial and imperialist state and involved a transformation of the peripheries into a Tokyo-centered national economy.

Consequently, information asymmetries were pervasive in British India while not in Japan, shaping the design and the dynamics of labor market institutions. To understand institutional dynamics I rely on Greif (2006) methodology.

Greif (2006) defines institutions as an interface between the rules of the game defining a concrete economic interaction and decision makers. This interface is necessary to generate a common cognitive system, information, and coordination. Institutions are, therefore, part of an equilibrium outcome. How do institutions change? To explain institutional dynamics, Greif introduces the concept of quasi-parameters. That is, features of the game that are exogenous in the short run, but endogenous in the long run. A self-reinforcing (undermining) institution is an institution that generates a regularity of behavior such that it is an equilibrium on a wider (smaller) set of parameter values than the initial parameter set. Therefore, as time passes the former is more likely to persist than the latter.

In British India intermediaries persisted because they were a *self-reinforcing Institution*. In particular, the high diversity of the workforce led managers to externalize recruitment and supervision on labor-market intermediaries, also called jobbers. The jobber's supervisory role implies that they prevented direct communication between employers and workers, decreased the incentives of employers to learn about their workers characteristics, and made stereotypes more likely to be maintained.<sup>32</sup> That is, the jobber effectively increased, or at least maintained, information asymmetries, making himself even more valuable to the manager. In contrast, intermediaries were replaced in Japan by productivity enhancing institutions, as discussed previously, because they were an *undermining institution*. The low diversity of their workforce meant that Japanese managers used intermediaries only as recruiters.<sup>33</sup> Consequently, the small informational advantage of intermediaries vanished over time, as employers and workers became familiar with each other. Once they did, they were able to introduce managerial changes and decrease their reliance on intermediaries. Informational asymmetries, arising from the diversity of the workforce,

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<sup>32</sup>Chandavarkar (2007) argues that “by operating through the jobber system, these groups perpetuated their own position and tried to exclude other. In these ways, the caste, communal and linguistic differences were, in some measure, reproduced within the labour process.”

<sup>33</sup>Hunter(2003) “in the textile industries intermediaries were rarely engaged in labour management.”

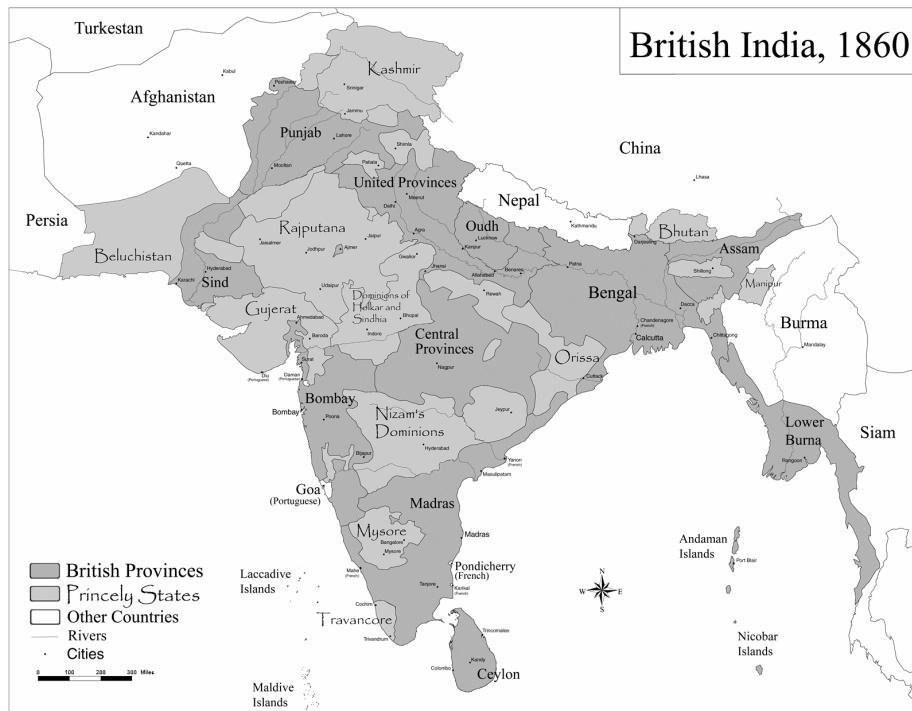
were, therefore, a *quasi-parameter* and drove institutional design and dynamics in both countries.

The emphasis on information asymmetries and labor market institutions offers a dynamic explanation of the productivity differentials and their evolution. Furthermore, it is consistent with the nature of the divergence, that took place via institutional changes in Japan. This is not the case of two sets of alternative explanations, which I briefly discuss next.

Cultural based explanations, such as workers' preferences (Clark, 1987) fail to account for the timing of the divergence, as culture is a slow moving institution (Roland, 2004). Furthermore, consider the fact that in 1903 the American missionary Sidney Gulick observed that many Japanese "give an impression of being lazy and utterly indifferent to the passage of time" while by 1930 Arno Pearse refers to Japanese textile workers habits saying that their "punctuality is ingrained". As Gupta (2008) argues "as cultural preferences are slow to change, it is difficult to explain the dramatic change in Japan in terms of sudden changes in effort leading to rise in wages."

Political based explanations fail to explain the timing but most of all the nature of the divergence. They stress either the fact that Japanese success was the result of state led development policies or that British colonial policies were exploitative and directed to the interest of the metropolis. Regarding the former, the Japanese government focused its policies on sectors other than the textile industry, such as shipbuilding and engineering. It is in the textile industry, nevertheless, that most remarkable growth materialized during the interwar period. This growth materialized in private hands. While most mills in 1886 had government sponsored origins, the expansion of the industry took place in private hands. In particular, government pilot plants failed, and were bought by new or existing private firms. From 1914 up to 1931, governmental subsidies and direct control of industries were small. "Government attempts to control and direct industrial life were thus limited in scope and tentative in method" (Allen, 1946). Similarly, trade policies were not especially protective of the textile industry in Japan and the use of tariffs was moderate and significant only in iron, steel, sugar, cooper, dyestuffs and woollen industries (ibid.). Regarding the latter, British India colonial policies were the result of a balance of power between three levels of government. In particular, of the Indian Office in London, the head of the government in India and the provincial governments. Far from functioning in concert, they defended different priorities. These were, trade and defense, finances and local development respectively. Before World War I, free trade between British India and the metropolis was a major goal of the colonial rule. After the War, the influence of Lancashire declined, protective tariffs increased and the balance of power turned in favor of India.

While the evolution of labor market institutions in Japan and British India is consistent with this paper's hypothesis, it is likely that a combination of factors may be behind the divergence. Acknowledging the limitations of cross-country comparisons, I next turn to compare the evolution of the three main textile centers within the Province of Bombay.



#### 4 Within British India evidence 1857-1947

In 1854, the first cotton spinning mill was established in Bombay. Due to transportation advantage and moist atmosphere, Bombay province became the major mill center in British India. By August 1929 the province located 219 out of the 344 mills in British India. Mill building was undertaken by English, Parsee, Hindu, and Muslim managers. The three biggest cotton textile centers in the province were the cities of Bombay, Ahmedabad and Solapur. In 1925 they employed 149609, 52745 and 16975 workers respectively.<sup>34</sup> In 1934, Bombay loss predominance to the advantage of Ahmedabad while Solapur remained stable. By then, their cotton mill industries employed 95367, 80866 and 18198 workers respectively. As many as fourteen other textile centers had developed a cotton textile industry, although none of them reached the 3000 workers cap.

In this part, I show that the mechanism described to explain British India and Japan cotton textile industries divergence was at play within India. To do so, I compare the cotton textile industries of Bombay, Ahmedabad, and Solapur cities. I find that textile centers with higher workforce diversity had bigger supervisory burdens. These resulted into higher organizational costs and influenced the formation of managerial beliefs and their policies.

<sup>34</sup>Report on an Enquiry into Family Budgets of Cotton Mill Workers in Sholapur City

## 4.1 Data sources and methodology

### Data sources

I collected and digitized data from British India Censuses, Parliamentary papers, General wage census, and other reports from the Labour Office.<sup>35</sup> To construct measures of the social diversity of the population at the district and city level, I used the decennial Census of the cities of Bombay and the Census of Bombay Presidency from 1872 up to 1941. To assess social diversity within the cotton textile industry, I rely on the “Report on an Enquiry into Working Class Family Budgets in Bombay city” and similar ones for Cotton Mill Workers in Ahmedabad and Solapur during the 1920s and 1930s. I also rely on Census data to assess the social diversity of managers and jobbers for certain years and locations. To quantify the burden of jobbers in the organization of mills I rely on reports from the Labour Office in 1921, 1923 and 1925. In particular, I use “The Report on an Enquiry into Wages and Hours of Labour in the Cotton Mill Industry” for 1921, 1923 and 1925. Finally, to infer contemporaries beliefs on the causes of low productivity I rely on the “Parliament Papers: Evidence taken by the Factory Labour Commission 1907-08,” which contains the oral and/or written testimony of a total of 833 witnesses, of which 105 are inspectors, 3 are government officials, 164 are managers or owners and 537 are operatives in British India. I use the evidence from the Indian Industrial Commission of 1916-18, the Royal Commission on Labour in India of 1929 and the Report of Conditions in the Textile Industry of India of 1927<sup>36</sup> to contextualize the evidence from 1907-08.

### Methodology

I next describe how I construct the measures of diversity, how I quantify the burden of jobbers and how I systematize the opinion of contemporaries to infer managerial beliefs.

The diversity measure I use captures the probability that two randomly drawn individuals in a given location belong to a different group. Formally,

$$Diversity_j = 1 - \sum_i (group_{ij})^2 \quad (10)$$

where  $group_{ij}$  is the share of the population belongin to group i and j is the dimension along which groups are defined (religion, caste, language). Measuring social diversity, particularly in India, is, nevertheless, intellectually challenging.<sup>37</sup> Furthermore, as individuals belong simultaneously to different groups that are not necessarily exclusive, these measures have conceptual limitations

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<sup>35</sup>Copies of the original sources are available in the appendix

<sup>36</sup>From the National Agriculture Library

<sup>37</sup>The following quote from Amartya Sen in “The Argumentative Indian” illustrates the practical limitations of these measures “India is an immensely diverse country with many distinct pursuits, vastly disparate convictions, widely divergent customs and a veritable feast of viewpoints.”

as well.<sup>38</sup> For the purpose of the current enquiry, nevertheless, these measures are useful. They capture the perceived diversity of the colonial administration and its categorization of the social environment. Finally, I do not construct measures of caste diversity of the population due to conceptual and practical limitations. I do provide measures of workforce diversity along caste divisions. In the Census of Bombay of 1871, more than 300 sub-divisions of castes are reported!

To quantify the burden of supervision, I compute the fraction of mill operatives,  $M$ , in a given production unit,  $i$ , that are jobbers,  $J$ . Formally:

$$Burden_i = \frac{\sum J_i}{\sum M_i} \quad (11)$$

To infer managerial beliefs from the opinions expressed in parliamentary papers, I proceed as follows: I systematize the qualitative evidence from the *Parliament Papers: Evidence taken by the Factory Labour Commission 1907-08* that contains the oral and/or written testimony of 164 managers. I categorize managerial comments into eight potential causes of low productivity, and whether a given manager argues it is or not a cause of inefficiency.<sup>39</sup> I distinguish between exogenous and endogenous causes. Exogenous causes are causes that managerial policies could not affect and include low effort, culture, preferences, climate and health (due to behavior outside the mill). Causes that managerial policies could change (endogenous causes) include health (due to work in the mills), education, long working hours, working conditions and coordination problem. I compute the percentage of managers believing a given factor explained (or did not) low productivity levels. Finally, I obtain information on the sources of labor for 46 of the managers. With this information I categorize workforce diversity as high if labor is said to come from three or more sources and as low if it comes mainly from one source.

## 4.2 Social diversity and characteristics of the population

In this section, I discuss the social diversity and characteristics of the inhabitants of the cities of Bombay, Ahmedabad, and Solapur. Table 6 in the appendix summarizes the following discussion.

The predominant religions in British India were Hinduism, Islam, Jainism, Zoroastrianism, Christianity, and Judaism. Religious diversity remained pretty stable over time. Bombay city and Solapur were the more and less religiously diverse cities respectively. Solapur had a predominantly Hindu population. Ahmedabad had higher proportions of Muslims and Jains than Solapur. Bombay had higher proportions of Zoroastrians and Christians than the other two cities. As for linguistic diversity, in 1911, the Census of Bombay specified as many as 22 different languages spoken in Bombay. Although districts were effectively defined along linguistic lines, linguistic diversity was very high in the

<sup>38</sup>For a discussion of this issue refer for example to "Identity and Violence" by Amartya Sen

<sup>39</sup>Examples of such comments are included in the appendix.



cities of Bombay.<sup>40</sup> Their polyglot character was largely due to the immigrant origin of their populations.<sup>41</sup> Migrants were coming from a variety of locations. In 1881 the probability that two migrants into the city of Bombay came from a different district was slightly lower than nine out of ten, cap that was attained in 1921. As for the bulk of migrants going to Ahmedabad they were also a highly diverse group. In 1921, for example, the probability that two randomly chosen migrants into the city were from different district was of three out of four. Migration flows were mainly the result of labor opportunities emerging in the cities, among others from the developing mechanized textile industry. These opportunities drove cities growth from 1891 up to 1941. Bombay city, characterized by the Census as a city of workers, remained the biggest city by far, followed by Ahmedabad while Solapur population size lagged behind.

The source of cities growth helps explaining their characteristics. Migration flows increased not only city size but also their density, the proportion of foreign born and decreased the relative size of female population. The number of female for every hundred males also indicates the extent of temporary migration, because temporary migrants were almost exclusively young adult male. The highest proportion of females in Solapur indicates that its population was much more stable, as the Census of the cities of Bombay 1911 pointed out “Sholapur operative is not a mere bird of passage during the slack season in this village but has come with his family to settle there for good.”

Finally, literacy rates and English literacy were higher in Bombay city, followed by Ahmedabad and Solapur that exhibited the lowest literacy rates. Literacy in urban centers was higher than in rural areas and varied along religious and gender lines.<sup>42</sup> English literacy was much lower for all groups but improved over time. Excluding non Indian Christians, English education was commonest among Parses, with 34.5 percent able to read and write in English. English literacy was smaller than average among Hindus and Muslims and about average among Jains. In 1911, it reached 1.7 percent of males and 0.3 percent females. By 1941, four percent of the presidency population were English literate. In Bombay city it attained sixteen percent of the population. Ahmedabad and Sholapur also improved in that respect, but did not reach the five percent cap. Literacy differences may be explained, in part, by the age profile of urban centers. In Bombay city children and older people represented a smaller share of the population than in Ahmedabad and Solapur.<sup>43</sup>

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<sup>40</sup>In particular, 94 percent of the population in the Gujarat spoke Gujarati, 93 percent of the population in Konkan spoke Marathi and 89 percent in the Deccan spoke Gujarati as well. The extent of bilingual individuals was quite small. As late as 1931, out of the speakers of the main ten languages in Bombay city, 9.2 percent were bilingual while the rest spoke only their mother tongue.

<sup>41</sup>In fact, the proportion of the population born outside the city is a good proxy of linguistic diversity in urban centers.

<sup>42</sup>The cities of Bombay literacy levels reached almost thirty percent among male population as soon as 1911, while the whole presidency counted seven percent of literate. Literacy rates were higher among men and among Christian and Parsee. Muslims followed by Hindus had very low literacy rates. Jains and Jews were in between.

<sup>43</sup>Refer to Table 11 in the appendix

### 4.3 Social diversity of the working class

Table 2 provides new diversity measures in terms of religion, caste and place of birth of the three cities working class. In Solapur the working class was solely composed of cotton textile workers. In Ahmedabad, they represented ninety percent of factory workers as of 1934. Bombay working class was composed of both textile and non textile workers. As these measures show, and the narrative evidence discussed later confirms, Ahmedabad working class stands out as the most diverse. Although to a lesser extent, Bombay city working class was also diverse and migratory in character. On the contrary, Solapur working class was local and relatively less diverse.<sup>44</sup> The differences in the extent of diversity are notable. For example, going from birthplace diversity of 0.52 in Solapur to 0.66 in Ahmedabad can be interpreted as follows: If groups were equal sized, it would mean that Solapur workers were born in two different locations versus three in Ahmedabad. Under this assumption, birth-place diversity of 0.82 in 1933 in Ahmedabad would mean that workers were born in five different locations.

|             | <b>Bombay 1932</b> | <b>Ahmedabad 1933</b> | <b>Ahmedabad 1926</b> | <b>Sholapur 1925</b> |
|-------------|--------------------|-----------------------|-----------------------|----------------------|
| Place-birth | 0.65               | 0.82                  | 0.66                  | 0.52                 |
| Caste       | 0.61               | 0.87                  | na                    | 0.71                 |
| Religious   | 0.12               | 0.33                  | na                    | 0.31                 |
| Local*      | 62                 | 49                    | 80                    | 93                   |

Table 2: Diversity of the working class

*Diversity:* measured as the probability that two randomly chosen workers belong to the same group(defined along religious, caste or place of birth lines)

*Sources:* Report on an Enquiry into Working Class Family Budgets in Bombay city 1933, Report on an Enquiry into Working Class Family Budgets in Ahmedabad 1933, Ibid. 1926, Report on an Enquiry into Family Budgets of Cotton Mill Workers in Solapur 1925

*Note:* \*Percentage of workers from the city's district

Regardless of the diversity dimension considered, Ahmedabad working class was the most diverse.<sup>45</sup> It is also the working class with a smaller proportion of workers born in the city's district. In fact, three out of four families reported expenditures on traveling to and from their native place. The "Report on an enquiry into working class family budgets in Ahmedabad" of 1933 stresses the migratory character of its working class, "over three fourths of the industrial population of Ahmedabad is migratory in character." The "Report on an enquiry into working class family budgets in Ahmedabad" of 1926 points out that unlike in Bombay and Solapur, there is not any one caste from whose member the bulk of the working class is drawn. No fewer than seventy different castes were distinguished among Hindu working classes. Chamars, Dheds, Thakerdas, Patidars and Waghris are said to be the predominant castes.

Similarly, the migratory character of Bombay's working class is reflected

<sup>44</sup>I include 1926 and 1933 for Ahmedabad because the city industrial expansion implied an increasingly diverse working class. Bombay city industry did not expand and to some extent decrease over the period while Solapur expansion was modest

<sup>45</sup>The appendix includes the distribution of the cities working class according to caste and religion

by the fact that in 1933 no less than 84 percent of its population reported spending on traveling to and from their native place, yearly or more frequently. In that same year, the probability that two randomly chosen workers were born in different places was of two out of three. While the majority of workers were Hindus, they did not belong to a single caste. In particular, the probability that two randomly chosen cotton textile workers belonged to a different caste was of two out of three.

In contrast with the working classes of Ahmedabad and Bombay, Solapur's workforce was relatively local and less diverse. In 1921 the Census Superintendent noted that "In the matter of birth-place Sholapur is not at all cosmopolitan inspite of its industrialized conditions. It draws its labour from the immediate neighborhood." Similarly, the "Report on an Enquiry into Family Budgets of Cotton Mill Workers in Sholapur city" noted that this view was "...completely borne out by the results of the present enquiry. It will be seen that over 60 percent of the workers come from the City itself or the surrounding villages. A little over 32 per cent, hail from the Deccan, particularly from Hyderabad territory which is very close to the Sholapur district." The report further emphasizes the contrasting condition with respect to Bombay city working class. "This proximity of the native places of the cotton mill workers in Sholapur is in contrast with the conditions in Bombay City." In terms of caste, as many as twenty different castes were distinguished. Yet, Marathas represented the biggest share, in particular, forty percent of workers.

In light of the social diversity of the population and working classes of the cities of Bombay province, the following quotes acquire special relevance:

It is also necessary that we realize the factory as something more than a place of employment, that has both a social and education background, that industrial establishments are social units<sup>46</sup>

It seemed surprising that to the jobber/worker what mattered more was not so much 'efficiency' as social skill<sup>47</sup>

#### 4.4 Organization and Diversity

Labor market intermediaries in British India cotton textile industry, also called jobbers, performed two tasks: recruitment and supervision. While the literature has widely discussed the figure of the jobber (Roy, 2008), no quantitative assessment of their importance over time and across space has been undertaken. This quantification is essential, nevertheless, to assess the importance of jobbers in the organization of mills. It is also needed to assess whether jobbers persisted and whether local conditions and not India's uniqueness led to their reliance.

Table 8 provides new measures of the burden of jobbers, measured as the percentage of male mill operatives that are jobbers. Ahmedabad, the center

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<sup>46</sup>Report 1950, P.Kanji Chairman

<sup>47</sup>Anonymous English observer. Cited in British India History of Science, Philosophy and Culture in Indian Civilization, Volume VIII

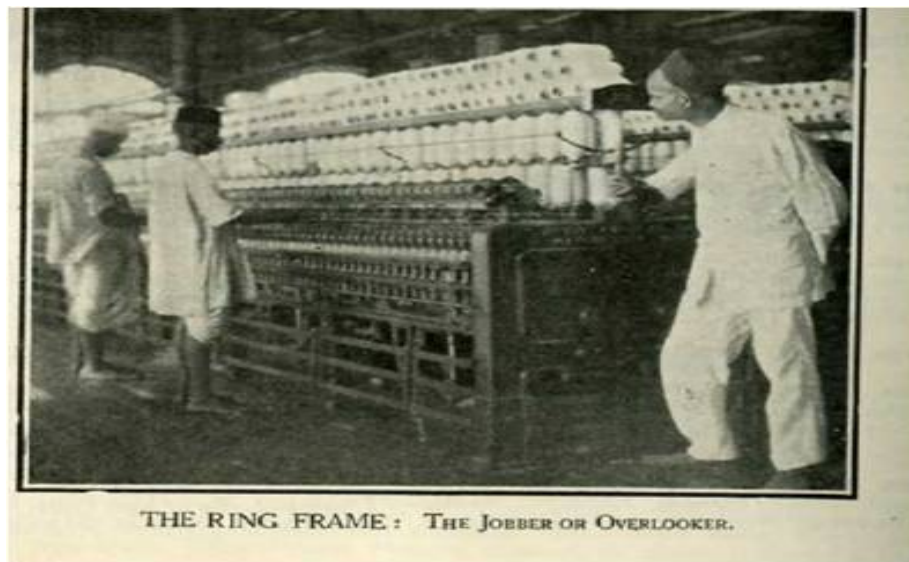


Figure 3: A jobber supervising mill operatives

with higher workforce diversity had the highest burden of supervision, followed by Bombay city and Solapur, which had both low workforce diversity and low burden of supervision.

|             | 1921 | 1923 | 1926 |
|-------------|------|------|------|
| Bombay city | 4.6  | 4.4  | 5.1  |
| Ahmedabad   | 5.6  | 5.4  | 5.8  |
| Sholapur    | 3.8  | 4.6  | 2.8  |

Table 3: Burden of jobbers of Male Mill operatives

*Burden of jobbers measure:*Percentage of operatives that are jobbers

*Source:*The Report on an Enquiry into Wages and Hours of Labour in the Cotton Mill Industry 1921, 1923 and 1926. In 1923 all mills are surveyed. In 1921, 99, 100 and 61 percent of mills were surveyed in Bombay, Solapur and Ahmedabad respectively. In 1926, these dropped to 25, 40 and 28 percent respectively.

These differences in the burden of supervision persisted over time and were not due to a different organization of production within the mills. Jobbers performed supervisory tasks and were consequently assigned to specific rooms. Table 4 shows the disaggregated burden of jobbers in specific production units within the cotton textile mill. Within production units, Ahmedabad consistently had higher burden of supervision than Bombay, and Solapur had the lowest.

Workforce diversity was not the only determinant of information asymmetries within the mills. Managerial and jobbers social background also contributed to the extent of the latter. Table 5 provides measures of the diversity of workers, jobbers and managers. Ahmedabad had the highest workforce, jobbers

|             | Weaving | R.Spining | M.Spining | Winding | Reeling | Warping |
|-------------|---------|-----------|-----------|---------|---------|---------|
| Bombay city | 6       | 2         | 3         | 2       | 3       | 2       |
| Ahmedabad   | 12      | 5         | 9         | 6       | 0       | 4       |
| Solapur     | 7       | 1         | 3         | 2       | 0       | 3       |

Table 4: Burden of supervision Male Mill operatives, 1923

*Burden of jobbers measure:*Percentage of operatives that are jobbers

*Source:*The Report on an Enquiry into Wages and Hours of Labour in the Cotton Mill Industry 1923 and 1926. In 1923 all mills are surveyed. R stands for ring, M. stands for mule

and managerial diversity. As this paper hypothesis predicts, it is the city where the burden of jobbers was the highest. The contrary is true of Solapur.

|                              | Ahmedabad | Bombay | Solapur |
|------------------------------|-----------|--------|---------|
| <b>Unskilled workers</b>     |           |        |         |
| Born in province(percentage) | 63        | 87     | 85      |
| Birth-place diversity        | 0.71      | 0.44   | 0.51    |
| <b>Jobbers</b>               |           |        |         |
| Birth-place diversity        | 0.61      | 0.43   | 0.32    |
| Religious/Caste diversity    | 0.63      | 0.58   | 0.69    |
| <b>Managers</b>              |           |        |         |
| Religious diversity          | 0.60      | 0.55   | 0.48    |
| European (percentage)        | 30        | 60     | 40      |
| Hindu (percentage)           | 53        | 16     | 60      |
| Muslim(percentage)           | 2         | 0      | 0       |
| Parsee(percentage)           | 15        | 23     | 0       |
| <b>Burden of jobbers</b>     | 5.6       | 4.6    | 3.8     |

Table 5: Diversity and Jobbers in Spinning and Weaving Mills, 1921

*Sources:*Census of the cities of Bombay Presidency 1921 and Report on an *Diversity measures:* Probability that two randomly chosen individuals belong to a different group *Burden of jobbers:*Percentage of operatives that are jobbers

The burden of jobbers measure captures the burden of supervision in terms of employment. To assess the direct cost of supervision, jobbers relative wages needs to be taken into account. In fact, jobbers wages were substantially higher than mill operative wages. In particular, in 1921 a jobber in Bombay costed 2.5 times as much the cost of an average male operative. In Ahmedabad, the relative cost was of 2 and in Solapur it was of 2.2.<sup>48</sup> Consequently, jobbers represented 11 percent of the wage bill destined to pay operatives in Bombay city and Ahmedabad, and 8.36 percent in Solapur. That is, the direct cost of supervision and not only the burden of jobbers was lower in Solapur, the city with lower workforce diversity.

Due to their key position between workers and managers, jobbers supposed indirect costs for the mills. These resulted from their ability to extract information rents, as the following quote reflects:<sup>49</sup>

<sup>48</sup>From "The Report on an Enquiry into Wages and Hours of Labour in the Cotton Mill Industry, 1921

<sup>49</sup>Kazi Zahir-ud-din Ahmad, Kankinara from Calcutta, president of an association composed

When say 2 hours' overtime is wrought six hours are put in the book, two for the babus two for the sirdar, and two for the worker for actual work. The mill has to pay for all these. A few exceptions are intentionally made.

In addition to short term indirect costs, such as information rents, jobbers also supposed long term indirect costs. In particular, they separated managers from workers.<sup>50</sup> This separation was blamed by authorities. "The reproach has repeatedly been made to the Bombay mill owners by Government and private investigators that they are out of touch with their workpeople" (Arno Pearse, 1930). Furthermore, it shaped managerial beliefs over workers aptitudes and their policies. The impact on managerial policies and beliefs will be investigated in detail in the next section.

## 4.5 Managerial policies and beliefs

### Managerial policies

Housing conditions and the provision of health services were much better in Solapur than in Bombay and Ahmedabad. More active policies from employers and a more gradual growth of its industrial population explain this fact.

In Bombay city, housing provision was highly done through informal channels, in the hands of jobbers or relatives. Overcrowding and bad housing conditions were described as paramount among the working class. Water supply and sanitation were deficient. Jobbers, recruiters and supervisors of the workforce, provided housing to newly arrived workers. Housing conditions in Ahmedabad were no better than those in Bombay, by virtue of absent employers policies and rapid industrial expansion. The Royal Commission on Indian Labour in 1930 described them as follows: "The areas occupied by the working classes in Ahmedabad present pictures of terrible squalor...badly built, insanitary, ill-ventilated and over-crowded, whilst water supplies are altogether inadequate and latrine accommodation is almost entirely wanting." By contrast, housing conditions were much better in Solapur. Accommodation was more spacious and cheaper, as consequence of two factors. First, Solapur was less congested. Second, all mills in Solapur city provided housing for their employees. Similarly, health services provision varied across textile centers. By 1934, seventy percent of the mills of the province of Bombay that did not provide hospitals or dispensaries were located in Ahmedabad, while only seven percent in Bombay and none was located in Solapur. Not surprisingly, the following was said of Solapur workers "average cotton mill worker in Sholapur appears cleaner and more robust than his prototype in Bombay and Ahmedabad."<sup>51</sup> Climatic conditions,

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solely of mill operatives. Babus and sirdar are different expressions for jobber.

<sup>50</sup>Why then did Managers not anticipate the long term costs of relying on jobbers? Managers working in a colonial state may be particularly myopic. Furthermore, many British managers had short term appointments in India and had other duties to attend in England as the following quote illustrates: "some of whom are taking their turn of duty in India while the others attend to the firm's affairs in London or elsewhere" (ibid.).

<sup>51</sup>Report on an Enquiry into Family Budgets of Cotton Mill Workers in Sholapur city

but also housing and welfare provisions from employers were said to contribute to the better shape of Solapur working class. Not surprisingly, by 1934, turnover rates were significantly higher in Ahmedabad and Bombay relative to Solapur.

The extent of separation between managers and workers surely contributed to the variation in managerial policies. In Solapur, where information asymmetries and reliance on jobbers was the smallest, managers implemented policies to improve their workers welfare. As the inquiry into managerial beliefs that I discuss in the next section suggests, managerial beliefs also shaped their policies. Furthermore, beliefs were influenced by the diversity of the workforce.

### Managerial beliefs

Although it may have been an optimal institution in the short run, as I show in the model, Jobbers reinforced the extent of information asymmetries by separating workers from managers. This separation allowed them to preserve their information rents. It influenced the formation of managerial beliefs, leading to the persistence of stereotypes and the development of prejudice, as the following quote reflects:<sup>52</sup> “It is said that Indians as a nation do not understand the significance of the holy word ”duty”, and this is particularly applicable to the Indian laborer.”<sup>53</sup>

In what follows, I provide a quantitative assessment of managerial beliefs. After discussing the reliability of the evidence, I comment managerial opinions on the causes of low labor productivity. I then analyze how they relate to the diversity of their workforce. I find that a majority of managers attributed the causes of low labor productivity to factors they could not change. More interestingly, managers of highly diverse workforce were the more likely to do so. Both findings shed light on the role of beliefs in explaining the persistence of jobbers and, in general, of institutions.

The British intervention in Colonial India took mainly the form of legislation. The enforcement of legislation was very unsuccessful, partially due to the lack of resources. This was common knowledge. Consequently, the views expressed by contemporaries in Parliamentary papers are likely to reflect the sincere opinion of contemporaries, given that the outcome of legislation would not be binding. Furthermore, the opinions were collected in India, where the influence of British officials in Great Britain was likely to be remote. The variety of opinions within each group shows how individuals felt free to express their opinion without being forced to sustain an official version of the facts.

I distinguish between exogenous and endogenous factors. That is, factors that managers could have not, or could have, changed with their policies. Figure

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<sup>52</sup>How do stereotypes change? Two approaches in social psychology offer different answers. From the cognitive approach, the information acquired via intergroup contact offers the best means of change (Hewstone and Brown, 1986). The collective and value-based approach identify the following indirect sources of learning stereotypes: language, mass media, and social norms and their change takes place via institutional change (Reicher 1986), leadership (Bartal 1989), and education.

<sup>53</sup>Mr. B.A.Dessai, managing agent of the Jafur Alee Spinning and Weaving Company, Limited, Surat, Bombay.

4 in the appendix summarizes the information discussed next.

The majority of managers and owners attributed the causes of low productivity to exogenous causes. In particular, they took habits, inclination towards work and inherent worker's quality as given. In particular, almost forty percent of the managers and owners considered that the main source of inefficiency was low effort levels. This is mainly attributed to a cultural low inclination towards work. In particular, twenty percent of the managers and owners considered that such cultural disposition explained inefficiency. Similarly, the majority of managers considered that endogenous causes did not explain low productivity. In particular, half of the managers and owners considered that long hours were not the source of inefficiency, while one third considered they were. Half of them rejected health deterioration in the work place as being a source of inefficiency. The majority of managers and owners did not consider long hours were a cause of inefficient labor. They argued that shorter hours would represent a loss for them, since no better work could be expected from the operatives. In fact, managers mention that they overcrowded factories because of workers' effort under-provision:<sup>54</sup> *"Owing to the idling habit he was obliged to employ from 30 to 40 per cent more hands..."*

Not only did managers exhibit beliefs that prevented them from undertaking organizational changes, but these beliefs were correlated with the diversity of their workforce. In particular, managers of highly diverse workforce were particularly inclined towards attributing the causes of labor inefficiency to exogenous variables, such as the absenteeism and laziness of the workforce. In particular, no manager with a highly diverse workforce argues that low effort is not a cause of inefficiency. Approximately ten percent more of managers argue that low effort and culture explain inefficiency relative to the sample with low workforce diversity and the whole sample. Among the high workforce diversity managers, no manager argues that health problems, due to working conditions, are the cause of inefficiency. On the contrary, 13 and 9 percent in the low workforce diversity and full sample respectively argue it is so. With respect to long hours, half of the managers in the full sample argues it is not the cause of inefficiency, compared to 62.5 in the high workforce diversity sample and 40 percent in the low workforce diversity sample. In short, managers of highly diverse workforce are more likely to argue that exogenous causes explain low productivity. Similarly, they are the more likely to argue that endogenous causes do not explain low productivity.

Despite the small size of the sub-sample, these results are remarkable. Furthermore, they highlight the role of beliefs in explaining institutional persistence in our concrete case study. Managers of highly diverse workforce, and so with stronger incentives to rely on supervisors, were inclined to believe that inefficiency was the result of workers laziness and cultural predisposition. Consequently, they were the less likely to undertake changes in the recruitment and management of the workforce and the more likely to continue relying on jobbers.

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<sup>54</sup>Written evidence from Mr. H.R. Greaves, a firm's partner from Bombay



## 5 Conclusion

This paper has proposed an alternative hypothesis to improve our understanding of the relation between social diversity and economic growth. Namely, that social diversity affects the extent of information asymmetries economic agents face in their interactions. I have analyzed the implications of this hypothesis modeling how workforce diversity affects the design of contracts and organizations. The main finding is that workforce diversity decreases the incentives given in principal agent interactions and multiplies the number of layers bureaucracies find necessary. Furthermore, the relation between diversity and productivity is institutional dependent. Stressing that institutions are endogenous not only to the technological but also to the social environment, I have analyzed the industrialization of India and Japan at the beginning of the XX century. I collected Census data, Parliamentary papers and Labour Office reports to provide evidence consistent with the main implications of the model. Namely, jobbers emerged and persisted in British India as a response to the cognitive challenge that colonization and social diversity imposed on labor market agents. Better positioned to recruit and supervise workers, jobbers extracted information rents that curbed the incentives given from managers. Labor market intermediaries did not persist in Japan, where the workforce was far from diverse and where State policies and nationalism eroded their power.

An empirical investigation on the social determinants of the organization of firms is the natural next step I envision in this line of research. Empirically, what are the social determinants of firms? This line of research may be fruitful to understand a vast array of relevant issues for the welfare of human beings. At the macroeconomic level, this research will foster the understanding of economic development. It will enrich our understanding of the impact of colonization. At the microeconomic level, emphasizing the interaction between social characteristics and the design of contracts and organizations may contribute to understand the nature of the firm. Finally, the present research may shed light on the nature of institutions, their dynamics and the role of the firm as a development actor. In our increasingly globalized world, these have notable public policy and business implications. At the public policy level, these questions have direct implications for migration related policies, labor market regulations such as positive discrimination and the use of quotas, the design of foreign aid programs and the fight against corruption oriented institutions, among others. At the business level, it may help guiding business expansions and the design of subsidiaries in new markets and environments.

The lesson I draw from my investigation is that the laziness societies need to overcome is not the laziness of the body, but the laziness of the mind.<sup>55</sup>

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<sup>55</sup>The following quote from Tagore acquires special relevance

Where the mind is without fear and the head is held high;  
Where knowledge is free;  
Where the world has not been broken up into fragments by narrow domestic walls;  
Where the clear stream of reason has not lost its way into the dreary desert sand of dead habit;  
Into that heaven of freedom, my Father, let my country awake.

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## 6 Appendix 1: Model proofs and derivations

### 6.1 Bounds on external supervision probability

The upper bound on external supervision is obtained by ensuring that when  $\frac{1}{N_k} \rightarrow 0$ ,  $\beta^F > \beta^H$ . The lower bound on external supervision is obtained by ensuring that when  $N_k = 2$ ,  $\beta^F < \beta^H$ . Merging both conditions one obtains:

$$\frac{1}{\sigma_\epsilon^2 + \sigma_\mu^2} > \frac{1}{\sigma_\epsilon^2} - \frac{1-p}{p} \lambda \theta c > \frac{1}{\sigma_\epsilon^2 + \sigma_\mu^2 + \sigma_\mu^4} \quad (12)$$

Isolating p one obtains condition (9) on the text.

## 6.2 Proof proposition 1

The worker optimally chooses  $a_i = \frac{\beta_k}{c}$ . Given that  $\frac{\delta \beta_k^F}{\delta N_k} > 0$  and  $\frac{\delta^2 \beta_k^F}{\delta N_k^2} > 0$  the result follows.

## 6.3 Derivation of optimal contract in Flat organization

Because of the normal distribution assumption, the worker is effectively maximizing the utility of the certainty equivalent,  $e^{-\eta[\tilde{w}(a_i) - \tau a_i]}$

Where<sup>56</sup>

$$\tilde{w}(a_i) = \alpha_k + \beta_k a_i + \gamma_k a_{-i} - \eta(\beta_k^2[\sigma_\epsilon^2 + \sigma_\mu^2] + \gamma_k^2 \frac{1}{N_k-1}[\sigma_\epsilon^2 + \sigma_\mu^2] + 2\beta_k \gamma_k \frac{1}{N_k-1} \sigma_\mu^2)$$

where  $a_{-i}$  is the average effort of the rest of i's group.

Worker i takes other workers' effort as given, and the solution to his problem is:

$$a_i = \frac{\beta_k}{c} \quad (13)$$

Using the reaction function of workers and reexpressing the IR constraint using the certainty equivalent wage,<sup>57</sup> the problem of the Manager can be rewritten as:

For each k and each i

$$\text{Max} \left( \frac{\beta_k}{c} - \left( \alpha_k + \frac{\beta_k^2}{c} + \gamma_k \frac{\beta_k}{c} \right) \right)$$

$$\text{s.t } \tilde{w}(a_i) \geq w_o$$

that is, s.t

$$\alpha_k = w_o - \left( \frac{\beta_k^2}{c} + \gamma_k \frac{\beta_k}{c} - \eta(\beta_k^2[\sigma_\epsilon^2 + \sigma_\mu^2] + \gamma_k^2 \frac{1}{N_k-1}[\sigma_\epsilon^2 + \sigma_\mu^2] + 2\beta_k \gamma_k \frac{1}{N_k-1} \sigma_\mu^2) \right)$$

Plugging in and simplifying, the objective function becomes:

$$\frac{\beta_k}{c} - w_o - \eta(\beta_k^2[\sigma_\epsilon^2 + \sigma_\mu^2] + \gamma_k^2 \frac{1}{N_k-1}[\sigma_\epsilon^2 + \sigma_\mu^2] + 2\beta_k \gamma_k \frac{1}{N_k-1} \sigma_\mu^2)$$

<sup>56</sup>Using the independence of the group and individual specific signal, and the iid assumption of individual specific signals.

<sup>57</sup>Which optimally binds

Taking FOC and solving the system of two equations and two unknowns, I obtain the solution under the flat organization:<sup>5859</sup>

$$\gamma_k^F = \frac{-\sigma_\mu^2}{\sigma_\epsilon^2 + \sigma_\mu^2} \beta_k$$

$$\beta_k^F = \frac{1}{2\eta c[\sigma_\epsilon^2 + \sigma_\mu^2]} \frac{1}{1 + \frac{\sigma_\mu^4}{[\sigma_\epsilon^2 + \sigma_\mu^2](N_k - 1)}}$$

## 6.4 Proof of proposition 2

*Proof:*  $\beta^{HH} = \frac{1}{2\eta c\sigma_\epsilon^2} > \frac{1}{2\eta c[\sigma_\epsilon^2 + \sigma_\mu^2]} \frac{1}{1 + \frac{\sigma_\mu^4}{[\sigma_\epsilon^2 + \sigma_\mu^2](N_k - 1)}} = \beta^F$

## 6.5 Derivation of optimal contract under Hierarchical Organization

SIC optimally binds, therefore:  $b = \frac{1-p}{p} \lambda(\beta + \gamma)\theta$

The manager faces a tradeoff between providing incentives to the workforce and ensuring truth-telling from the supervisor.

The objective function of the manager becomes<sup>60</sup>:

$$\frac{\beta}{c} - w_o - \eta(\beta_k^2[\sigma_\epsilon^2] + \gamma^2 \frac{1}{N-1}[\sigma_\epsilon^2]) - \frac{1-p}{p} \lambda(\beta + \gamma)\theta$$

Taking FOC the solution follows.

## 6.6 Proof of proposition 3

*Proof:* It follows from  $\frac{\delta\beta_k^H}{\delta N_k} = 0$  that effort is unrelated from workforce diversity in a hierarchical organization. Because  $\beta^H = \beta^{HH} - \frac{(1-p)\lambda\theta}{p2\eta\sigma_\epsilon^2}$ , it follows that  $\beta^H < \beta^{HH}$ . That is, when the manager has to design an incentive compatible contract incentives are revised downwards.

# 7 Appendix 2: Model extensions

## 7.1 Diversity and the boundaries of the Firm

Does workforce diversity affect the size of the Firm? Does the firm expand intensively (hiring workers of groups present in the workforce) or extensively (hiring workers of groups not present in the workforce)?

The baseline model I assume that the size of the firm is given, and I study how diversity affects the shape of the organization. Crucially, I assume that

<sup>58</sup> $\alpha_k$  is determined for a given reservation wage

<sup>59</sup>F denotes the solution under a flat organization

<sup>60</sup>Following the same steps as before and doing the pertinent substitutions

the composition of the workforce is exogenous to the Firm. This may be a reasonable assumption on average and in the limit but not on the margin. That is, when deciding to incorporate an additional worker to the workforce, what group he belongs to may be important to whether he will be hired. Furthermore, it is essential to know who is recruiting that marginal worker.

**Case I: Flat organization**

Assume the current size of the firm is  $N_o$  and let  $N_a$  be the expanded size potentially undertaken.

If the manager does an intensive expansion, let's assume he increases workers in every group in the same proportion, that is  $\Delta N = K\Delta N_k$ . Diversity of the workforce remains unchanged and the size of every given group increases. The size effect of the expansion gives an extra benefit to the Manager. This extra benefit<sup>61</sup> is equal to:

$$\Delta\Pi_k^F = \frac{\delta\Delta\Pi^F}{\delta N_k} \frac{\delta N_k}{\delta N} = \frac{1}{K} \frac{1}{(N_k-1)^2} [\gamma_k^2[\sigma_\epsilon^2 + \sigma_\mu^2] + 2\beta_k\gamma_k\sigma_\mu^2]$$

The benefit of intensive expansion is higher for managers when group noisiness is higher.

Assume that due to labor market conditions, Management has to expand extensively if wishes to expand. Adding a group to the workforce carries no extra benefit for the already hired workers and may imply a change in the organization structure. In particular, if group characteristics are such that group noise for this additional group is very high, or that the wished expansion is small enough, Management may decide not to undertake the expansion unless it changes the organizational structure. That is,  $\Pi_{K+1}^L < 0$  but  $\Pi_{K+1}^H > 0$  for the additional group. Hiring a supervisor may be optimal for the additional group but not for the workforce as a whole, as the organization was two-tier to start with. The cost of changing the organization of the firm may prevent the expansion from taking place, placing a limit on the size of non hierarchical firms. This depends on what type of expansion the manager is able to carry on, and on the level of diversity of the workforce to begin with.

Whenever possible, the Manager will prefer to expand the firm intensively. Doing so he is better able to insure workers against uncertainty and to provide higher incentives without changing the organization of the Firm.

**Case II: Hierarchical organization**

In a hierarchical organization, I assume it is the supervisor who decides on the expansion size and on who to hire. The supervisor will prefer to expand extensively: a more diverse workforce makes him more necessary for Management. If he cannot hire extensively, he will hire intensively up to the point where the Management would not need him anymore. That is, when diversity is very high, supervisors want to protect their information rent and will expand the size of the Firm only insofar this does not jeopardize their job.

There is no clear prediction about the relation between diversity and the size of the Firm. The reason for this ambiguity is that increasing the size of firm can be done by increasing, decreasing or without affecting the degree of

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<sup>61</sup>per worker

diversity. Who hires workers, what is the initial level of diversity and labor supply conditions will define the relation.

Management will prefer to expand the firm intensively. If not possible, extensive expansion may not be carried on due to suboptimal changes in the organizational structure. In general, I predict that more hierarchical organizations are likely to be more elastic to a diverse workforce, while less hierarchical organizations are likely to be less elastic. *Insofar as increasing the size of the firm implies decreasing/increasing its diversity, flat organizations will be bigger/smaller and hierarchical organization will be smaller/bigger.* Finally, it may be optimal for the Management to separate hiring and supervising functions, despite the complementarities in information these two tasks require, to prevent exacerbating rent seeking attitudes from supervisors.

## 7.2 Endogenous manipulation

In the benchmark model I assumed that the extent of manipulation is exogenous and that it is costless. The only decision of the supervisor is whether to manipulate or not. What type of manipulation fits this description? What forms can manipulation take in general? The present extension explores the possibility that the supervisor chooses how much to manipulate, that manipulation is costly or costless, and that it may depend on the composition of the workforce. I analyze whether these possibilities affect the core predictions of the simple model. My preliminary conclusion is that they do not.

Some types of manipulation can be considered exogenous without much controversy. For example, whether or not a worker attended work is a dummy variable. But how late he arrived or how many hours he worked is not. In the historical case study, particular instances of manipulation include false attendance and timing issues including misrepresentation of extraordinary hours worked.

Consider the following testimony from Kazi Zahir-ud-din Ahmad, Kankinara from Calcutta, president of an association composed solely of mill operatives: "When say 2 hours' overtime is wrought six hours are put in the book, two for the babus<sup>62</sup>, two for the sirdar<sup>63</sup>, and two for the worker for actual work. **The mill has to pay for all these. A few exceptions are intentionally made. To ward off suspicion** the babu generally puts less overtime than what has been worked against some workers..."

Costly and endogenous manipulation:

Assume that, as before, the supervisor may collude with the workforce to send a distorted signal. With probability  $p$  there is an external inspection<sup>64</sup> and

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<sup>62</sup>South Asian term of respect (meaning 'boss' or 'father')

<sup>63</sup>In India, in Punjabi, Hindi and other Indian languages, the word often refers to a male follower of the Sikh faith. Often, the -ji is added to the word to denote respect, resulting in the word "Sardarji". The word may convey several meanings, often associated with military authority.

<sup>64</sup>In the Indian case external inspectors visited the factories giving a statement on the causes of inefficiency.



the manager learns whether collusion took place or not. Let  $b$  be the bonus per worker that the manager may offer to honest supervisors.

Let  $\theta$  be the amount of distortion in the event of collusion such that the signal sent is  $\hat{S}_i^J = S_i^J + \theta$ . But now assume that the supervisor chooses  $\theta \in \mathbb{R}_+$  balancing the marginal benefit and the marginal cost of manipulation. In particular, let  $c(\theta)$  be a strictly convex function. That is, it is increasingly costly to manipulate the signal. Then the supervisor chooses  $\theta$  such that  $c'(\theta) = \lambda(\beta + \gamma)$ . Assuming  $c(\theta) = \theta^2$  we get  $\theta^* = \frac{\lambda(\beta + \gamma)}{2}$ . That is, the bigger the incentives given to workers, the higher the incentive to increase the amount of manipulation and bear its cost. Recall that the extra surplus generated, given the wage offered, is:  $(\beta + \gamma)\theta$  and that  $\lambda$  is the fraction of it appropriated by the supervisor.

To ensure truthtelling the bonus offered by the manager must satisfy the supervisor truthtelling constraint, given  $\theta^*$  that is:

$$pb \geq (1 - p)\lambda(\beta + \gamma)\theta^* \text{ (SIC)}$$

$$\text{such that } b = \frac{(1-p)\lambda^2(\beta + \gamma)^2}{p}$$

The problem of the manager is fundamentally unchanged.

### 7.3 Diversity and discrimination

What if groups size differ?

Minorities receive lower incentives and consequently exert lower effort not because they are less able but because they are minorities and the cost of insuring them against uncertainty is higher<sup>65</sup>

Under what organization structure is discrimination more likely?

The model's answer is that de facto discrimination is more likely to take place in flat organizations. Further, the model predicts that minorities are less likely to be paid for performance as the cost of insuring them against group noisiness is higher than for majorities.

## 8 Appendix 2: Historical section

List of hypotheses and examples of managerial comments:

1. Low effort

*"...he considered that the overcrowding was largely the result of the idling habit."* Mr. J.D.F.Engel, 1st Inspector of Factories, Bombay.

2. Culture

*"It is said that Indians as a nation do not understand the significance of the holy word "duty"* Mr. B.A.Dessai, managing agent of the Jafur Alee Spinning and Weaving Company, Surat.

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<sup>65</sup>This framework may shed some light on the economics of discrimination debate

3. Preferences

*"even if he gets less money...earned sufficient for his month...prefers to idle his time..."* Mr. J.B. Sunderland, Cawnpore

4. Climate

*"Some factories, indeed, suggest that they might have been constructed by cold weather visitors, for they show little respect for the sun in their orientation and elevation,"* Royal Commission on labour in India Report of 1929.

5. Health and education

*"their physique, as far as I can judge, has not been affected by the present working hours."* Mr. B.H. Saklatvala, manager of the Dinshaw Petit Mill, Bombay.

6. Long working hours

*"employers, who now complain of these dawdling habits of the workpeople. The long hours are really the cause of such habits..."* Mr. Bazanji Dadabhoy, Nagpur.

7. Working conditions

*"The suffocating, impure and artificial atmosphere in the factory...cruel and inhuman."*  
Mr. K.A. Keluskar, Secretary of the Maratha Aikyeckhoo Subba, Bombay.

|                            | Ahmedabad | Bombay | Solapur |
|----------------------------|-----------|--------|---------|
| <b>Population</b>          |           |        |         |
| 1891                       | 144       | 821    | 61      |
| 1901                       | 181       | 776    | 75      |
| 1921                       | 271       | 1175   | 119     |
| 1931                       | 310       | 1161   | 145     |
| 1941                       | 591       | 1489   | 213     |
| <b>Religious diversity</b> |           |        |         |
| 1871                       | 0.47      | 0.54   | 0.4     |
| 1921                       | 0.43      | 0.46   | 0.35    |
| 1931                       | 0.43      | 0.5    | 0.37    |
| 1941                       | 0.44      | 0.49   | 0.34    |
| <b>City born</b>           |           |        |         |
| 1881                       | 82        | 27     | 84      |
| 1911                       | 64        | 20     | 81      |
| <b>1911</b>                |           |        |         |
| Density                    | 21        | 43     | 10      |
| Female                     | 85        | 53     | 92      |
| Literacy M                 | 21        | 28     | 9       |
| Literacy F                 | 3         | 12     | 0.5     |
| English Literacy M         | 2         | 10     | 0.7     |
| English Literacy F         | 0.1       | 4      | 0.07    |

Table 6: Characteristics of the population of Bombay, Ahmedabad and Solapur  
*Sources:* British India decennial Census *Note:* Population and density are in miles. Density is the number of persons per square mile. Females is the number of female per 100 males. Literacy is in percentages. M and F stand for male and female. City Born refers to those born in the city (percentage)

*Religious diversity:* Probability that two randomly chosen individuals belong to a different religion

|                            | Ahmedabad | Bombay | Solapur |
|----------------------------|-----------|--------|---------|
| <b>1911</b>                |           |        |         |
| Density                    | 21        | 43     | 10      |
| Female                     | 85        | 53     | 92      |
| Literacy M                 | 21        | 28     | 9       |
| Literacy F                 | 3         | 12     | 0.5     |
| English Literacy M         | 2         | 10     | 0.7     |
| English Literacy F         | 0.1       | 4      | 0.07    |
| <b>Population</b>          |           |        |         |
| 1891                       | 144       | 821    | 61      |
| 1901                       | 181       | 776    | 75      |
| 1921                       | 271       | 1175   | 119     |
| 1931                       | 310       | 1161   | 145     |
| 1941                       | 591       | 1489   | 213     |
| <b>Religious diversity</b> |           |        |         |
| 1871                       | 0.47      | 0.54   | 0.4     |
| 1921                       | 0.43      | 0.46   | 0.35    |
| 1931                       | 0.43      | 0.5    | 0.37    |
| 1941                       | 0.44      | 0.49   | 0.34    |
| <b>City born</b>           |           |        |         |
| 1881                       | 82        | 27     | 84      |
| 1911                       | 64        | 20     | 81      |

Table 7: Characteristics of the population of Bombay, Ahmedabad and Solapur  
*Sources:* British India decennial Census *Note:* Population and density are in miles. Density is the number of persons per square mile. Females is the number of female per 100 males. Literacy is in percentages. M and F stand for male and female. City Born refers to those born in the city (percentage)  
*Religious diversity:* Probability that two randomly chosen individuals belong to a different religion

| Caste or Religion                  | Bombay city |
|------------------------------------|-------------|
| Maratha                            | 56          |
| Bhandari                           | 3           |
| Agri                               | 2           |
| Padma-Sali and Koshti              | 2           |
| Vani                               | 1           |
| Others excluding depressed classes | 9           |
| Mahar depressed class              | 13          |
| Chamar and Mochi                   | 4           |
| Others                             | 3           |
| Muslims                            | 5           |
| Christians                         | 1           |
| Jews                               | 0.3         |

Table 8: Social origin of the working class, 1933 (percentages)  
*Source:* Report on an Enquiry into working class family budgets in Bombay City, 1933

| Caste or religion                | Ahmedabad city |
|----------------------------------|----------------|
| Patidar                          | 10             |
| Thakerda                         | 10             |
| Rajput                           | 4              |
| Waghri                           | 4              |
| Lavar and Lohar                  | 2              |
| Padmasali and Koshti             | 2              |
| Garashia                         | 2              |
| Kumbhar                          | 2              |
| Maratha                          | 2              |
| Bhavasara                        | 1              |
| Thakore and Thakur               | 1              |
| Others excluding depressed class | 2              |
| Vankar and Dhed depressed class  | 1              |
| Mochi and Chamar dep class       | 7              |
| Bhangu dep class                 | 1              |
| Others                           | 0.5            |
| Muslims                          | 18             |
| Christians                       | 1              |
| Jains                            | 0.6            |

Table 9: Social origin of the working class, 1933

Source: Report on an Enquiry into working class family budgets in Ahmedabad city, 1933

| Caste or Religion | Solapur |
|-------------------|---------|
| Marathas          | 40      |
| Padmasalis        | 7       |
| Dhangars          | 8       |
| Mahars            | 7       |
| Kolis             | 3       |
| Mochis            | 2       |
| Lingayat, Vanis   | 2       |
| Rajputs           | 2       |
| Other castes      | 9       |
| Muslims           | 19      |
| Unspecified       | 0.2     |

Table 10: Social origin of the working class, 1925

Source: Report on an Enquiry into Family Budgets of Cotton Mill Workers in Sholapur City 1925

| City      | 1891 | 1901 | 1911 | 1921 | 1931 | 1941 |
|-----------|------|------|------|------|------|------|
| Ahmedabad | 144  | 181  | 214  | 271  | 310  | 591  |
| Bombay    | 821  | 776  | 979  | 1175 | 1161 | 1489 |
| Karachi   | -    | -    | 151  | 216  | -    | -    |
| Poona     | 126  | 120  | 127  | 164  | 198  | 258  |
| Sholapur  | 61   | 75   | 61   | 119  | 145  | 213  |
| Surat     | 109  | 119  | 115  | 117  | 99   | 171  |

Table 11: Population of major cities in Bombay Presidency (in miles)

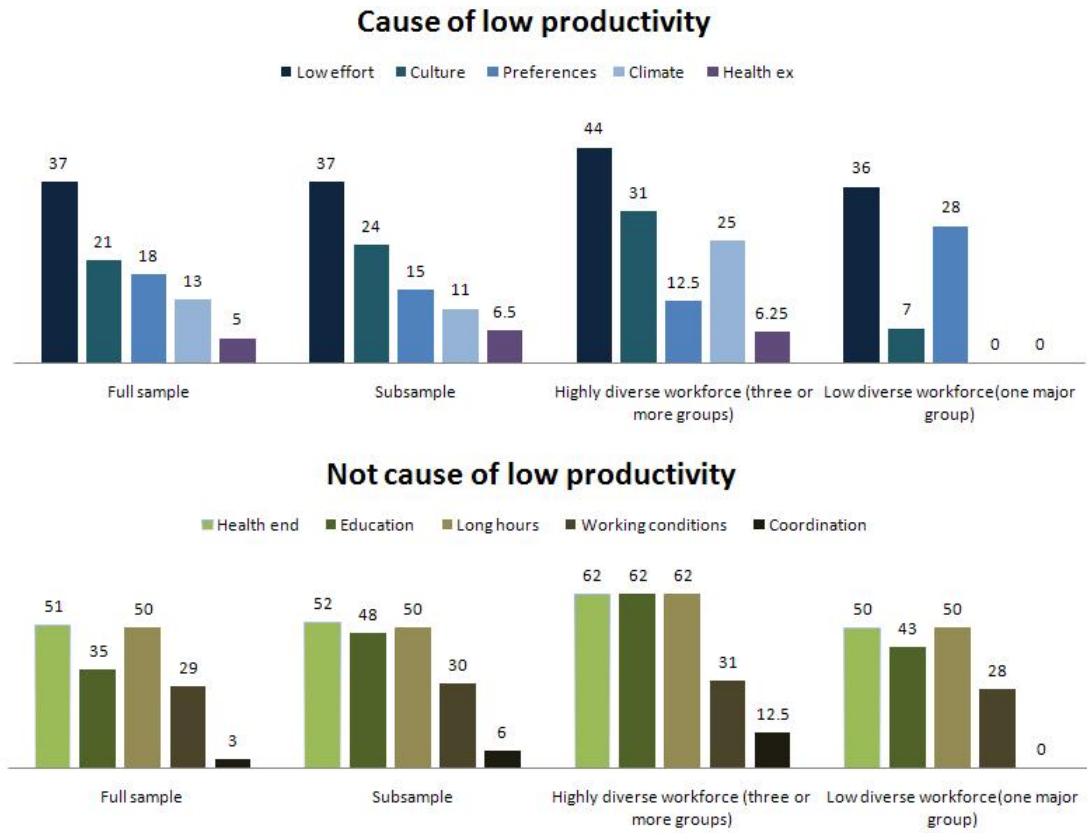


Figure 4: Managerial beliefs and workforce diversity

|           | -15 | 15-50 | 50- |
|-----------|-----|-------|-----|
| Bombay    | 21  | 72    | 07  |
| Ahmedabad | 32  | 58    | 10  |
| Sholapur  | 35  | 54    | 11  |

Table 12: Age distribution of urban population 1921

TABLE VI.  
RELIGIONS.

| District and State.                             | POPULATION. |            |            | HINDU.     |            |           | SIKH.    |        |          | JAIN.    |         |          | BUDDHIST. |        |          |
|---|-------------|------------|------------|------------|------------|-----------|----------|--------|----------|----------|---------|----------|-----------|--------|----------|
|   | Persons.    | Males.     | Females.   | Persons.   | Males.     | Females.  | Persons. | Males. | Females. | Persons. | Males.  | Females. | Persons.  | Males. | Females. |
| 1 BOMBAY PRESIDENCY including Native States ... | 26,424,236  | 13,065,883 | 12,358,353 | 10,216,438 | 10,139,052 | 6,777,336 | 1,502    | 1,033  | 469      | 635,950  | 379,554 | 250,408  | 473       | 323    | 119      |
| 2 British Districts ...                         | 18,615,637  | 6,652,879  | 6,962,708  | 14,197,322 | 7,230,908  | 6,965,414 | 1,051    | 715    | 336      | 227,530  | 128,421 | 104,109  | 473       | 323    | 119      |
| 3 BOMBAY CITY ...                               | 775,006     | 479,780    | 295,220    | 558,698    | 315,902    | 192,766   | 83       | 84     | 4        | 14,248   | 10,316  | 3,933    | 325       | 233    | 121      |
| 4 NORTHERN DIVISION ...                         | 3,513,532   | 1,834,260  | 1,729,272  | 2,361,736  | 1,523,196  | 1,428,600 | 604      | 346    | 258      | 65,453   | 34,174  | 31,284   | 27        | 25     | 3        |
| 5 Ahmedabad ...                                 | 795,907     | 469,059    | 326,938    | 638,773    | 341,488    | 324,374   | 103      | 108    | 55       | 37,790   | 19,001  | 16,723   | 24        | 24     | ...      |
| 6 Bharuch ...                                   | 291,783     | 143,229    | 105,153    | 186,122    | 93,395     | 95,683    | 23       | 13     | 11       | 5,334    | 1,707   | 1,647    | ...       | ...    | ...      |
| 7 Kaira ...                                     | 710,333     | 375,647    | 340,685    | 614,146    | 323,888    | 311,833   | 98       | 98     | 40       | 8,439    | 4,343   | 4,123    | ...       | ...    | ...      |
| 8 Panch Mahals ...                              | 291,020     | 132,047    | 128,073    | 210,631    | 107,145    | 103,379   | 513      | 166    | 148      | 1,076    | 819     | 827      | ...       | ...    | ...      |
| 9 Surat ...                                     | 687,217     | 317,767    | 310,239    | 551,037    | 275,586    | 274,441   | 3        | 2      | 1        | 11,785   | 6,001   | 5,554    | ...       | ...    | ...      |
| 10 Thana ...                                    | 811,433     | 423,192    | 389,541    | 724,413    | 370,133    | 349,239   | 0        | 3      | 3        | 2,494    | 1,740   | 1,740    | ...       | ...    | ...      |
| 11 CENTRAL DIVISION ...                         | 5,914,447   | 2,987,587  | 2,926,860  | 4,642,081  | 2,787,702  | 2,724,379 | 334      | 256    | 68       | 73,634   | 40,190  | 38,644   | 33        | 28     | 5        |
| 12 Ahmednagar ...                               | 387,086     | 217,789    | 210,527    | 378,527    | 203,086    | 200,441   | 10       | 9      | 2        | 16,254   | 8,057   | 7,837    | ...       | ...    | ...      |
| 13 Chhambhai ...                                | 1,427,392   | 721,908    | 708,454    | 1,232,129  | 647,381    | 634,728   | 4        | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 14 Nashik ...                                   | 816,504     | 419,380    | 403,119    | 761,471    | 384,358    | 377,179   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 15 Poona ...                                    | 895,580     | 502,686    | 492,446    | 720,855    | 4,2,218    | 420,667   | 290      | 230    | 51       | 10,703   | 6,198   | 4,906    | ...       | ...    | ...      |
| 16 Satara ...                                   | 1,140,650   | 590,533    | 577,479    | 1,058,308  | 538,618    | 547,688   | 17       | 8      | 14       | 18,493   | 9,618   | 8,967    | ...       | ...    | ...      |
| 17 Sholapur ...                                 | 730,977     | 385,777    | 369,200    | 636,651    | 329,709    | 325,933   | 3        | 2      | 1        | 8,443    | 4,464   | 3,989    | ...       | ...    | ...      |
| 18 SOUTHERN DIVISION ...                        | 5,070,632   | 2,519,456  | 2,551,176  | 4,513,555  | 2,342,444  | 2,271,141 | 85       | 29     | 8        | 79,069   | 38,249  | 34,820   | 17        | 7      | 10       |
| 19 Belgum ...                                   | 998,378     | 502,473    | 491,503    | 850,560    | 432,137    | 424,423   | 3        | 3      | ...      | 61,820   | 30,233  | 28,201   | ...       | ...    | ...      |
| 20 Bijapur ...                                  | 735,446     | 383,333    | 382,413    | 640,788    | 324,064    | 322,724   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 21 Dharsir ...                                  | 1,112,398   | 560,947    | 558,331    | 984,431    | 480,243    | 474,768   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 22 Kurnool ...                                  | 654,496     | 336,047    | 334,440    | 567,430    | 282,100    | 281,811   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 23 Kolar ...                                    | 895,508     | 464,441    | 461,123    | 870,491    | 439,343    | 434,318   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 24 Ratnagiri ...                                | 1,107,947   | 547,535    | 530,443    | 1,077,945  | 537,413    | 530,327   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 25 SIND ...                                     | 3,210,910   | 1,761,790  | 1,449,120  | 2,751,283  | 1,411,664  | 1,339,538 | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 26 Karachi ...                                  | 607,628     | 339,820    | 323,003    | 1,112,940  | 55,607     | 49,878    | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 27 Hyderabad ...                                | 980,030     | 545,420    | 544,010    | 923,023    | 129,954    | 122,328   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 28 Solapur ...                                  | 1,018,113   | 541,945    | 529,157    | 914,530    | 457,748    | 450,380   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 29 Thar and Parkar ...                          | 363,894     | 202,737    | 1,1,167    | 181,723    | ...        | ...       | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 30 Upper Sind Frontier ...                      | 232,945     | 121,877    | 120,163    | 22,795     | ...        | ...       | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 31 Native States and Agencies ...               | 6,908,648   | 3,513,003  | 3,395,645  | 5,719,116  | 2,906,144  | 2,810,972 | 451      | 313    | 132      | 308,420  | 156,123 | 152,237  | ...       | ...    | ...      |
| 32 GUJARAT GROUP ...                            | 4,361,565   | 2,233,658  | 2,137,690  | 3,555,192  | 1,824,909  | 1,740,533 | 433      | 310    | 123      | 227,223  | 114,023 | 112,901  | ...       | ...    | ...      |
| 33 Cambay ...                                   | 78,226      | 38,016     | 38,003     | 61,037     | 31,674     | 29,208    | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 34 Gadhwa ...                                   | 485,622     | 244,043    | 241,379    | 306,734    | 154,690    | 150,628   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 35 Kathiawar ...                                | 3,323,166   | 1,737,301  | 1,741,235  | 3,289,235  | 1,667,430  | 1,660,799 | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 36 Mahi Kantha ...                              | 381,546     | 192,968    | 190,177    | 324,023    | 164,437    | 161,039   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 37 Palampur ...                                 | 467,471     | 242,097    | 234,674    | 395,881    | 206,100    | 190,195   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 38 Rana Kantha ...                              | 479,905     | 246,495    | 238,880    | 434,023    | 222,709    | 212,314   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 39 Surat Agency ...                             | 161,543     | 82,358     | 79,989     | 165,197    | 79,101     | 76,026    | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 40 KONKAN GROUP ...                             | 350,684     | 171,880    | 178,894    | 338,656    | 169,276    | 164,830   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 41 Janjira ...                                  | 86,414      | 41,261     | 44,133     | 70,210     | 34,467     | 34,749    | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 42 Jawar ...                                    | 47,533      | 24,553     | 23,883     | 47,001     | 24,251     | 22,769    | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 43 Savantadi ...                                | 217,733     | 108,077    | 111,056    | 206,483    | 100,598    | 105,076   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 44 DECCAN GROUP ...                             | 378,779     | 188,852    | 181,927    | 353,386    | 178,368    | 175,028   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 45 Akalkot ...                                  | 89,047      | 41,639     | 40,614     | 70,378     | 35,040     | 34,783    | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 46 Bhur ...                                     | 137,268     | 69,163     | 67,076     | 135,307    | 67,595     | 67,042    | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 47 Khandesh Agency ...                          | 35,272      | 17,201     | 16,071     | 32,438     | 15,948     | 15,059    | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 48 Satara Agency ...                            | 19,530      | 9,534      | 9,193      | 19,393     | 9,192      | 9,314     | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 49 Sangli ...                                   | 11,592      | 6,091      | 5,971      | 11,212     | 5,932      | 5,940     | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 50 KARNATAK GROUP ...                           | 1,023,206   | 519,819    | 503,337    | 1,440,451  | 723,641    | 713,810   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 51 Kolhapur ...                                 | 810,011     | 420,874    | 449,137    | 818,056    | 404,319    | 403,210   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 52 S. M. Jijirga ...                            | 694,749     | 349,637    | 345,993    | 809,340    | 30,414     | 302,923   | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 53 Savanur ...                                  | 15,440      | 8,238      | 8,180      | 18,100     | 6,671      | 6,629     | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 54 KHAIRPUR ...                                 | 199,313     | 103,766    | 99,547     | 26,451     | 19,280     | 17,171    | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |
| 55 Aden ...                                     | 43,974      | 20,530     | 18,444     | 2,725      | 2,053      | 678       | ...      | ...    | ...      | ...      | ...     | ...      | ...       | ...    | ...      |

Figure 5: British India Census 1901, Indian Office Records V.15.6.8 Part II

TABLE No. IV.

AVERAGE EARNINGS AND ATTENDANCE IN THE TEXTILE  
COTTON INDUSTRY IN THE AHMEDABAD CITY AREA.

\*(Figures for average monthly earnings are given in respect of only those occupations  
in which workers are paid on the monthly basis.)

| Occupation.                         | Time<br>or<br>piece. | Number<br>of<br>workers. | Percent-<br>age<br>attend-<br>ance. | Average<br>daily<br>earnings. |           | Average<br>monthly<br>earnings.* |  |
|-------------------------------------|----------------------|--------------------------|-------------------------------------|-------------------------------|-----------|----------------------------------|--|
|                                     |                      |                          |                                     | Rs. a. p.                     | Rs. a. p. |                                  |  |
| <i>Process Operatives.</i>          |                      |                          |                                     |                               |           |                                  |  |
| Head Jobbers—Spinning Side ..       | T                    | 199                      | 95.4                                | 2 13 0                        | 72 4 11   |                                  |  |
| .. Weaving Side ..                  | T                    | 134                      | 96.2                                | 4 14 3                        | 126 10 11 |                                  |  |
| .. ..                               | P                    | 10                       | 99.2                                | 7 5 4                         | 187 10 8  |                                  |  |
| Jobbers—Spinning Side ..            | T                    | 868                      | 93.8                                | 1 8 2                         |           |                                  |  |
| .. Weaving Side ..                  | T                    | 273                      | 94.6                                | 1 14 9                        | 48 14 2   |                                  |  |
| .. ..                               | P                    | 1,051                    | 94.3                                | 4 5 5                         |           |                                  |  |
| .. .. —Women.                       | T                    | 1                        | 96.3                                | 0 14 3                        | 23 3 6    |                                  |  |
| .. ..                               | T                    | 305                      | 91.5                                | 1 10 8                        | 41 1 9    |                                  |  |
| Fancy Jobbers ..                    | T                    | 92                       | 94.6                                | 1 4 5                         |           |                                  |  |
| Humidifier Attendants ..            | T                    | 103                      | 91.3                                | 2 7 8                         |           |                                  |  |
| Erector Fitters ..                  | T                    | 299                      | 92.8                                | 0 14 7                        |           |                                  |  |
| Opener Attendants—Men ..            | T                    | 8                        | 93.8                                | 0 12 1                        |           |                                  |  |
| .. .. Women ..                      | T                    | 93                       | 93.8                                | 0 15 0                        |           |                                  |  |
| Intermen ..                         | T                    |                          |                                     |                               |           |                                  |  |
| Single Machine Scutcher<br>Tenters— |                      |                          |                                     |                               |           |                                  |  |
| Men ..                              | T                    | 281                      | 92.9                                | 0 15 0                        |           |                                  |  |
| Women ..                            | T                    | 1                        | 100.0                               | 0 13 7                        |           |                                  |  |
| Two Machine Scutcher Tenters ..     | T                    | 5                        | 89.3                                | 0 15 6                        |           |                                  |  |
| Willowmen—Men ..                    | T                    | 95                       | 93.3                                | 0 14 4                        |           |                                  |  |
| .. Women ..                         | T                    | 19                       | 94.4                                | 0 14 7                        |           |                                  |  |
| Thread Extractors—Men ..            | T                    | 73                       | 95.5                                | 0 13 6                        |           |                                  |  |
| .. .. Women ..                      | T                    | 13                       | 98.3                                | 0 12 2                        |           |                                  |  |
| .. ..                               | P                    | 7                        | 65.9                                | 0 11 1                        |           |                                  |  |
| .. ..                               | T                    | 402                      | 93.1                                | 0 15 4                        |           |                                  |  |
| Strippers ..                        | T                    | 139                      | 93.1                                | 1 2 1                         |           |                                  |  |
| Grinders ..                         | T                    | 6                        | 98.7                                | 0 15 9                        |           |                                  |  |
| Strippers and Grinders ..           | T                    | 27                       | 90.6                                | 1 4 7                         |           |                                  |  |
| Flat Grinders ..                    | T                    | 169                      | 92.8                                | 0 14 9                        |           |                                  |  |
| Lap Carriers ..                     | T                    |                          |                                     |                               |           |                                  |  |
| Carding Machine Attendants—         |                      |                          |                                     |                               |           |                                  |  |
| Standard System—                    |                      |                          |                                     |                               |           |                                  |  |
| Men ..                              | T                    | 541                      | 92.5                                | 0 14 10                       |           |                                  |  |
| Women ..                            | T                    | 2                        | 100.0                               | 0 14 0                        |           |                                  |  |
| Carding Machine Attendants—         |                      |                          |                                     |                               |           |                                  |  |
| Efficiency System ..                | T                    | 31                       | 95.8                                | 0 14 6                        |           |                                  |  |
| Fly Collectors—Men ..               | T                    | 67                       | 94.9                                | 0 14 2                        |           |                                  |  |
| .. Women ..                         | T                    | 13                       | 95.0                                | 0 14 0                        |           |                                  |  |
| Silver Lap Machinemen ..            | T                    | 33                       | 89.9                                | 1 1 2                         | 26 0 10   |                                  |  |
| Ribbon Lap Machinemen ..            | T                    | 32                       | 90.5                                | 1 1 4                         | 26 6 7    |                                  |  |
| Comber Tenters ..                   | T                    | 95                       | 84.4                                | 1 1 1                         | 24 4 10   |                                  |  |
| Needlers ..                         | T                    | 3                        | 80.2                                | 0 15 11                       | 21 8 8    |                                  |  |
| Combing Can Boys ..                 | T                    | 6                        | 82.1                                | 0 11 1                        | 15 6 2    |                                  |  |
| One Head Drawing Tenters—           |                      |                          |                                     |                               |           |                                  |  |
| Men ..                              | T                    | 3                        | 95.2                                | 1 0 2                         |           |                                  |  |
| .. ..                               | P                    | 1,162                    | 91.0                                | 1 4 0                         |           |                                  |  |
| .. ..                               | P                    | 29                       | 90.1                                | 1 3 0                         |           |                                  |  |

Figure 6: Example of Occupation Tables for Ahmedabad