# On the Risks of Belonging to Disadvantaged Groups: A Bayesian Analysis of Labour Market Outcomes

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# Employment and Labour Market

# Chapter 8

# On the Risk Associated With Belonging to Disadvantaged Groups: A Bayesian Analysis with an Application to Labour Market Outcomes in India

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**Abstract**

Although methods of analysis based on Bayes' theorem have had rich applications in Law and in Medicine they have not been much used in Economics. We use Bayes' theorem to construct two concepts of the "risk" associated with belonging to a particular group in terms of a favourable labour market outcome; this, in the Indian context, is taken as being in "regular employment". The first concept, the *Employment Risk Ratio*, measures the odds of a person being in regular employment to being in non-regular employment, given that he belongs to a particular group. The second, the *Group Risk Ratio*, measures the odds of a person being in regular employment, given that he belongs to one group against belonging to another group. We then apply these concepts of risk to data for four subgroups in India: forward-caste Hindus; Hindus from the Other Backward Classes; *Dalits* (collectively the Scheduled Castes and Scheduled Tribes); and Muslims. We show that, on both measures of risk, forward caste Hindus do best in the Indian labour market. This is partly due to their superior labour market attributes and partly due to their better access to good jobs. When inter-group differences in attributes are neutralised, the favourable labour market performance of forward caste Hindus is considerably reduced. We conclude that it is the lack of attributes necessary for, rather than lack of access to, regular employment that holds back India's deprived groups.

**Keywords: Labour Market; Risk Ratio; India; Caste; Religion.**

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# On the Risk Associated With Belonging to Disadvantaged Groups: A Bayesian Analysis with an Application to Labour Market Outcomes in India

## 1. Introduction

The concepts and ideas found in Bayes' Theorem encapsulated in equation 1 (See technical note below) to construct two concepts of the "risk" associated with belonging to a particular group in terms of the favourable labour market outcome. The first concept, the *Employment Risk Ratio*, measures the odds of a person being in regular employment to being in non-regular employment, given that he belongs to a particular group. The second, the *Group Risk Ratio*, measures the odds of a person being in regular employment, given that he belongs to one group against belonging to another group. These concepts of risk are applied to data for four subgroups in India: *forward-caste Hindus* (ie. Hindus belonging to the *Brahmin*, *Kshatriya*, and *Bania* "castes"); Hindus from the *Other Backward Classes* (OBC)[1]; *Dalits* (the Scheduled Castes); and the Scheduled Tribes; and *Muslims*. Dalits and Muslims are the least privileged groups, and forward-caste Hindus the most privileged group, in India with Hindus from the OBC occupying an intermediate position.

However, under the Indian Constitution, Dalits are protected by affirmative action in jobs ("jobs reservation"), education, and representation on elected bodies while Muslims are not. Affirmative action for *Dalits* was intended to assist groups who had known centuries of suppression while, for the Scheduled Tribes, it was intended to assist groups who were traditionally isolated from the modern world and from mainstream society.[2]

We use our concepts of risk to assess the extent to which the low representation of India's deprived groups in regular employment can be attributed to their low educational qualifications ("attribute disadvantage") and the extent to which it emanates from their lack of access to such employment ("access disadvantage"). The topic of minority disadvantage in the Indian labour market has always been a contentious issue in India but it has received new impetus through the publication of the Indian Cabinet Secretariat's Report on the social, economic and educational status of Muslims in India (Cabinet Secretariat, 2006). On the

[1] These are Hindus belonging to the *Sudra* "caste", the lowest caste within the ambit of the caste system.
[2] For the history and evolution of caste-based preferential policies in India see Osborne (2001).

basis of this report, the Prime Minister of India has made a case for Dalits and Muslims having first claim on national resources.[3]

The NSS employment and unemployment data give the distribution of its respondents - who are distinguished by various characteristics, including their caste, religion, and educational standard - between different categories of economic status. Of these categories, the three which are the most important are: *self-employed*; *regular salaried or wage employees;* and *casual wage labourers*. Using these data, we focused on prime-age (25-45 years of age) males and estimated, using the methods of multinomial logit, the probabilities of men being in these categories of employment, after controlling for their caste/religion[4] and their employment-related attributes.[5]

These probabilities were then used to decompose the difference between "group *X*" and forward caste Hindus in the proportions of their members in regular salaried or wage employment.[6] This decomposition allowed us to assign a proportion of this (overall) difference to "attribute differences" between the group X and forward caste Hindus – i.e. the outcome difference when the *different* attributes of group X and forward caste Hindus were evaluated using a *common* coefficient vector[7] ; the rest of the overall difference was then due to "coefficient differences" i.e. the outcome difference in when the attributes of group X were evaluated, first using the coefficient vector of group X and, then, using the coefficient vector of forward caste Hindus.[8] The proportionate contributions of the attributes and the coefficients differences, to the overall difference, are termed, respectively, the *attributes contribution* and the *coefficients contribution*.

[3] Speech to the National Development Council, 9th December 2006. http://pmindia.nic.in/speech/content.asp?id=464

[4] The caste/religion groups considered are: ST (Christian); ST (non-Christian); SC; OBC (Muslim); OBC (non-Muslim); forward caste Hindus (non-OBC/SC/ST Hindus); Muslims (non-OBC/SC/ST); Christian (non-OBC/SC/ST); Sikhs (non-OBC/SC/ST).

[5] The choice of prime-age males was influenced by the fact that very large proportion of these men were likely to be active in the labour market in the sense of being either employed or seeking employment.

[6] forward caste Hindus were Hindus who were not included in the OBC/SC/ST categories. However, since the designation of groups in the OBC category is a state responsibility a particular (caste) group may be included in the OBC category in one state (i.e. be excluded from forward caste Hindus) but be excluded from the OBC category in another state (i.e. be included in forward caste Hindus).

[7] Which could be the coefficient vector of either group X or forward caste Hindus.

[8] Alternatively, the attributes of forward caste Hindus could be evaluated, first using the coefficient vector of group X and, then, using the coefficient vector of forward caste Hindus.

We can compute the proportion of the (overall) difference between forward caste Hindus and persons in group X, in the proportions of their members in regular salaried and wage employment, which is due to "coefficient differences" (the coefficients contribution). This proportion may be interpreted as a measure of "discrimination" against, or for, persons from group X.

If this difference is *positive* – the proportion of persons in regular salaried and wage employment is *higher* when the attributes of group X are evaluated using its own coefficients than the coefficients of forward caste Hindus – then discrimination works *in favour* of group X; on the other hand, if this difference is *negative* – the proportion of persons in regular salaried and wage employment is *smaller* when the attributes of group X are evaluated using its own coefficients than the coefficients of forward caste Hindus – then discrimination works *against* group X. Given that employers might be expected to have a preference for employing forward caste Hindus, compared to persons from the SC or the ST,[9] jobs reservation policies in favour of applicants from the SC and ST might be expected to blunt discrimination against SC/ST applicants and, possibly, even reverse it.

This method of measuring discrimination for or against persons from group X, described above, needs to be qualified in, at least, three respects. First, note that discrimination is computed *conditional upon a given set of attributes*. If these attributes are added to, or subtracted from, then the degree of discrimination would also change. For example, if better data on educational qualifications became available, then the degree of discrimination computed from the new data would be different from the original estimate. So, there is no unique degree of discrimination.

Second, even if one could establish a definitive vector of relevant attributes, an unique degree of discrimination might still not be established. This is because the attributes contribution could be computed using either the coefficients of group X or the coefficients of forward caste Hindus *and the two methods may not yield the same result*. There is nothing in the methodology to suggest that one computation is to be preferred over the other. Consequently, the coefficients difference – computed as the difference between the overall difference and the contribution of attributes difference - would be different depending upon

how the attributes contribution was computed.[10] Also for this reason, there may be no unique degree of discrimination.

Third, the methodology assumes a one-way relation between attributes and employment outcomes. For example, exogenously given high (low) educational qualifications are likely to lead to good (bad) employment outcomes. This assumed exogeneity of qualifications might be justified at a point in time but, with a broader time frame, it is plausible that past good/bad employment outcomes in the past contribute to present high/low educational qualifications. In other words, there is a two-way relation between qualifications and employment outcomes: qualifications influence employment outcomes but employment outcomes also influence qualifications.

To put it differently, the degree of discrimination as measured by our methodology measures discrimination at a point in time, conditional on a given set of attributes. But the poor attributes of the members of a group may be the result of past discrimination against such persons: the fact that members of a group were denied good jobs in the past was a barrier to their acquiring good educational qualifications and this resulted in their inability to secure good jobs today. Consequently, it needs to be emphasised that the degree of discrimination measured in this study will necessarily understate the "true" (i.e. historical), but unknown, degree of discrimination.

Two final points may be made. First, a person may be discouraged from applying for a particular type of job if he feels that applications from members of his group are treated unfavourably compared to applications from members of other groups. This "discouraged applicant" effect as it pertains to certain groups cannot be observed. Second, the category "regular salaried and wage employment" is a broad one encompassing low status/poorly paid to high status/well paid jobs. We are unable, given the data, to break such employment into different types of jobs but it is very possible that a further type of discrimination is that, for some groups, the access of its members to "regular salaried and wage employment" is largely confined to the lower end of the spectrum of such jobs.

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[9] This preference might be engendered by a distaste for persons from such groups (bigotry: Becker, 1971) or by a belief that employees from such groups were inferior workers (statistical discrimination: Phelps, 1972).

[10] An equivalent way of expressing is that the coefficient difference may be computed either by evaluating the attributes of group X or by evaluating the attributes of forward caste Hindus using the two different coefficient vectors.

## 2. Empirical Background

The relevant data are from the 55th round (1999-2000) of the National Sample Survey (NSS) for India. The NSS employment and unemployment data give the distribution of its respondents - who are distinguished by various characteristics, including their caste, religion, and educational standard - between different categories of economic status. In this study we focus on the 73,789 Hindu and Muslim respondents, living in the 16 major states of India and the Union Territory of Delhi, who were prime-age (25-45 years of age) males. A large proportion of these men were likely to be active in the labour market i.e. either employed or seeking employment. Amongst Hindus, we drew a distinction between forward caste (FC) Hindus, Hindus from the Other Backward Classes (OBC), and Dalits.

Table 1 shows the distribution of these men, by their educational standard, between the following categories of economic status[11]:

1. Own account workers (self-employed)
2. Unpaid family workers
3. Regular salaried or wage workers
4. Casual wage worker
5. Employers
6. Seeking and/or available for work

Of these six categories, the first four were the main categories of economic status for prime-age men: 28,470 of the 73,789 men (39 percent) were self employed; 16,379 men (22 percent of the total) were regular salaried or wage workers; 18,451 men (25 percent of the total) were casual labourers; and 7,988 men (11 percent of the total) were unpaid family workers.

Being a casual wage worker or self employed was largely the preserve of poorly educated men while those in regular employment were largely drawn from the ranks of the better educated men: half of the 18,451 prime-age men who were casual wage workers were illiterate and, of those who were literate, nearly all had an education standard less than secondary school; of the 28,470 men who were own account workers, one-fourth were illiterate and, of those that were literate, nearly 90 percent had an education standard less than secondary school; on the other hand, of the 16,379 prime-age men who were regular

[11] Excluded from this analysis were 2,359 prime-age males who were: attending educational institutions (655 men); attending domestic duties, and/or producing goods and services for household use (for example, serving, tailoring, weaving), and/or engaged in free collection of goods - for example, vegetables, roots, firewood, cattle

salaried or wage workers, 61 percent were educated to secondary (or above) and 27 percent of the 16,379 workers were graduates (or above). A striking feature of Table 1 is how few men were seeking, and/or available for, work: only 1,553 men (2 percent of the total) were unemployed in the conventional meaning of the term. Moreover, job search appeared to be the prerogative of better educated men: of the 1,553 "unemployed" men, 76 percent were educated to secondary level or above and 41 percent were graduates or postgraduates.

Table 2 shows the distribution of prime-age men across the categories of economic status by religion and caste. Table 2 clearly shows that Hindu OBC prime-age males were different from Dalits in two important respects. First, Hindu OBC men were *more* likely to be in self employment (41 percent) than Dalits (30 percent). Second, Hindu OBC men were *less* likely to work as casual labourers (25 percent) than Dalits (45 percent). Prime-age Hindu males from the OBC also differed from their FC Hindu counterparts in two important respects. First, FC Hindu men were more likely to be in regular employment (32 percent) than Hindu OBC men (19 percent). Second, FC Hindu men were even less likely (10 percent) to work as casual labourers than Hindu men from the OBC.

Lastly, 46 percent of Muslims were self employed, 24 percent worked as casual wage workers, and 18 percent were regular salaried or wage workers. Thus the labour market position of prime-aged Muslim men was very similar to that of Hindus from the OBC. Consequently, if one was to establish a hierarchy of communities in terms of the "desirability" of the economic status of their prime-age men then, undoubtedly, Dalits, a large proportion of whose (prime age) men were casual wage workers, would lie at the bottom; FC Hindus, with one third of their men in regular employment, and only one tenth of their men working for casual wages, would be at the top; and sandwiched between them would be Hindus from the OBC and Muslims.

This study implicitly assumes that becoming a regular salaried or wage worker was the most desirable outcome for prime-aged men and, compared to that, self employment or casual wage labour were inferior outcomes. One can cite many justifications for this assumption. First, as referred to already, the Prime Minister of India has set up a high-powered committee to look at minority employment and, in particular, to examine why Muslims comprise only a fraction of India's workforce. Second, this assumption is also

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feed (310 men); rentiers, pensioners, and remittance recipients (175 men); unable to work owing to a disability (448 men); beggars and prostitutes (42 men); and "others" (729 men).

consistent with evidence from the field: for example, Jeffery and Jeffery (1997) argued that many Muslims regarded their relative economic weakness as stemming from anti-Muslim discriminatory practices in hiring. The belief that their sons would not get jobs then led Muslim parents to devalue the importance of education as an instrument of upward economic mobility.[12]

Lastly, Table 3 shows the education standards of prime-age men from the different communities. Dalits had, by far, the lowest level of educational achievement: 44 percent of prime-age Dalit men were illiterate. They were followed by Muslims and Hindus from the OBC: 31 percent of Muslim men and 27 percent of Hindu OBC men were illiterate. The best educated men were FC Hindus: only 10 percent of FC Hindu men were illiterate and 24 percent of them were graduates.

## 3. Empirical Analysis: The Group Risk Ratio and the Group Bayes Factor

Table 4 presents estimates of the upper-triangle of the matrix of Group Risk Ratios (*GRR*), for regular salaried and wage employment, for the total of 63,300 prime age men (hereafter, simply "men") from four groups: FC Hindus (19,190), Hindus from the OBC (20,082), Muslims (7,997), and Dalits (16,031). The values of the *unadjusted* GRR, shown in the top panel of Table 4, were calculated from the sample data and show that the proportion of FC Hindu men in regular employment (38.7 percent) was: 1.74 times the proportion of Hindu men from the OBC in regular employment (22.3 percent); 1.85 times that of Muslim men (20.9 percent); and 2.21 times that of Dalit men (17.5 percent).

One reason why there might be differences between the groups in the proportions of their men in regular employment, $P(R|X)$, is because of inter-group differences in the distribution of attributes relevant for regular employment. For example, since half of all male graduates were in regular employment (Table 1) and since 24 percent of FC Hindu men, but only 5 percent of Dalit men, were graduates (Table 3) then, compared to FC Hindus, one would expect to see a (considerably) smaller proportion of Dalits in regular employment. A second reason for the unequal representation of groups in regular employment is that persons from some groups may have better access to such employment than those from other groups. For example, a graduate who is a FC Hindu may find it much easier to find employment than a Dalit graduate; consequently, even without inter-group differences in attributes, there may

[12] However, there may be cases where self employment is the preferred outcome over the available choices. We are unable to take account of such preferences because all we observe is the outcome and not the reasons for the outcome.

be marked differences between the groups in their representation among those in regular employment. The numbers under the "unadjusted" rubric result from the combined influence of inter-group differences in attributes and access.

The adjusted *GRR*, shown in the lower panels of Table 4, are the result of neutralising inter-group differences in attributes. In order to eliminate attribute differences, we constructed an "equal attributes" scenario:

(i) Inter-group differences in land holdings were eliminated by assuming that everyone was landless.
(ii) Inter-group age differences were eliminated by assuming that everyone was in the 25-30 years age bracket.
(iii) Inter-group differences in the state of residence were eliminated by assuming that everyone lived in the default state, Tamil Nadu.
(iv) Inter-group sectoral differences were eliminated by assuming that everyone worked in the urban sector.

Then, under this umbrella of uniformity - (i)-(iv), above - we assumed that all the individuals in the sample had the *same* level of education at, successively, lower levels:

(a) Everyone was a graduate.
(b) Everyone was educated up to secondary level.
(c) Everyone was educated to above primary, but below secondary, level.
(d) Everyone was literate, but *all* had below primary level education.

Lastly, we estimated a multinomial logit model in which the dependent variable $Y_i$ took the values, 1, 2, or 3, depending upon whether person *i* was self employed; a regular salaried or wage worker; a casual wage labourer (63,300 observations):

$$\frac{\Pr(Y_i = j)}{\Pr(Y_i = 1)} = f(\text{landholding, social group, education, state, sector})$$

These multinomial estimates are shown in Table A of the Appendix, with self employment as the base, or reference, category. [13] These estimates were used to predict the average probabilities of persons in the four different groups being in regular employment – *P(R|X)*, *X=H, O, M, D* – under four different scenarios: (i)-(iv) plus (a); (i)-(iv) plus (b); (i)-(iv) plus (c); (i)-(iv) plus (d). The *GRR* implied by the predicted probabilities are shown in the lower panels of Table 4, prefaced by the term "adjusted".

As observed earlier, the values for the different groups of their *unadjusted GRR* are the result of two forces: inter-group differences in attributes and inter-group differences in access to regular employment. On the other hand, the values of the *adjusted GRR* were obtained by eliminating differences in attributes between the groups: consequently, inter-group differences in the values of adjusted *GRR* are a reflection solely of differences between the groups in their access to regular employment.

As a consequence, the values of adjusted *GRR* – of FC Hindus over the three other groups – for regular employment were always lower than the corresponding unadjusted values: once the attributes advantage that FC Hindus enjoyed over the other groups (see Table 3) were neutralised, the odds of being in regular employment of Hindu men to men from other groups was predicted to be (considerably) lower than the odds computed from the sample averages.

[13] With *J* mutually exclusive and collectively exhaustive outcomes, indexed *1…J*, the multinomial logit model is defined by a pair of equations. The first, defines *the log odds ratio* of a person *i* being in status *j>1*, relative to being in the 'base' status *j=1*, as a linear function of $\mathbf{X_i} = \{X_{ik},\ k = 1...K\}$, the vector of values of *K* explanatory variables ( $X_{i1} = 1$ ) for the person: $\log\left(\frac{\Pr(Y_i = j)}{\Pr(Y_i = 1)}\right) = \sum_{k=1}^{K} \beta_{jk} X_{ik} = \mathbf{X_i}\boldsymbol{\beta}_\mathbf{j}$ where: $Y_i$ is an integer variable which takes the value *j* if, and only if, outcome *j* occurs for person *i*, and $\boldsymbol{\beta}_\mathbf{j}$ is the vector of coefficients associated with outcome *j*, $\beta_{j1}$ being the coefficient associated with the intercept term. The second equation defines the probability of outcome *j* (*j=1…J*) occurring for individual *i* as: $\Pr(Y_i = j) = \exp(Z_{ij}) / [1 + \sum_{r=1}^{J} Z_{ir}] = F(\mathbf{X_i}\boldsymbol{\beta}_\mathbf{j})$ . The coefficient estimates are to be interpreted as the *change* in the log odds-ratios, consequent upon a unit change in the value of the associated variable: $\beta_{jk} = \frac{\partial}{\partial X_{ik}} \log\left(\frac{\Pr(Y_i = j)}{\Pr(Y_i = 1)}\right)$

Within the context of the adjusted *GRR* values – of FC Hindus over the three other groups – for regular employment, these were lowest when it was assumed that all the men were graduates (i.e. scenario (i)-(iv) plus (a)) and they increased as the common level of education was reduced. The quality of jobs which offered regular employment was likely to be low if applicants had poor educational levels: for example, a government department might appoint graduates to officer level positions but offer more lowly jobs to those who failed to complete school. Consequently, attributes, and probity in selection procedures, were likely to be relatively less important than access in getting regular employment in "low-status", compared to "high status", jobs. Indeed, because of the Indian government's affirmative action policies in favour of Dalits, the adjusted *GRR* values of FC Hindus over Dalits, for regular employment, was, under the "all men are graduates" scenario less than 1 or, equivalently, the probability of Hindu graduates being in regular employment was lower than that of Dalit graduates.

The Group Bayes Factor *(GBF)* values represent the odds of a person, *who is in regular employment*, belonging to one group over belonging to another group. As equation (3) of technical note 2 shows, the *GBF* values are obtained from the *GRR* by multiplying the latter by the total numbers in one group over the other. Consequently, if $N_X$ and $N_Y$ are the numbers in two groups $X$ and $Y$, $\Omega^R_{XY} > \sigma^R_{XY}$ if $N_X > N_Y$.

Since the number of FC Hindus in the sample (19,190) was greater than the number of Dalits (16,031) and Muslims (7997), the odds of a person *in regular employment* being a FC Hindu rather than a Dalit or a Muslim (unadjusted *GBF* was 2.65 for Dalits and 4.44 for Muslims) were greater than the odds of a Hindu to a Dalit, or a Muslim, *being in regular employment* (Table 4: unadjusted *GRR* was 2.21 for Dalits and 1.85 for Muslims).

Conversely, since the sample had more Hindus from the OBC (20,082) than FC Hindus (19,190), the odds of a person *in regular employment* being a FC, rather than an Other Backward Classes, Hindu (unadjusted *GBF* was 1.67) was smaller than the odds of a FC to a OBC Hindu *being in regular employment* (Table 4: unadjusted *GRR* was 1.74 for Hindus from the Other Backward Classes).

## 4. Empirical analysis: The Employment Risk Ratios and the Employment Bayes Factors

In the empirical analysis of the Employment Bayes Factors (*EBF*) and the Employment Risk Ratios (*ERR*), described in section 3 above, we focused on the three main employment categories: regular salaried or wage employment (16,379 men); self employment (28,470 men); and casual wage employment (18,451 men).[14] This yielded a total of 63,300 prime-age men. All those who were self employed or who were casual wage employees were regarded as being in *non-regular employment*. The values of the *EBF* and the *ERR* are shown in Table 5 for each of the four social groups: FC Hindus, Hindus from the OBC, Muslims, and Dalits.

The first set of figures in Table 5, under the heading "unadjusted", shows the values of $P(X \mid R)$ and $P(X \mid C)$, calculated as the sample proportions of persons in regular and non-regular employment who belonged to group X. Of the 16,739 men in regular employment: 45 percent were FC Hindus, 27 percent were Hindus from the OBC, 17 percent were Dalits, and 10 percent were Muslims. Of the 46,921 men in non-regular employment: 25 percent were FC Hindus, 33 percent were Hindus from the OBC, 28 percent were Dalits, and 13 percent were Muslims. On these "unadjusted" probabilities of belonging to a group, *conditional on being in regular employment /being in non-regular employment*, the *EBF* (equation (2) of technical note 2) was 0.55 for FC Hindus, 1.22 for Hindus from the OBC, 1.32 for Muslims, and 1.64 for Dalits.

This means that a man was less likely, by a factor of 0.55, to be a FC Hindu if he was in non-regular employment than if he was in regular employment. On the other hand, the Bayes Factor for the other groups was greater than unity and was highest for Dalits: a man was more likely to be a Dalit, by a factor of 1.64, if he was in non-regular employment than if he was in regular employment .

[14] Excluded from the analysis were men who were: in unpaid family employment (7,988 men); employers (948 men); seeking work (1,553 men).

The ratio of those in non-regular employment (16,379) to those in regular employment (46,921) was 2.87 (i.e. $P(C)/P(R) = 2.87$), yielding a *ERR* value (equation (2)) of 1.58 for FC Hindus, 3.50 for Hindus from the OBC, 3.78 for Muslims, and 4.70 for Dalits. This means that the probability of a FC Hindu male being in non-regular employment was 1.58 times more than the probability of him being in regular employment. The *ERR* was highest for Dalits: the probability of a Dalit male being in non-regular employment was as much as 4.7 times more than the probability of him being in regular employment.

As discussed earlier, the unequal representation of the different groups in the ranks of those in regular employment stems from differences between the groups in the attributes relevant for such employment and from inter-group differences in access to such employment. For example, if 27 percent of those in regular employment are graduates (Table 1) and 62 percent of graduates are Hindus, but only 9 percent of graduates are Dalits (Table 3) then one would expect to see a larger proportion of Hindus than Dalits among those in regular employment. The numbers under the "unadjusted" rubric represent inter-group differences emanating from both these sources.

The next set of calculations in Table 5 (i.e. those headed "adjusted") show the *EBF* and *ERR* values after differences in attributes between the individuals in the different groups had been eliminated using the methodology described in the previous section. The estimates from a multinomial logit model (shown in Table B of the Appendix) - whose dependent variable $Y_i$ took one of the values 1, 2, 3 or 4 depending upon whether person *i* was a FC Hindu, a Hindu from the OBC, a Dalit, or a Muslim - were used to predict the average probabilities, of persons in regular employment, of belonging to the different groups under the four scenarios, described in the preceding section: (i)-(iv) plus (a); (i)-(iv) plus (b); (i)-(iv) plus (c); (i)-(iv) plus (d).

Under uniformity of attributes, the *ERR* for Hindus rose from 1.58 (unadjusted) to 2.61 (adjusted, "all graduates"). In other words, if it was assumed that all the men were graduates, the probability of a FC Hindu male being in non-regular employment rose from 1.58 times, to 2.61 times, of the probability of him being in regular employment. Paralleling this rise, the *ERR* for Hindus from the OBC fell from 3.5 to 2.92; for Muslims it fell from 3.78 to 3.67; and for Dalits, it fell from 4.7 to 2.75.

These changes from the unadjusted to the adjusted *ERR* reveal many interesting features of the Indian labour market. First, as Table 2 shows, FC Hindu men enjoyed a tremendous educational advantage over men from the other groups. This resulted in the unadjusted *ERR* of FC Hindu men being less than half that of Hindus from the OBC and of Muslims, and less than one-third that of Dalits. When differences in education between FC Hindus and the other groups were neutralised, the differences in the *ERR* values were appreciably reduced. Now, the only advantage that FC Hindus had was better access to regular employment. However, jobs reservation in favour of Dalits served to blunt the "access advantage" of FC Hindus: in consequence, once education differences were neutralised, there was not much difference in their *ERR* values between FC Hindus and Dalits.

Neutralising inter-group educational differences affected the *ERR* of Muslims the least: the unadjusted *ERR* fell from its unadjusted value of 3.78 to around 3.66. A large part of Muslim disadvantage in the jobs market stems from the difficulty that Muslims have in finding regular employment ("access disadvantage"). For example, Jeffery and Jeffery (1997) in their study of Muslims in Bijnor argued that many Muslims regarded their relative economic weakness as stemming from their being excluded from jobs due to discriminatory practices in hiring. The belief that their sons would not get jobs then led Muslim parents to devalue the importance of education as an instrument of upward economic mobility. However, unlike Dalits, Muslims are not protected by jobs reservation. Consequently, even after abstracting from their low education levels, compared to FC Hindus, Muslims still suffered from considerable access disadvantage in terms of obtaining regular employment.

## 5. Access versus Attributes: An Assessment of the Social Groups in Terms of Their Outcomes for Regular Employment

Intuitively, the ratio of the unadjusted and the adjusted values of the Group Risk Ratios (GRR), of FC Hindus to, say, Dalits, is a measure of the attribute advantage of FC Hindus over Dalits, if this exceeds 1, i.e. the unadjusted GRR is greater than the adjusted GRR - or disadvantage, if this is less than 1, i.e. the unadjusted GRR is less than the adjusted GRR - in terms of securing regular employment. Then the percentage contributions made to the unadjusted Hindu-Dalit *GRR* by the attributes and access advantages of FC Hindus over Dalits are computed.

The first row of Table 6 shows the unadjusted *GRR* of FC Hindus to the three other groups: Hindus from the OBC, Muslims, and Dalits. When assumptions (i)-(iv) of the attribute equalising scenario, detailed in section 3, were applied *in conjunction with the assumption that everyone was a graduate*, the *GRR* values of the groups fell to 1.01, 1.06, and 0.98 for, respectively, Hindus from the OBC, Muslims, and Dalits. From this we conclude that 98 percent of the unadjusted *GRR* of FC Hindus to Hindus from the OBC was due to attributes advantage and only 2 percent was due to access advantage; of the unadjusted *GRR* of FC Hindus to Muslims, 90 percent was due to attributes advantage and 10 percent was due to access advantage; [15] attributes advantage contributed entirely to the unadjusted *GRR* of FC Hindus to Dalits. [16]

As the common educational standard in the simulations was lowered, the advantage of FC Hindus over the other groups was reduced: for example, as Table 3 shows, 32 percent of FC Hindus – compared to 12 percent of Dalits, 17 percent of Muslims, and 21 percent of Hindus from the OBC – were educated up to secondary level. When this advantage was neutralised by assuming that all prime age men were educated up to secondary level, men from the other groups did not benefit by as much, in terms of their probabilities of being in regular employment, as they had in the earlier simulation in which it was assumed that all prime age men were graduates.

Similarly, when the attributes advantage of FC Hindus was neutralised by assuming that all prime age men were educated up to middle school level, men from the other groups did not benefit by as much, in terms of their probabilities of being in regular employment, as they had in the earlier simulation in which it was assumed that all prime age men were educated up to secondary level. Consequently, as Table 6 illustrates, the importance of access to regular employment increased, and the importance of possessing the attributes needed for regular employment decreased, as the common educational threshold was lowered.

[15] The fact that Hindus have access advantage to regular employment over Muslims is evidenced by the fact that even when attributes between prime age men in the two groups are equalised, with all being assumed to be graduates, the predicted probability of Muslims being in regular employment ( $P(R \mid \tilde{M}) = 0.797$ ) is less than that of Hindus ( $P(R \mid \tilde{H}) = 0.849$ ).

[16] The fact that Hindus have access disadvantage to regular employment over Dalits is evidenced by the fact that even when attributes between prime age men in the two groups are equalised, with all being assumed to be

## 6. Conclusions

This paper argues that participation in regular employment across different social groups is determined by the relative advantage of groups in terms of "attributes" (e.g., educational attainment) and "access" (e.g., reservation for specific groups). It first develops two concepts of "risk", namely, the *Employment Risk Ratio*, measured the odds of a person being in regular employment to being in non-regular employment, given that he belongs to a particular group; and the *Group Risk Ratio*, measured the odds of a person being in regular employment, given that he belonged to one group against belonging to another group.

These concepts of risk were then applied to data for four subgroups in India: forward-caste Hindus, Hindus from the Other Backward Classes, Muslims, and *Dalits* (collectively the Scheduled Castes and Scheduled Tribes); this showed that, on both measures of risk, FC Hindus did best in the Indian labour market. A decomposition of the effects suggested that their superior labour market attributes were partly due to the relatively large number of FC Hindus who were graduates; partly also due to their better access to jobs offering regular employment.

When inter-group differences in attributes were neutralised, the favourable labour market performance of FC Hindus was considerably reduced. The conclusion of this study is that it is the lack of attributes necessary for, rather than lack of access to, regular employment that holds back India's deprived groups. However, to date, the Indian government's jobs reservation policies has placed little emphasis on improving job-related attributes but, instead, has focused almost entirely on improving access. This paper has drawn attention to another prong of policy which is to improve the educational standards of Dalits and Muslims especially by improving job-related attributes through education and skill formation and concurrently imporove access to regular employment through fair financial allocations and leagal backing if necessary.

The second conclusion of this study is that, compared to FC Hindus, Muslims – who, unlike Dalits, are not protected by jobs reservation - suffered from considerable access disadvantage in terms of obtaining regular employment, even after abstracting from their low

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graduates, the predicted probability of Dalits being in regular employment ( $P(R \mid \tilde{D}) = 0.870$ ) is higher than that of Hindus ( $P(R \mid \tilde{H}) = 0.849$ ).

education levels. Indeed, compared to FC Hindus, the access disadvantage of Muslims was considerably higher than that of the Hindu OBC. So, if the object of jobs reservation is to correct for discriminatory bias in the jobs market, and if reservation is to be extended beyond Dalits, then Muslims have a more compelling case than the Hindu OBC!

The third and perhaps most important conclusion of this study is – as the more patient readers of this chapter will, undoubtedly, have already inferred – that the subject of jobs reservation in India is a complex one, requiring a careful, detailed, and painstaking analysis of the available data. However, too often, in the Indian context, the opposite is the case: the rhetoric underpinning the discussion of jobs reservation is often shrill and recriminatory and the actions accompanying these ill-tempered words are usually retributive and violent. If this paper has any message then it is that this course of action is sterile and unproductive at best and, at worst, destructive of self, society, and country.

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## Table 1

**Economic Status and Educational Standards of Men between 25 and 45 years of age (1999-00)**

| | Illiterate | Literate, but below primary | Primary or Middle School | Secondary School | Graduate | Total |
|---|---|---|---|---|---|---|
| | | | | | | |
| **SE** | 7,094 | 3,399 | 9,148 | 6,125 | 2,704 | 28,470 |
| | 24.92 | 11.94 | 32.13 | 21.51 | 9.50 | 100.00 |
| | 37.17 | 41.44 | 42.94 | 37.97 | 29.82 | 38.58 |
| | | | | | | |
| **EMP** | 74 | 62 | 300 | 318 | 194 | 948 |
| | 7.81 | 6.54 | 31.65 | 33.54 | 20.46 | 100.00 |
| | 0.39 | 0.76 | 1.41 | 1.97 | 2.14 | 1.28 |
| | | | | | | |
| **UFW** | 1,424 | 688 | 2,635 | 2,339 | 902 | 7,988 |
| | 17.83 | 8.61 | 32.99 | 29.28 | 11.29 | 100.00 |
| | 7.46 | 8.39 | 12.37 | 14.50 | 9.95 | 10.83 |
| | | | | | | |
| **RSWE** | 1,316 | 1,053 | 4,046 | 5,469 | 4,495 | 16,379 |
| | 8.03 | 6.43 | 24.70 | 33.39 | 27.44 | 100.00 |
| | 6.90 | 12.84 | 18.99 | 33.90 | 49.56 | 22.20 |
| | | | | | | |
| **CWW** | 9,136 | 2,950 | 4,896 | 1,329 | 140 | 18,451 |
| | 49.51 | 15.99 | 26.54 | 7.20 | 0.76 | 100.00 |
| | 47.88 | 35.97 | 22.98 | 8.24 | 1.54 | 25.01 |
| | | | | | | |
| **SKW** | 39 | 50 | 278 | 552 | 634 | 1,553 |
| | 2.51 | 3.22 | 17.90 | 35.54 | 40.82 | 100.00 |
| | 0.20 | 0.61 | 1.30 | 3.42 | 6.99 | 2.10 |
| | | | | | | |
| **Total** | 19,083 | 8,202 | 21,303 | 16,132 | 9,069 | 73,789 |
| | 25.86 | 11.12 | 28.87 | 21.86 | 12.29 | 100.00 |
| | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Notes to Table 1:
SE=self-employed; EMP=employer; RSWE=regular salaried or wage worker; CWW=casual wage worker; SKW=seeking work.
First figure in column is total in caste/religion category; second figure is row percentage; third figure is column percentage.
*Source: NSS 55$^{th}$ Round*

**Table 2**
**Economic Status and Caste/Religion of Men between 25 and 45 years of age (1999-00)**

| | Dalits | Muslims | Other Backward Classes | Forward Caste Hindus | Total |
|---|---|---|---|---|---|
| **SE** | 5,285 | 4,149 | 9,686 | 9,350 | 28,470 |
| | 18.56 | 14.57 | 34.02 | 32.84 | 100.00 |
| | 30.25 | 45.88 | 40.83 | 39.70 | 38.58 |
| | | | | | |
| **EMP** | 59 | 137 | 301 | 451 | 948 |
| | 6.22 | 14.45 | 31.75 | 47.57 | 100.00 |
| | 0.34 | 1.51 | 1.27 | 1.91 | 1.28 |
| | | | | | |
| **UFW** | 1,132 | 729 | 2,970 | 3,157 | 7,988 |
| | 14.17 | 9.13 | 37.18 | 39.52 | 100.00 |
| | 6.48 | 8.06 | 12.52 | 13.40 | 10.83 |
| | | | | | |
| **RSWE** | 2,807 | 1,670 | 4,472 | 7,430 | 16,379 |
| | 17.14 | 10.20 | 27.30 | 45.36 | 100.00 |
| | 16.07 | 18.47 | 18.85 | 31.55 | 22.20 |
| | | | | | |
| **CWW** | 7,939 | 2,178 | 5,924 | 2,410 | 18,451 |
| | 43.03 | 11.80 | 32.11 | 13.06 | 100.00 |
| | 45.44 | 24.08 | 24.97 | 10.23 | 25.01 |
| | | | | | |
| **SKW** | 250 | 180 | 369 | 754 | 1,553 |
| | 16.10 | 11.59 | 23.76 | 48.55 | 100.00 |
| | 1.43 | 1.99 | 1.56 | 3.20 | 2.10 |
| | | | | | |
| **Total** | 17,472 | 9,043 | 23,722 | 23,552 | 73,789 |
| | 23.68 | 12.26 | 32.15 | 31.92 | 100.00 |
| | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Notes to Table 2:
SE=self-employed; EMP=employer; RSWE=regular salaried or wage worker; CWW=casual wage worker; SKW=seeking work.
First figure in column is total in caste/religion category; second figure is row percentage; third figure is column percentage.
*Source: NSS 55$^{th}$ Round*

**Table 3**
**Education Standard and Caste/Religion of Men between 25 and 45 years of age (1999-00)**

| | Dalits | Muslims | Other Backward Classes | Forward Caste Hindus | Total |
|---|---|---|---|---|---|
| | | | | | |
| **Illiterate** | 7,803 | 2,913 | 6,506 | 2,321 | 19,543 |
| | 39.93 | 14.91 | 33.29 | 11.88 | 100.00 |
| | 43.81 | 31.37 | 26.89 | 9.59 | 25.89 |
| | | | | | |
| **Literate, but below primary** | 2,437 | 1,341 | 2,851 | 1,696 | 8,325 |
| | 29.27 | 16.11 | 34.25 | 20.37 | 100.00 |
| | 13.68 | 14.44 | 11.78 | 7.01 | 11.03 |
| | | | | | |
| **Primary or Middle School** | 4,556 | 2,842 | 7,741 | 6,530 | 21,669 |
| | 21.03 | 13.12 | 35.72 | 30.14 | 100.00 |
| | 25.58 | 30.61 | 32.00 | 26.98 | 28.70 |
| | | | | | |
| **Secondary School** | 2,165 | 1,541 | 5,049 | 7,779 | 16,534 |
| | 13.09 | 9.32 | 30.54 | 47.05 | 100.00 |
| | 12.15 | 16.59 | 20.87 | 32.14 | 21.90 |
| | | | | | |
| **Graduate** | 852 | 649 | 2,046 | 5,877 | 9,424 |
| | 9.04 | 6.89 | 21.71 | 62.36 | 100.00 |
| | 4.78 | 6.99 | 8.46 | 24.28 | 12.48 |
| | | | | | |
| **Total** | 17,813 | 9,286 | 24,193 | 24,203 | 75,495 |
| | 23.59 | 12.30 | 32.05 | 32.06 | 100.00 |
| | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Source: NSS 55$^{th}$ Round

**Table 4**
**Group Risk Ratios for Regular Salaried and Wage Employment**

| | Unadjusted Group Risk Ratios | | | |
|---|---|---|---|---|
| | Forward Caste Hindus | Hindus from the OBC | Muslims | Dalits |
| Forward Caste Hindus | 1 | 1.74 | 1.85 | 2.21 |
| Hindus from the OBC | | 1 | 1.07 | 1.27 |
| Muslims | | | 1 | 1.19 |
| Dalits | | | | 1 |
| | Adjusted Group Risk Ratios: all are graduates | | | |
| Forward Caste Hindus | 1 | 1.01 | 1.06 | 0.98 |
| Hindus from the OBC | | 1 | 1.05 | 0.96 |
| Muslims | | | 1 | 0.92 |
| Dalits | | | | 1 |
| | Adjusted Group Risk Ratios: all have secondary education | | | |
| Forward Caste Hindus | 1 | 1.04 | 1.12 | 1.02 |
| Hindus from the OBC | | 1 | 1.08 | 0.98 |
| Muslims | | | 1 | 0.91 |
| Dalits | | | | 1 |
| | Adjusted Group Risk Ratios: all have middle education | | | |
| Forward Caste Hindus | 1 | 1.10 | 1.21 | 1.14 |
| Hindus from the OBC | | 1 | 1.09 | 1.03 |
| Muslims | | | 1 | 0.94 |
| Dalits | | | | 1 |
| | Adjusted Group Risk Ratios: all have below primary education | | | |
| Forward Caste Hindus | 1 | 1.16 | 1.25 | 1.26 |
| Hindus from the OBC | | 1 | 1.08 | 1.09 |
| Muslims | | | 1 | 1.01 |
| Dalits | | | | 1 |

Notes:
R is regular salaried and wage employment; X and Y are groups.

Group Risk Ratio = $\frac{P(R|X)}{P(R|Y)}$ with group Y represented *across the columns*

**Table 5**
**Employment Bayes Factor (EBF) and Employment Risk Ratio (ERR) Calculations for Social Groups in India:**
**Regular versus Non-Regular Employment**

| | Forward Caste Hindus | Hindus from OBC | Muslims | Dalits |
|---|---|---|---|---|
| ***Unadjusted:*** | | | | |
| P(group X \|R) | 45.36 | 27.30 | 10.20 | 17.14 |
| P(group X \|C) | 25.06 | 33.27 | 13.48 | 28.18 |
| EBF | 0.55 | 1.22 | 1.32 | 1.64 |
| ERR | 1.58 | 3.50 | 3.78 | 4.70 |
| ***Graduates:*** | | | | |
| P(group X \|R) | 23.85 | 57.44 | 6.09 | 12.61 |
| P(group X \|C) | 21.71 | 58.35 | 7.85 | 12.09 |
| EBF | 0.91 | 1.02 | 1.28 | 0.96 |
| ERR | 2.61 | 2.92 | 3.67 | 2.75 |
| ***Secondary Education:*** | | | | |
| P(group X \|R) | 14.25 | 64.83 | 6.83 | 14.09 |
| P(group X \|C) | 12.82 | 65.11 | 8.71 | 13.36 |
| EBF | 0.90 | 1.01 | 1.28 | 0.95 |
| ERR | 2.58 | 2.89 | 3.67 | 2.72 |
| ***Primary and above but below Secondary Education:*** | | | | |
| P(group X \|R) | 8.09 | 65.40 | 8.22 | 18.28 |
| P(group X \|C) | 7.22 | 65.17 | 10.40 | 17.20 |
| EBF | 0.89 | 1.00 | 1.27 | 0.94 |
| ERR | 2.55 | 2.87 | 3.64 | 2.69 |
| ***Literate but Below Primary Education:*** | | | | |
| P(group X \|R) | 5.43 | 61.35 | 10.82 | 22.39 |
| P(group X \|C) | 4.81 | 60.69 | 13.59 | 20.91 |
| EBF | 0.88 | 0.99 | 1.25 | 0.93 |
| ERR | 2.52 | 2.84 | 3.58 | 2.66 |

Notes:
R is regular salaried or wage employment.
C is non-regular employment (self employment or casual wage employment).
X is a group.

$$\text{Employment Bayes Factor (EBF)} = \frac{P(X|C)}{P(X|R)}$$

$$\text{Employment Risk Ratio (ERR)} = EBF \times \frac{P(C)}{1-P(C)} = \frac{P(C|X)}{P(R|X)}$$

**Table 6**
**The Contribution of Access and Attribute Advantage to the Group Risk Ratios of Forward Caste Hindus over other Groups**

| | Group Risk Ratios | | |
|---|---|---|---|
| | **Hindus from OBC** | **Muslims** | **Dalits** |
| ***Unadjusted GRR*** | 1.74 | 1.85 | 2.21 |
| ***Graduates:*** | | | |
| % contribution: Access Disadvantage | 1.8 | 9.5 | -5 |
| % contribution: Attributes Disadvantage | 98.2 | 90.5 | 105 |
| ***Secondary Education:*** | | | |
| % contribution: Access Disadvantage | 7.1 | 18.4 | 2.5 |
| % contribution: Attributes Disadvantage | 92.9 | 81.6 | 97.5 |
| ***Primary and above but below Secondary Education:*** | | | |
| % contribution: Access Disadvantage | 17.2 | 31.0 | 16.5 |
| % contribution: Attributes Disadvantage | 82.8 | 69 | 83.5 |
| ***Literate but Below Primary Education:*** | | | |
| % contribution: Access Disadvantage | 26.8 | 36.3 | 29.1 |
| % contribution: Attributes Disadvantage | 73.2 | 63.7 | 70.9 |

Notes:
R is regular salaried and wage employment; X and Y are groups.

Group Risk Ratio = $\frac{P(R|X)}{P(R|Y)}$

# Appendix
# Multinomial Estimation Results

**Table A**
**Multinomial Logit Estimates for Prime Age Males**
**Dependent Variable is Employment Status**

| | Regular Salaried or Wage Workers | Casual Wage Labour |
|---|---|---|
| **Land-ownership (default: no land)** | | |
| Land owner: < 0.22 hectares | -0.665*** | 0.022 |
| | (24.21) | (0.70) |
| Land owner: 0.22-1.13 hectares | -1.381*** | -1.056*** |
| | (33.30) | (27.66) |
| Land Land owner: > 1.13 hectares | -1.787*** | -2.774*** |
| | (41.37) | (53.40) |
| **Age (default:25-30 years)** | | |
| Age: 30-35 years | -0.109*** | -0.425*** |
| | (3.61) | (14.49) |
| Age: 36-40 years | -0.056* | -0.661*** |
| | (1.86) | (21.95) |
| Age: 41-45 years | 0.066** | -0.782*** |
| | (2.07) | (23.84) |
| **Social Group (default: forward caste Hindus)** | | |
| Dalits | 0.333*** | 1.095*** |
| | (9.96) | (32.27) |
| Muslims | -0.352*** | 0.004 |
| | (9.27) | (0.09) |
| Hindus from the OBC | -0.039 | 0.354*** |
| | (1.31) | (10.46) |
| **Education (default: illiterate)** | | |
| Literate, below primary level schooling | 0.357*** | -0.416*** |
| | (7.33) | (12.19) |
| Primary or Middle level schooling | 0.624*** | -0.849*** |
| | (16.38) | (29.89) |
| Secondary or higher secondary level schooling | 1.287*** | -1.594*** |
| | (33.05) | (40.80) |
| Graduate | 1.899*** | -2.798*** |
| | (43.72) | (30.58) |
| **Sector (default: rural)** | | |
| Urban | 0.512*** | -1.099*** |
| | (17.82) | (38.59) |
| **States** | | |
| state1 | -0.365*** | -0.424*** |
| | (6.52) | (7.51) |
| state2 | -0.044 | -0.878*** |
| | (0.68) | (13.17) |
| state3 | -1.039*** | -0.654*** |
| | (17.09) | (12.14) |
| state4 | -0.343*** | -0.033 |

| | | |
|---|---|---|
| | (5.55) | (0.51) |
| state5 | -0.415*** | -1.079*** |
| | (4.94) | (10.74) |
| state6 | 0.141* | -0.374*** |
| | (1.73) | (3.93) |
| state7 | -0.245*** | 0.079 |
| | (3.83) | (1.22) |
| state8 | -0.060 | 0.839*** |
| | (0.79) | (11.84) |
| state9 | -0.483*** | -0.141** |
| | (8.34) | (2.49) |
| state10 | 0.134** | 0.030 |
| | (2.50) | (0.51) |
| state11 | -0.261*** | -0.317*** |
| | (3.65) | (4.81) |
| state12 | -0.205*** | -1.126*** |
| | (2.58) | (11.29) |
| state13 | -0.383*** | -1.019*** |
| | (6.07) | (14.68) |
| state15 | -0.809*** | -1.216*** |
| | (15.53) | (22.74) |
| state16 | -0.672*** | -0.642*** |
| | (11.70) | (11.13) |
| state17 | -0.169* | -1.411*** |
| | (1.94) | (9.02) |
| Constant | -0.595*** | 1.535*** |
| | (8.98) | (23.88) |
| Observations | 63300 | 63300 |

Notes:
Dependent variable =1, if man is self employed (base category); =2, if he is a regular salaried or wage worker; =3, if he is a casual wage labourer.
Absolute value of z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

**Table B**
**Multinomial Logit Estimates for Prime Age Males**
**Dependent Variable is Group Membership**

| | Dalit Equation | Muslim Equation | Hindus from OBC Equation |
|---|---|---|---|
| **Land-ownership (default: no land)** | | | |
| Land owner: < 0.22 hectares | 0.085*** | 0.212*** | 0.126*** |
| | (2.61) | (5.81) | (4.10) |
| Land owner: 0.22-1.13 hectares | -0.261*** | -0.469*** | 0.115*** |
| | (6.09) | (8.81) | (2.81) |
| Land Land owner: > 1.13 hectares | -1.004*** | -0.930*** | -0.264*** |
| | (21.68) | (15.61) | (6.38) |
| **Age (default:25-30 years)** | | | |
| Age: 30-35 years | -0.206*** | -0.200*** | -0.101*** |
| | (6.45) | (5.26) | (3.35) |
| Age: 36-40 years | -0.355*** | -0.275*** | -0.146*** |
| | (10.91) | (7.15) | (4.78) |
| Age: 41-45 years | -0.421*** | -0.366*** | -0.234*** |
| | (12.19) | (8.91) | (7.27) |
| **Education (default: illiterate)** | | | |
| Literate, below primary level chooling | -0.766*** | -0.433*** | -0.337*** |
| | (17.47) | (8.49) | (7.56) |
| Primary or Middle level schooling | -1.367*** | -1.106*** | -0.672*** |
| | (39.24) | (26.77) | (19.38) |
| Secondary or higher secondary level schooling | -2.194*** | -1.857*** | -1.246*** |
| | (54.87) | (39.45) | (33.68) |
| Graduate | -2.819*** | -2.487*** | -1.882*** |
| | (54.03) | (41.24) | (42.11) |
| **Sector (default: rural)** | | | |
| Urban | -0.980*** | 0.180*** | -0.589*** |
| | (30.99) | (4.95) | (19.92) |
| **States** | | | |
| state1 | -1.390*** | -0.706*** | -1.772*** |
| | (18.08) | (7.62) | (26.76) |
| state2 | -1.447*** | 0.119 | -2.909*** |
| | (17.52) | (1.27) | (37.07) |
| state3 | -0.744*** | -0.085 | -1.251*** |
| | (9.51) | (0.90) | (18.02) |
| state4 | -1.463*** | -1.304*** | -2.641*** |
| | (18.54) | (13.03) | (37.13) |
| state5 | -2.183*** | -2.568*** | -3.037*** |
| | (20.85) | (14.56) | (33.53) |
| state6 | -1.945*** | -3.052*** | -4.212*** |
| | (20.23) | (14.39) | (36.71) |
| state7 | -1.453*** | -0.748*** | -2.333*** |
| | (17.78) | (7.70) | (32.45) |
| state8 | -1.611*** | 0.253** | -1.738*** |
| | (15.79) | (2.50) | (21.42) |
| state9 | -0.493*** | -0.694*** | -1.626*** |
| | (6.50) | (7.13) | (23.86) |
| state10 | -1.665*** | -0.907*** | -2.650*** |
| | (22.37) | (10.21) | (40.67) |

| | | | |
|---|---|---|---|
| state11 | -0.989*** | -2.620*** | -2.347*** |
| | (11.96) | (15.99) | (30.41) |
| state12 | -1.033*** | -2.842*** | -2.956*** |
| | (10.91) | (13.70) | (29.77) |
| state13 | -1.032*** | -0.952*** | -2.266*** |
| | (12.83) | (9.20) | (31.13) |
| state15 | -1.330*** | -0.265*** | -2.090*** |
| | (18.45) | (3.09) | (33.02) |
| state16 | -1.755*** | -0.857*** | -4.270*** |
| | (23.96) | (9.82) | (53.29) |
| state17 | -1.579*** | -1.374*** | -2.862*** |
| | (13.44) | (9.49) | (26.18) |
| **Employment status (default:not in RSWE)** | | | |
| RSWE | -0.052* | -0.349*** | -0.110*** |
| | (1.66) | (9.48) | (3.88) |
| Constant | 3.215*** | 1.291*** | 3.460*** |
| | (42.10) | (14.01) | (49.57) |
| Observations | 63300 | 63300 | 63300 |

Notes:
Dependent variable =1, if man is Dalit; =2, if he is Muslim; =3, if he is Hindu from OBC; =4, if he is forward caste Hindu (base category)
RSWE=regular salaried or wage employment
Absolute value of z statistics in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

## Technical Note 1 : On Bayes' Theorem

The Reverend Thomas Bayes, an18th century Presbyterian minister, proved what is, arguably, the most important theorem in statistics. [17] Bayes' Theorem says that the probability of a theory being true (event T), *given that the data has been observed* (event A), is:

$$P(T \mid A) = \frac{P(A \mid T)}{P(A)} \times P(T) \qquad (1)$$

where: $P(T)$ represents the *prior* belief that the theory is true and $P(A \mid T) / P(A)$ is the Bayesian "updating factor" which translates one's *prior* belief about the theory's validity into a *posterior* belief.[18]

Bayes' theorem has been extensively applied in Law and in Medicine. For example, in the area of Law it has shed light on the so-called "prosecutor's fallacy" whereby a prosecutor argues that since the probability of observing a particular piece of evidence (say, blood type identical to that found at the scene of the crime), *under the assumed innocence of the defendant*, is very small (that is, $P(A \mid T)$ is low), the probability of the defendant being innocent, *given that his blood type matches that at the crime scene*, must also be very small (that is, $P(T \mid A)$ must also be low). This fallacious reasoning stems, of course, from assuming that the ratio $P(A \mid T) / P(A)$ in equation (1) is equal to unity (Thompson and Schumann, 1987; Aitken, 1996).

In Medicine it has, for example, been used to analyse the efficacy of breast screening. Proponents of screening would argue, on the basis of the "screening fallacy", that because the probability of the screen returning a positive result, *given that the patient has cancer*, is large (that is, $P(A \mid T)$ is high), the probability of the patient having cancer, *given that the screen returns a positive result*, must also be large (that is, $P(T \mid A)$ must also be high). This fallacious reasoning stems, of course, from assuming that the ratio $P(T) / P(A)$ in equation (1) is equal to unity. However, if the proportion of persons with cancer in the population, relative to the proportion of positive screen results, is small (i.e. $P(A \mid T) / P(A)$ in equation

[17] See "In Praise of Bayes", The *Economist*, 28 September 2000.

[18] The updating factor is the ratio of the probability of observing the data when the theory is true, to that of observing the data regardless of whether the theory is true or false: $P(A) = P(A \mid T)P(T) + P(A \mid \bar{T})P(\bar{T})$, $\bar{T}$ being the event that the theory is false.

(1) is low) then $P(T \mid A)$ could be appreciably smaller than $P(A \mid T)$. The size of this difference represents cancer "over diagnosis" and has, recently, been estimated at 10 percent (Zackrisson et. al., 2006): in effect, 1 in 10 women diagnosed with breast cancer undergoes unnecessary treatment.

These ideas can also be applied to the labour market performance of different population subgroups. Suppose there is a favourable labour market outcome – say, being in regular salaried or wage employment (hereafter, "regular employment") – denoted by the event *T* and that membership of a particular group is denoted by the event *A*. Then we might be interested in computing the probability of a person being in regular employment, *given that he belongs to a particular group*: $P(T|A)$. From equation (1) we can write this as the product of the probability of a person belonging to the group, *given that he is in regular employment* (i.e. ($P(A|T)$, the proportion of persons in regular employment *who are from that group*) and the ratio of the *total* number of persons in regular employment to the *total* number in the group (i.e. $P(T)/(PA)$).

The "employment fallacy" would be to argue that because only a small proportion of persons in regular employment are from the group (ie. $P(A/T)$ is low), the probability of a person from that group being in regular employment must also be small (ie. $P(T/A)$ is also low). As equation (1) shows this reasoning is valid if, and only if, the "proportionality condition" meaning that the group's share in regular employment is equal to its population share (i.e. $P(T)/P(A) = 1$). Otherwise, the ratio $P(T)/(PA)$ in equation (1) cannot be ignored; if, say, the total number of persons in regular employment is large, relative to the size of the group, then $P(T|A)$ could be high even though $P(A|T)$ is low.

## Technical Note 2 : The Analytical Framework

Suppose there are four groups – FC Hindus (H), Hindus from the OBC (O), Muslims (M), and Dalits (D) - and two categories of employment – regular (R) and non-regular employment (C). Then, the probabilities of a person *from group X* (*X* being FC or OBC Hindu, Muslim or Dalit) being in regular and in non-regular employment are, respectively:

$$P(R \mid X) = \frac{P(X \mid R)P(R)}{P(X)} \quad \text{and } P(C \mid X) = \frac{P(X \mid C)P(C)}{P(X)}$$

Then the *Employment Risk Ratio* (ERR) of non-regular to regular employment, associated with belonging to group X, is:

$$\begin{aligned} \rho^X &= \frac{P(C \mid X)}{P(R \mid X)} = \frac{P(X \mid C)P(C)}{P(X)} \times \frac{P(X)}{P(X \mid R)P(R)} \\ &= \frac{P(X \mid C)}{P(X \mid R)} \times \frac{P(C)}{P(R)} = \Phi^X \frac{P(C)}{P(R)} \end{aligned} \qquad (2)$$

where: $\Phi^X = \frac{P(X \mid C)}{P(X \mid R)}$ is the *Employment Bayes Factor* (EBF), of regular to non-regular employment, applied to persons who belong to group X.

The *ERR* is the odds of a hypothesis being "true" (the person is in non-regular employment) to another, competing, hypothesis being "true" (the person is in regular employment) under a particular set of data (the person belongs to group X). On the other hand, the *EBF* is the odds of the data (the person belongs to group X) being observed when a hypothesis is true (the person is in non-regular employment) to the data being observed when another, competing, hypothesis is true (the person is in regular employment): $\Phi^X > 1 (\Phi^X < 1)$, signifies that a person is more (less) likely to be belong to group X if he is in non-regular employment than if he is in regular employment (Matthews, 2000).

An alternative view of risk is provided by posing the following question: given two persons – one a FC Hindu, the other a Dalit - what is the ratio of their probabilities of being in regular employment? In order to answer this question, the relevant "risk ratio" is the *Group Risk Ratio* (GRR), $\frac{P(R \mid H)}{P(R \mid D)}$. The *GRR*, which is the odds of a person being in regular employment under two different sets of data – the person is a FC Hindu (H); the person is a Dalit (D) - may be evaluated as:

$$\sigma_{HD}^{R} = \frac{P(R \mid H)}{P(R \mid D)} = \frac{P(H \mid R)P(R)}{P(H)} \frac{P(D)}{P(D \mid R)P(R)}$$
$$= \frac{P(H \mid R)}{P(D \mid R)} \frac{P(D)}{P(H)} = \Omega_{HD}^{R} \frac{P(D)}{P(H)}, \text{ where: } \Omega_{HD}^{R} = \frac{P(H \mid R)}{P(D \mid R)} = \sigma_{HD}^{R} \frac{P(H)}{P(D)} \quad (3)$$

$\Omega_{HD}^{R}$ can be termed the *Group Bayes Factor* (GBF), of Hindus to Dalits, applied to persons who are in regular employment. The *GBF* is the odds of observing one set of data (say, the person is a FC Hindu) to observing another, competing, set of data (say, the person is a Dalit) when the null hypothesis is true (a person is in regular employment): $\Omega_{HD}^{R} > 1 (\Omega_{HD}^{R} < 1)$ means that a person in regular employment is more (less) likely to be a Hindu than a Dalit.