Gender Bias and Caste Exclusion in Engineering Admission: Inferences from the Engineering Entrance Examination in Kerala

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Article

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Abstract

The major problem of the engineering entrance examination is the exclusion of certain sections of the society in social, economic, regional and gender dimensions. This has seldom been taken for analysis towards policy correction. To lessen this problem a minor policy shift was prepared in the year 2011 with a 50–50 proportion in academic marks and entrance marks. The impact of this change is yet to be scrutinized. The data for the study is obtained from the Nodal Centre of Kerala functioning at Cochin University of Science and Technology under the National Technical Manpower Information System and also estimated from the Centralized Allotment Process. The article focuses on two aspects of exclusion based on engineering entrance examination; gender centred as well as caste-linked. Rank order spectral density and Lorenz ratio are used to cognize the exclusion and inequality in community and gender levels in various performance scales. The article unfolds the fact that social status in society coupled with economic affordability to quality education seems to have significant influence in the performance of students in the Kerala engineering entrance examinations. But it also shows that there is wide gender disparity with respect to performance in the high ranking levels irrespective of social groups.

Keywords

Exclusion, gender relation, reservation, Centralized Allotment Process, rank order spectra, Lorenz ratio

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Introduction

Engineering admission in Kerala has recently been changed to entrance rank cum academic merit. The merit of a student is manifested in multi-faceted levels starting from the quality of primary and secondary education. The quality in education depends on affordability as it is imparted in Kerala in three levels, government, public and aided-private. The students who could afford to have quality education in terms of the syllabus pursued, teaching methods and the infrastructure availability seem to have performed better in school as well as in entrance examinations. In the real situation, these factors are theorized to vary between economic and social conditions of the aspirants, gender relations and the specific social order prevailing in Kerala. As the facilities and exposures availed by the stakeholders differ significantly owing to the developmental aspects of the region, they may vary between regions too. Ultimately, what is evident through the entrance examinations is the over-representation of some privileged classes, castes and gender.

Since the inception of entrance examinations in the state in 1982, a few disparities have been pointed out owing to inequality in socio-economic, cultural, gender and regional aspects. However, the major problem is the exclusion faced by a number of sections of the society, owing to innumerable factors and this has very rarely been taken up for discussion or for analysis. In some states, the common entrance examination has been abolished and in many states, various discourses are going on whether to continue or modify the system due to the exclusion of the unprivileged. Having made detailed deliberations with the education and other social thinkers in the state, the system of entrance examination for the engineering stream was revamped in the year 2011 in 50–50 proportions based on academic[1] and entrance marks. The pros and cons of the revised system are yet to be evaluated in an exclusion-inclusion framework.

Theoretical Framework and Methodology

The basic focus of the study is to use gender as a starting point in addressing wider social exclusion and multiple disparities in education. Inclusive development can only be achieved by addressing the disproportionate social opportunity given to women and backward communities in any society. In order to address the gender disparity in admission to professional colleges in Kerala, the list of all candidates who are offered admission to various engineering courses during 2004–2011 as per the Common Entrance Examination (CEE) allotment ranks is taken for investigation. It is not necessary that all students who are offered admission finally accept admission in the allotted colleges. They may opt for other better openings like IITs. Hence students admitted to various colleges are rearranged in ordinal fashion giving distinct ordinal numbers like 1, 2, 3, 4, etc., against their admitted rank, based on the rank in the entrance examination. These ranks are subsequently

disaggregated into male and female and within each group separate ranks from 1, 2, 3, etc., are given as gender ranks.

To understand gender analysis within class/caste, three categories are considered.

1. General Category: This is non-reservation category, which comes to about 35 per cent.
2. Muslim and Ezhava: Though there has been an apparent change in the general outlook, the social organization in the Muslim community is considered highly unfavourable to females compared to any other community (Tharakan, 2008). Ezhava is the single largest caste group in Kerala that has undergone visible social transformation. These two groups together encompass 55 per cent of the population (*Mathrubhumi*, 2012).
3. Scheduled Castes and Scheduled Tribes: They are the poorest and the most deprived communities in Kerala. This population group is assumed to constitute roughly 10 per cent of the population in Kerala (Census, 2011).

The data for the study is obtained from the Nodal Centre of Kerala functioning at Cochin University of Science and Technology under National Technical Manpower Information Systems (Nodal Centre, 2008) and also estimated from the Centralized Allotment Process. Rank order spectral density (Gangan Prathap, 2010) and Lorenz ratio are used to cognize the exclusion and inequality in community and gender levels in various performance scales.

Gender Bias

The admission to engineering colleges has been done as per the Centralized Allotment Process, and under the Centralized Allotment Process a specific ranking system is followed. The candidate who scores a higher rank will be given admission to the chosen colleges. Rank order spectral analysis is used to track the gender bias in admission. The computed admitted ranks of students correspond to the admission order which in turn is based on the rank they obtained in the entrance examination (Centre for Study of Social Exclusion and Inclusive Policy, 2010). The admitted ranks are then disaggregated into male and female ranks to assign gender ranks. These two ranks (the admission rank and gender rank) are displayed in a scatter plot to draw the spectral lines to demonstrate the gender bias. The splaying of the two lines (Male and Female) with the line of perfect equality is an indication of the gender disparity in the Centralized Allotment Process. If the male–female spectral lines are widely spread, they indicate a wide gender gap in admission. If the male and female spectral lines tend to overlap with the equality line, it means that there is no gender gap in admission. This indicates that both male and female are given equal preference in admission. If any point in the spectral

line of the admitted rank in the Y-axis is taken, the corresponding X-axis shows the gender rank for male and female, to the extent to which males outnumber the females. As the splaying of the spectral lines widens, gender gap also widens. Figure 1 shows the rank order spectral lines for all students for various years (2004–2011).

The analysis has been augmented with inequality quotients to track and quantify the degree of exclusion due to gender bias. One of the inequality quotients is the Male/Female ratio and the other more meaningful one is the (M − F) / (F + M) ratio, where a value of 0 implies perfect equality and a value of 1 implies perfect inequality. Table 1 shows the gender bias ratios for admission under Centralized Allotment Process for various years (2004–2011).

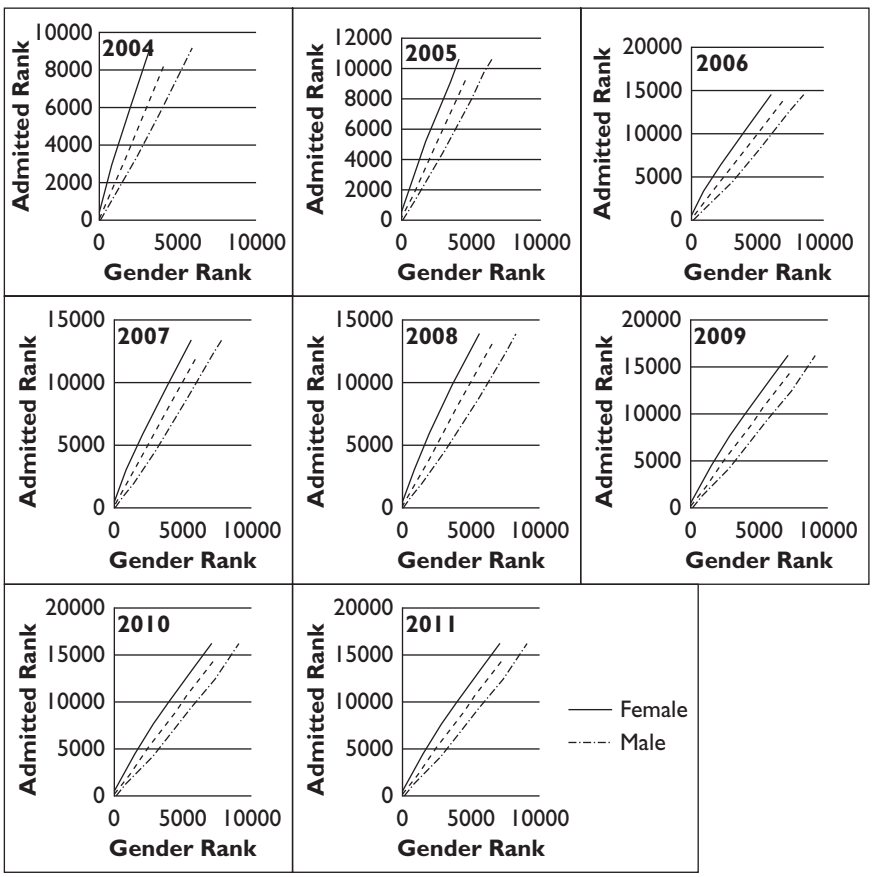


Figure 1. Rank Order Spectral Lines for all Ranks

Source: Worked out from NTMIS and CAP data (2004–11).

Table 1. Gender Bias Ratios for Admission Under Centralized Allotment Process

Rank	All Categories		General		Muslim		Ezhava		SC/ST	
	Male/ Female	(m–f)/ (m+f)	Male/ Female	(m–f)/ (m+f)	Male/ Female	(m–f)/ (m+f)	Male/ Female	(m–f)/ (m+f)	Male/ Female	(m–f)/ (m+f)
					2004					
1st 25 Rank	7.33:1	0.76	4:01	0.6	7.33:1	0.76	5.25:1	0.68	5.25:1	0.68
1st 101 Rank	5.73:1	0.7	4.94:1	0.7	6.76:1	0.74	4.05:1	0.6	2.06:1	0.35
1st 1001 Rank	3.90:1	0.59	3.18:1	0.5	2.51:1	0.43	1.81:1	0.29	1.49:1	0.2
All rank	1.81:1	0.29	1.84:1	0.3	2.30:1	0.39	1.60:1	0.23	1.49:1	0.2
					2005					
1st 25 Rank	2.57:1	0.44	2.57:1	0.44	7.33:1	0.76	4.01:1	0.6	2.12:1	0.36
1st 101 Rank	6.21:1	0.72	4.61:1	0.64	6.76:1	0.74	2.74:1	0.5	1.65:1	0.25
1st 1001 Rank	3.44:1	0.55	2.85:1	0.48	1.74:1	0.27	1.47:1	0.2	1.38:1	0.16
All rank	1.55:1	0.22	1.55:1	0.22	1.74:1	0.27	1.45:1	0.2	1.38:1	0.16
					2006					
1st 25 Rank	2.57:1	0.44	1.78:1	0.28	–	1	–	1	2.12:1	0.36
1st 101 Rank	3.59:1	0.56	3.39:1	0.54	9.1:1	0.8	5.73:1	0.7	1.97:1	0.33
1st 1001 Rank	3.35:1	0.54	2.46:1	0.42	2.40:1	0.41	1.92:1	0.32	1.11:1	0.055
All rank	1.41:1	0.17	1.41:1	0.17	1.72:1	0.27	1.33:1	0.14	1.12:1	0.058
					2007					
1st 25 Rank	5.25:1	0.68	2.57:1	0.44	3.16:1	0.52	4.01:1	0.6	2.57:1	0.44
1st 101 Rank	4.31:1	0.62	3.80:1	0.58	6.21:1	0.72	2.88:1	0.5	1.88:1	0.31
1st 1001 Rank	3.02:1	0.5	2.58:1	0.44	2.01:1	0.34	1.52:1	0.2	1.21:1	0.1
All rank	1.39:1	0.16	1.40:1	0.17	1.59:1	0.23	1.26:1	0.1	1.25:1	0.12

(Table 1 Continued)

(Table 1 Continued)

Rank	All Categories		General		Muslim		Ezhava		SC/ST	
	Male/ Female	(m–f)/ (m+f)	Male/ Female	(m–f)/ (m+f)	Male/ Female	(m–f)/ (m+f)	Male/ Female	(m–f)/ (m+f)	Male/ Female	(m–f)/ (m+f)
					2008					
1st 25 Rank	6.01:1	0.71	6.01:1	0.71	2.5:1	0.43	2:01	0.92	2:01	0.36
1st 101 Rank	4.05:1	0.6	3.81:1	0.58	4.6:1	0.64	7.42:1	0.76	1.6:1	0.21
1st 1001 Rank	3.45:1	0.55	2.76:1	0.47	2.6:1	0.44	1.95:1	0.32	1.11:1	0.06
All rank	1.49:1	0.2	1.52:1	0.21	1.86:1	0.3	1.42:1	0.17	1.1:1	0.04
					2009					
1st 25 Rank	2.57:1	0.44	1.77:1	0.28	2.57:1	0.44	3.16:1	0.52	2.12:1	0.36
1st 101 Rank	2.60:1	0.45	3.39:1	0.54	4.94:1	0.66	2.06:1	0.35	2.36:1	0.41
1st 1001 Rank	2.64:1	0.45	2.20:1	0.38	2.65:1	0.45	1.44:1	0.18	1.25:1	0.11
All rank	1.28:1	0.12	1.29:1	0.13	1.76:1	0.28	1.06:1	0.03	1.147:1	0.07
					2010					
1st 25 Rank	2.13:1	0.36	1.78:1	0.28	2.57:1	0.44	4.0:1	0.6	2.57:1	0.44
1st 101 Rank	2.16:1	0.37	2.61:1	0.45	3.21:1	0.52	2.16:1	0.37	2.48:1	0.43
1st 1001 Rank	2.31:1	0.4	1.92:1	0.31	2.10:1	0.35	1.35:1	0.15	1.18:1	0.08
All rank	1.22:1	0.1	1.07:1	0.04	1.79:1	0.28	1.14:1	0.06	1.06:1	0.03
					2011					
1st 25 Rank	2.57:1	0.44	2.57:1	0.44	2.13:1	0.36	2.57:1	0.44	1.78:1	0.28
1st 101 Rank	2.32:1	0.49	2.48:1	0.43	2.88:1	0.49	1.81:1	0.29	1.89:1	0.31
1st 1001 Rank	2.61:1	0.3	1.73:1	0.27	1.85:1	0.3	1.20:1	0.09	1.13:1	0.06
All rank	1.19:1	0.08	1.17:1	0.08	1.57:1	0.22	1.11:1	0.05	1.04:1	0.02

Source: Worked out from NTMIS and CAP data (2004–11).

All Students

Gender inequality ratio among the first 25 ranks for all students has remained above 2:1 during 2004–2011. During 2011, it was 2.5:1 (2 females got admitted as against five males), whereas the 2010 value was slightly lower at 2.13:1. An almost similar association of inequality is found among the first 101 ranks and the first 1001 ranks. But, when all the ranks are taken into consideration, the inequality decreases and moves towards equality. The male candidates with the first 25 ranks (which are the best ranks) have a comparative advantage over females as they have an option to get admitted in the best colleges, which in turn, will reflect in their employability (*The Hindu*, 2013a). The rank order spectral lines (Figure 1) show gender bias in the admitted ranks during the period 2004–2011. The convergence of spectral lines over the years would imply a decline in gender bias.

General Category

When the general category alone is considered, the degree of inequality is found to be high among the first 25 ranks for all the years during 2004–2011, which tends to decline when all ranks are considered. The spectral lines given in Figure 2 show the extent of gender gap in admission for various years. It can be inferred from the declining gender ratios and the converging spectral lines that the gender gap is narrowing during the period under review for this category as well.

Muslim/Ezhava

Among Muslims, except for 2004–2006, the gender bias is relatively high in the first 101 ranks compared to the other ranks. The gender bias exhibits a decelerating trend as more and more ranks are included for analysis. Even though inequality is relatively consistent and high across various performance levels, it has shown a decrease since 2007 and has improved considerably during 2011 (Table 1). In 2008, a greater gender bias is seen among the Ezhava community.

Among the best 25 performers, inequality is nearly one (0.92). In this category only one female got admitted as against 24 males. Figure 3 shows the combined spectral lines for Muslim/Ezhava. These are the most splaying spectral lines exhibiting the greatest level of disparity among all the categories considered for analysis across the years.

Scheduled Caste/Scheduled Tribe

Compared to other categories, gender inequality is the least among SC/STs. The inequality ratio among the first 25 ranks for the year 2011 is 1.78:1. A similar trend is seen also among the first 25 ranks over the years.

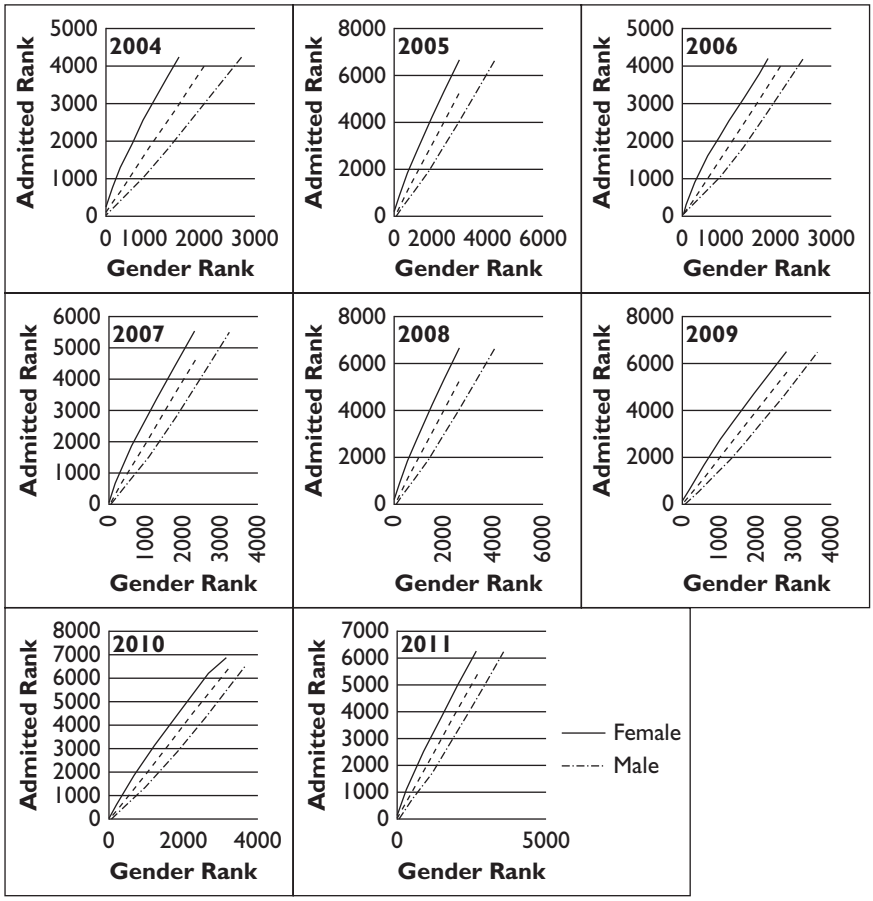


Figure 2. Rank Order Spectral Lines for General Category

Source: Worked out from NTMIS and CAP data (2004–11).

For the other performance levels (the first 101 ranks and the first 1001 ranks), male and female candidates get admitted to engineering colleges almost equally for all years. Over the years, significant inequality is found only among the best performing 25 students in this category. Figure 4 shows spectral lines for SC/STs, which are very close (sometimes overlap) to the line of equality assuming relatively lesser gender disparity. It is found that among them there is no gender difference in the Centralized Allotment Process when all the admitted ranks are taken together.

The above analysis of gender inequality quotients of various years for different social categories does not exhibit any particular pattern. Nevertheless, it can be concluded that significant gender inequality exists in the admission especially among the best performers. The higher the performance level, the greater the possibility of gender bias and vice versa. Hence, the option for the best colleges to study

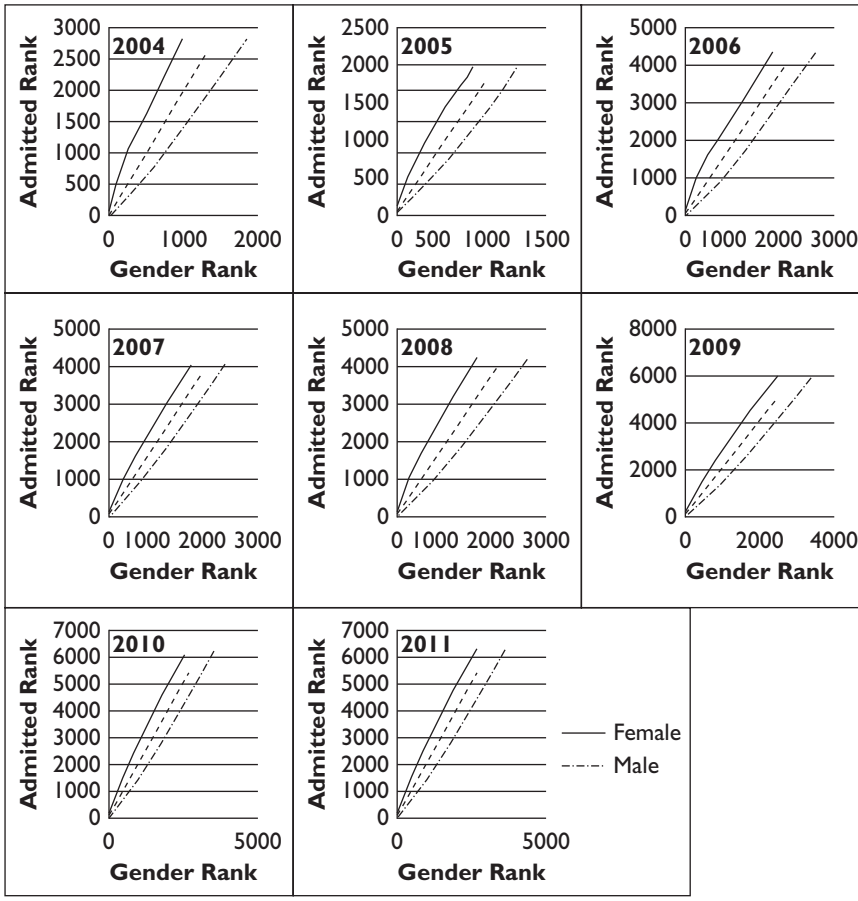


Figure 3. Rank Order Spectral Lines for Muslim/Ezhava

Source: Worked out from NTMIS and CAP data (2004–11).

for an engineering degree is unevenly distributed between male and female students. This will have many negative ramifications. When females are excluded from the top ranks, the opportunity for female students to get admitted into the best engineering colleges decreases as per the CEE admission data. This will reflect in the employability of female engineering aspirants unfavourably and they tend to be segregated in the labour market with lower quality jobs (Parikh & Sukhatme, 2004). Another implication is that, girl-students' choice to opt for their preferred course is limited. One possible explanation for the high exclusion of females in the top performing categories might be the differential treatment imparted to boys based on socially evolved notions (Alice & Navaneetham, 2008). The boys also have an added advantage to avail the coaching facilities in the best institutions even though they are far-off from the schools where they are studying for plus two courses.

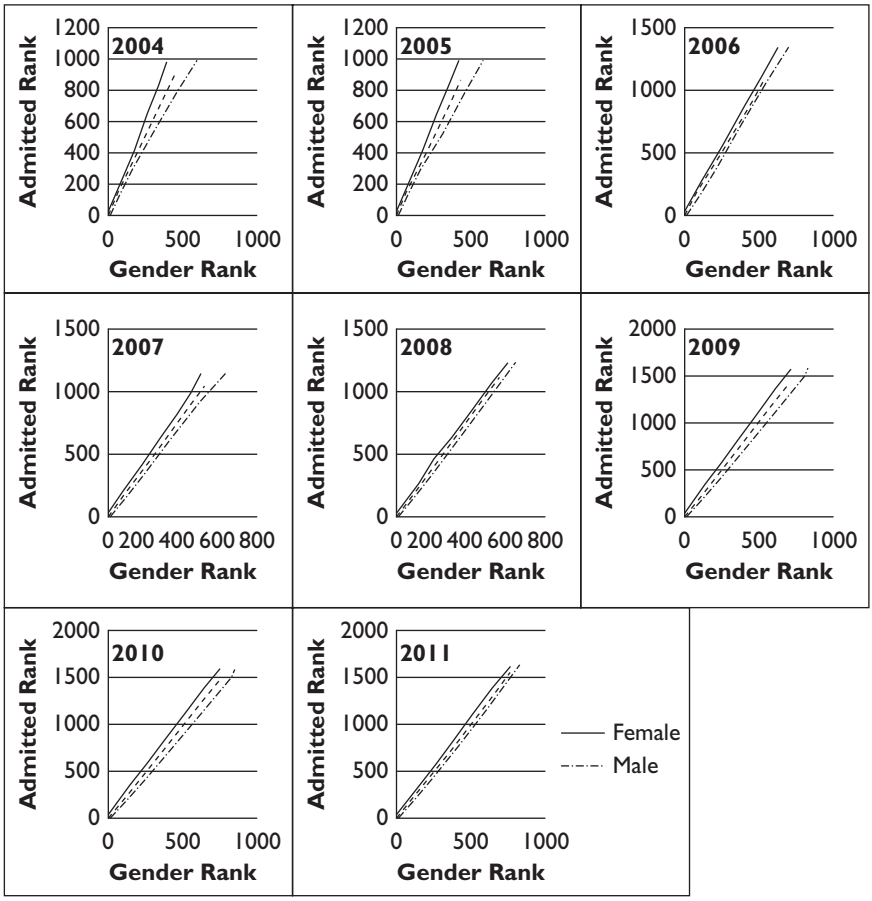


Figure 4. Rank Order Spectral Lines for SC/ST

Source: Worked out from NTMIS and CAP data (2004–11).

Trends in the Variation of Gender Inequality

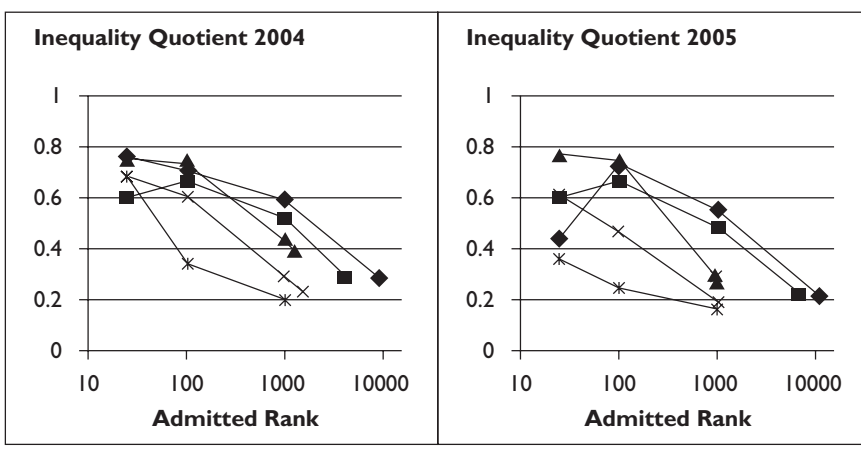
The above analysis of admission to engineering colleges during the eight years shows that there has been substantial gender bias in the admitted ranks. But the pattern is not the same among all the communities, as in some communities gender inequality is found to be high and in others it is relatively low. A temporal analysis of inequality quotients will help to understand its dynamics. In each year, we have taken four performance levels; the first 25 ranks, the first 101 ranks and the first 1001 ranks and all ranks taken together to comprehend the variation across different performance levels. First, we have taken up the inequality quotients [(Male − Female)/(Male + Female)] of all the students who got admission to engineering colleges. Then these have been further disaggregated to know what

is happening at the community level. The general category students, Muslim/Ezhava and SC/ST are separately taken to analyse the trend. 'All' category includes all students who are admitted to engineering colleges irrespective of any class/caste demarcation. Thus, 'All' category is not strictly the sum of communities independently taken for analysis here, but includes communities like Christians and other minorities.

Variation of Inequality Quotient at Different Performance Levels and across Communities

During the period 2004–2011, it is found that inequality differs at different performance levels and at different ranks. However, it shows a declining trend as more ranks are taken into consideration. Inequality is high among the first 101 performers for all categories, Muslim and SC/ST, whereas for general and Ezhava sections it is the highest in the first 25 ranks. The lowest inequality in all the sections during 2011 and 2010 is at a point where all ranks are taken into consideration. The Ezhavas experienced the highest gender disparity among the top and the best performers the same year and it tends to slash down as the ranks go poorer.

In 2009, inequality among the SC/ST is found to be very low compared to the other communities and it reaches almost the state of equality when all the SC/ST candidates are taken into consideration. In the year 2006, gender inequality is one among the first 25 performers of the Muslim and Ezhava communities and it slashes down to around 0.4 when the first 1001 ranks are considered and it again comes down to 0.2 when all the ranks are considered. An overall decreasing trend of gender inequality can be found over the different performance levels (Figure 5) for the various years (2004–2011).



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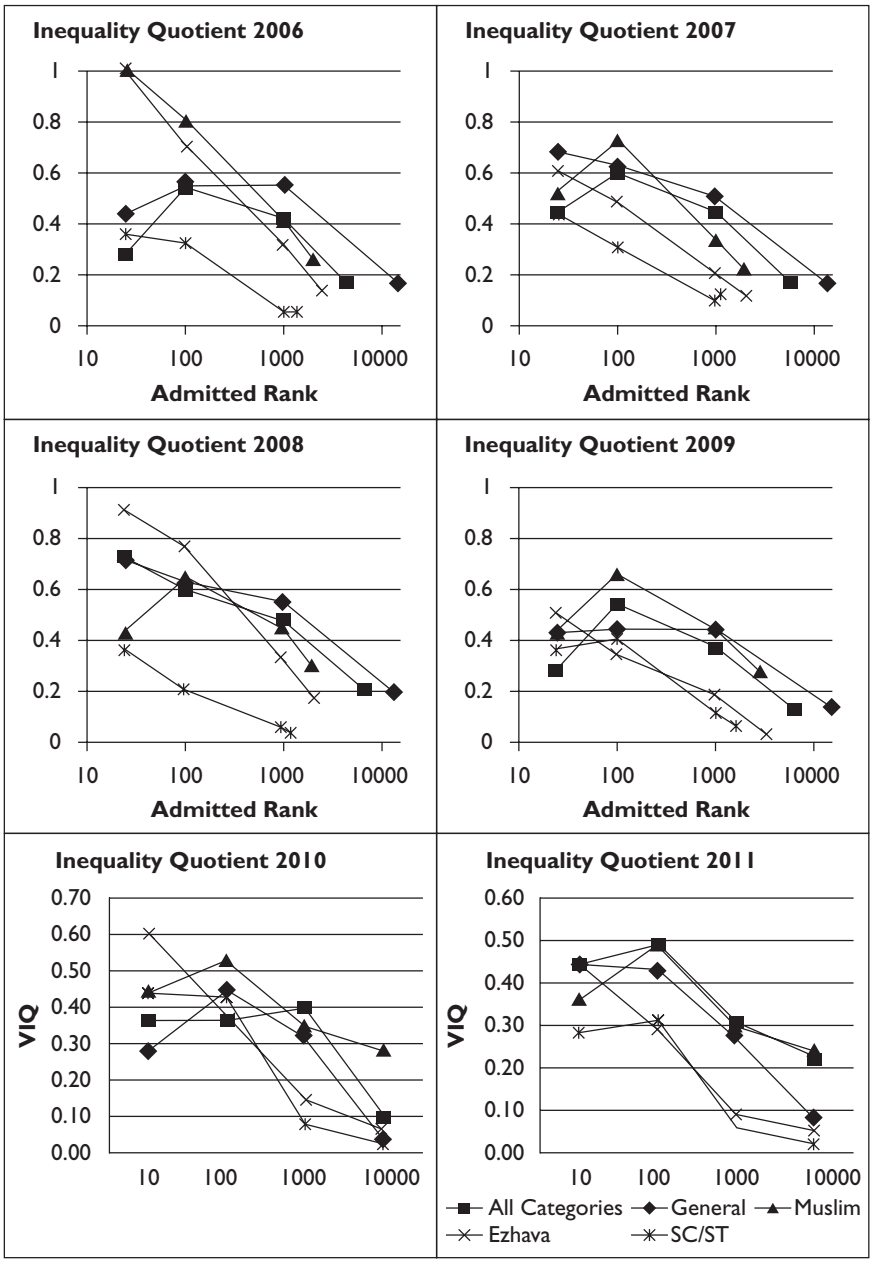

Figure 5. Variation of Inequality Quotient at Different Levels of Performance across Communities

Source: Worked out from NTMIS and CAP data (2004–11).

Variation of Inequality Quotient over the Years for each Performance Level

The aforementioned analysis has explored the decreasing trend of inequality across the different performance levels. Here the focus is to explore how inequality changes over the periods for different communities. It takes into consideration eight consecutive years starting from 2004 and explores the trends in gender inequality across all the communities like general category, Muslim, Ezhava and SC/ST. Figure 6 shows that among the performance levels, gender inequality is the highest among the first 25 and the first 101 performers and it is the lowest when

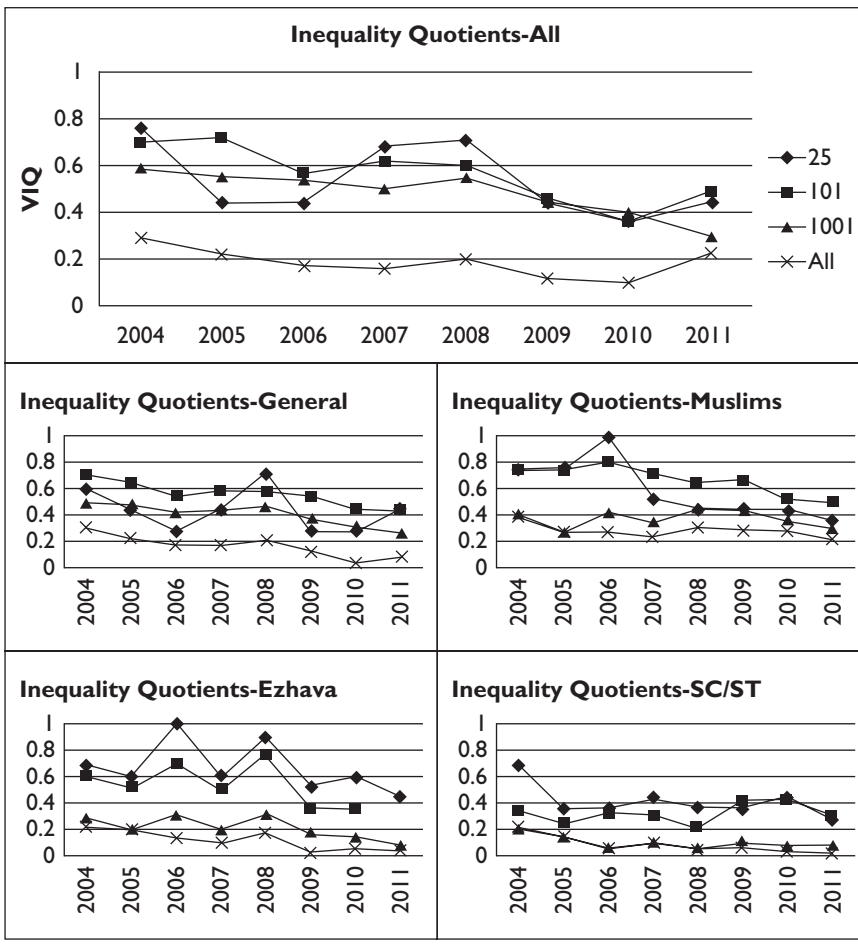

Figure 6. Variation of Inequality Quotients over the Years for each Performance Level

Source: Worked out from NTMIS and CAP data (2004–11).

all the ranks are taken together. At each performance level, inequality tends to decrease over the years. Among the general category, very high inequality is found among the first 101 ranks. Inequality is the least among all ranks category. Among the Muslim community, inequality is high among the first 101 rank holders consistently. In the initial years inequality is the highest among the first 25 performers and it decreases from 2007 onwards. Among the Ezhava community, inequality ratios are the highest among the first 25 performers followed by the first 101 and the first1001 respectively. A similar trend is seen among the SC/ST category, where inequality is found to be the highest among the first 25 performers and the lowest among all the ranks. In all the communities, inequality is found to be on a downward trend over the years at each performance levels.

Variation of Inequality Quotient over the Years for Each Community

Figure 7 shows that in all rank categories, the highest inequality is found among Muslims over the eight consecutive years. The general community shows the second highest gender inequality and the lowest is found among SC/ST. Among the first 25 ranks gender inequality is found to be high among Ezhava over the years. There has been a steady decline in inequality ratio among Muslims since 2006 for the first 25 ranks. But when the first 1001 ranks are considered, very high inequality is found among 'All' categories, followed by the general category. Over the years and at the overall performance levels, gender inequality is found to be the least among SC/ST communities. One possible reason for this could be that most of the students in this category are undergoing studies in government schools and hence the difference in quality of education based on different streams does not act as a pertinent variable in making the impacts (*The Hindu*, 2013b).

Among the best performing 101 students, gender inequality is the highest for the Muslims and the lowest for the SC/STs down the years. At this performance level, the inequality ratio for Muslim, Ezhava and General community is between 60 and 80 per cent and for SC/ST it is just around 50 per cent. It can be seen from Figure 7 that among the best performing 1001 students, gender inequality is the highest among the 'All category' over the years. This category includes other communities like Christians in addition to Muslim, Ezhava, General and SC/ST, where the Ezhava, Muslim and SC/ST category representation is less in the best performing 1001 category.

Gender Inequality based on Lorenz Curve

Lorenz (1905) curve is used to depict how much of the total admitted rank is concentrated among the upper class, the middle class and the lower class against their share in population. In order to gauge the gender bias, population is subdivided into

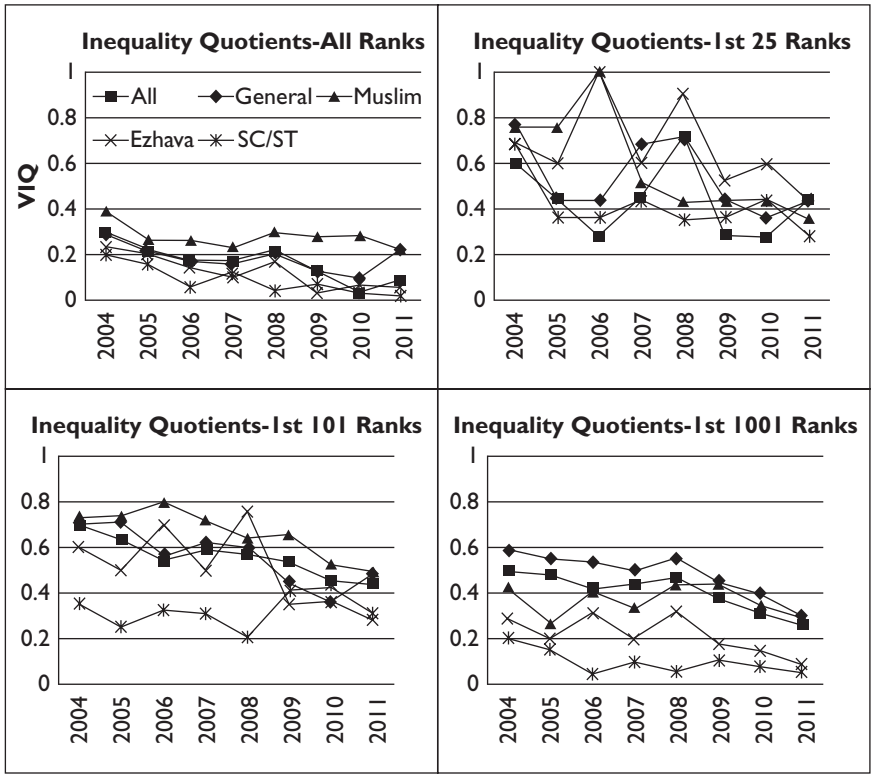

Figure 7. Variation of Inequality Quotients over the Years by Community

Source: Worked out from NTMIS and CAP data (2004–11).

upper class male (UM), upper class female (UF), middle class male (MM), middle class female (MF), lower class male (LM) and lower class female (LF) based on reservation status (No reservation category as UM and UF, non-creamy layer OBC category as MM and MF and SC and ST reservation category as LM and LF).

Figure 8 gives the Lorenz curve for the first 101 ranks and all the ranks from 2004 to 2011. The area between the Lorenz curve and the line of equality shows the extent of inequality. During the period 2004–2011, the Lorenz curve of the first 101 ranks is farther from the line of equity. The share of SC/ST is nil in the first 101 ranks during this period (see Figure 8). Communities like SC/ST and Muslim/Ezhava are found to be under-represented among the best performers. However, while all ranks are taken into consideration in Lorenz curve, the level of inequality evidently tends to decrease. The share of the poor and the backward sections like SC/ST and Muslim/Ezhava seems to improve when all ranks are taken into consideration. The gender difference among the SC/ST population is almost zero. This does not mean that there is no gender difference, but they have

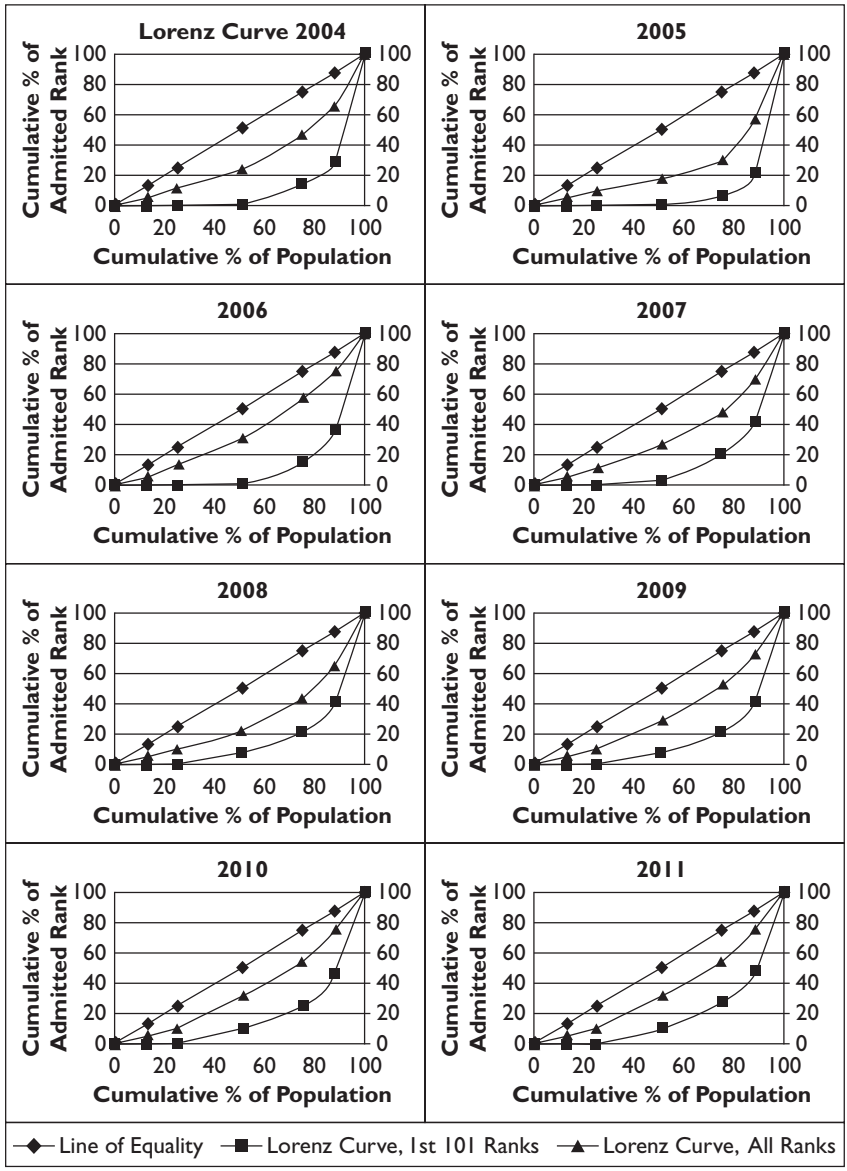

Figure 8. Lorenz Curves

Source: Worked out from NTMIS and CAP data (2004–11).

not been represented in the first best performing 101 ranks, as percentage distribution of males and females is zero. A wide gender difference is visible in the case of upper class population. A similar trend is found in the following years also. As far as reservation policy is in existence, the under-representation of the reserved

candidates in the best ranks does not seem to be an issue. This may be attributed to the reason that the allotment to the colleges is done with the separate list of reservation categories. But the pertinent issue here remains that, if a relatively incompetent student opts for The College of Engineering, Thiruvananthapuram, which the most meritorious students opt for, he/she gets to compete with the top students who secured the best ranks in CEE.

Conclusion

The core of CEE analysis brings to light interesting conclusions. It shows very high gender inequality among the top rank levels and the inequality quotients decrease if we extend the analysis incorporating all the candidates irrespective of their ranks. When the females are excluded from the top ranks, the opportunities for female students to get admitted into the best engineering colleges tend to reduce. This certainly will affect the employability of female engineering aspirants negatively. As per the ATMR (2008) the female employability problem is somehow circumvented with the increase in the number of seats to courses in IT and IT related subjects due to the emergence of the new career opportunities. These jobs are in tune with the female's choice and 'desirability' and therefore more females are found to be espoused to this opportunity. The results derived from the computed pseudo Lorenz curves show over-exclusion of communities like SC/ST and Muslim/Ezhava and over-inclusion of upper class/category students in the best performances. In the best performing levels (the first 101 ranks), SC/ST (both male and female) and Muslim/Ezhava (females) hardly have any representation other than reservation seats. But when all ranks are taken together, the aforementioned under-representation goes unnoticed. Since the government is implementing reservation in each college for SC/ST and Muslim/Ezhava students this indeed does not seem to be a major issue. As a result of the revised scheme of entrance-cum-marks in 2011, the gender impact and the under-representation of the unprivileged show almost identical results as in the previous years. But it necessitates various years' data set in order to ascertain the dynamics of social as well as gender inclusion as contemplated in the revised scheme of engineering admissions in the state.

Note

1. This is a contentious standardization process of different steams of plus two systems in the country.

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