

The arithmetic of quotas

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On 14 December 2006, the UPA government passed a Bill in the parliament providing reservation of 27% for the 'other backward classes' (OBCs) in Central higher educational institutions. The Bill has received the President's assent. There is still a debate as to how to achieve the target of 27% reservation in a phased manner.

Here we do not discuss the merits of the reservation policy. A quantitative analysis of the manner of implementation of the quota helps us explore the various options available and choose an optimum one.

We assume that the present OBC quota is nil. This has to increase to 27% over a period of time. We illustrate the problem with an example of a possible strategy. (a) The concerned educational institutions will plan for an annual growth rate – compounded annually – of 12% in the capacity of seats. (b) Of the extra seats created every year, 50% will be reserved for OBCs. (c) At the end of seven years, the strength of OBCs would have increased from nil to 27%. (d) Once the desired target of 27% is achieved, the percentage of reservation of the extra seats every year will be reduced from 50 to 27%. This will sustain a constant 27% reservation in subsequent years.

We will now elaborate on the above features. An annual growth rate of about 10–12% is considered feasible and many institutions are planning for such growth without compromising on the quality of education. Since the quota for OBCs should not affect the existing entitlement of other categories, it is proposed to provide OBC reservation only in the incremental seats every year. The Supreme Court has decreed that the total quota for reservation should not exceed 50%. Here we will consider two categories for quota: (a) OBCs and (b) ORCs (other reserved classes) which includes all classes other than the OBCs. For now we will ignore ORCs, but will return later to consider them too.

The proposed OBC quota of 27% is only for Central higher educational institutions like the IITs, IIMs and AIIMS (about 20 institutions). For reservation in State institutions, different State Governments have adopted different quotas for various

classes like SC, ST, OBC, etc. but these are not relevant for our analysis.

For example, suppose the present strength is 1000. In the first year, 120 extra seats will be added of which one-half, 60 seats will be reserved for OBCs. At the end of seven years, the total strength would have increased from 1000 to 2211, of which 607 seats (27.45%) will be for OBCs. Once the overall percentage of OBCs has reached 27, reservation in incremental seats for the following years will also be 27%.

Table 1 gives the year by year status. Column 2 gives the total number of seats which increases by 12% each year. Column 3 is the extra seats created in the particular year and column 4 the extra OCB seats in the year (50% of column 3). Column 5 is the actual number (aggregate) of OBC seats and column 6 its percentage of the total (column 2). The row for year 7 is shown in bold to indicate the reaching of the target of 27%. In subsequent rows (shown in italics), column 4 is only 27% of column 3 (not 50%).

By increasing the annual growth rate, the target year for reaching 27% quota can be lowered. For example, if the annual growth rate is 15%, the target will be attained between years 5 and 6 (25.2 and 28.4%). If the growth rate is reduced to 10%, the target year will be the eighth year. To achieve the target in three years, the annual growth rate has to be 29.5%, which appears to be unrealistic.

The proposed scheme ensures that while the OBC quota increases each year, the

non-OBC strength also increases at a decent rate. For example, after 7 years the non-OBC number is 1604 (2211 – 607), which reflects an average growth rate of 7% over a period of 7 years. Seven years is also a reasonable timescale in which education at lower levels (elementary, middle and high school, college) can be made accessible to all sections of society with proper incentives and scholarships, to bring the disadvantaged classes into the main stream of education. It is even possible that after seven years there will be no need for any reservations and the transition from a regime of quotas to one without quotas will be smooth.

Fundamental to the arithmetic of quotas is the power of exponential (compounded) growth. It is familiar to the investors of the 1990s, when an interest rate of 12% (compounded annually) yielded a doubling of the principal in 6 years, a four-fold increase in 12 years and an eightfold increase in 18 years. In the long run, the principal is only a small fraction of the total amount and most of the total amount is accounted by the accumulated interest over the years. Analogously, after an annual growth of 12% in the number of seats for many years, the initial number of seats (1000 in the illustration) is only a small fraction of the total number of seats attained.

The arithmetic involves four parameters: annual growth rate (x), the number of years required (y) to reach a desired target of quota (q), and the proportion of extra seats reserved every year (p). x and

Table 1. Year-by-year status of OBC quota (%); $p = 0.5$, $q = 0.27$, $x = 0.12$

Year (y)	Total no. of seats	Extra seats	Extra OBC	Total OBC	OBC % of total
0	1000				
1	1120	120	60	60	5.36
2	1254	134	67	127	10.13
3	1405	151	76	203	14.45
4	1574	169	85	288	18.29
5	1762	188	94	382	21.68
6	1974	212	106	488	24.72
7	2211	237	119	607	27.45
8	<i>2476</i>	<i>265</i>	<i>72</i>	<i>679</i>	<i>27.42</i>
9	<i>2773</i>	<i>297</i>	<i>80</i>	<i>759</i>	<i>27.37</i>
10	<i>3106</i>	<i>333</i>	<i>90</i>	<i>849</i>	<i>27.33</i>

Table 2. x (as %) vs y for different values of r , $p + r = 0.5$, $q = 0.27$

y	$p = 0.5$ $r = 0$	$p = 0.45$ $r = 0.05$	$p = 0.4$ $r = 0.1$	$p = 0.35$ $r = 0.15$
1	117.4	150.0	207.7	337.5
2	47.4	58.1	75.4	109.2
3	29.5	35.7	45.4	63.6
4	21.4	25.7	32.4	44.6
5	16.8	20.1	25.2	34.3
6	13.8	16.5	20.6	27.9
7	11.7	14.0	17.4	23.5
8	10.2	12.1	15.1	20.3
9	9.0	10.7	13.3	17.8
10	8.1	9.6	11.9	15.9

y are growth parameters, whereas p and q are quota parameters. An equation relates the four quantities.

$$(1 + x)^y = p/(p - q). \tag{1}$$

Given any three, the fourth can be found. For example, for $q = 0.27$ (27%), $p = 0.5$ (50%) and $y = 7$ years, x is 11.73% (nearly 12%).

The equation can be derived as follows. Every year the number of seats increases by a fraction x compounded annually. Assume that now ($y = 0$) the total number of seats is N , of which the OBC quota is nil. In y years the number increases to $N(1 + x)^y$; the increase in seats being $N[(1 + x)^y - 1]$. A fraction p of this increase in seats is reserved for OBCs. This number must equal the fraction q of the total seats.

$$pN[(1 + x)^y - 1] = qN(1 + x)^y. \tag{2}$$

Cancelling N on both sides and rearranging terms, we obtain eq. (1). Note that it is independent of N , the initial capacity of seats.

Variations of the scheme

The current ORC quota in Central educational institutions is not well defined, one of the reasons being that the actual quota realized is less than the prescribed limit. We assume that the actual quota is less than 15%. So far we have set the ORC quota as nil. Now suppose the present ORC quota is r (< 0.15) and has to remain the same over the years. This will require that a fraction r of the incremental seats every year has to be set apart for ORCs. Since p is the fraction of incremental seats reserved for OBCs,

$p + r$ should not exceed 0.5. How does this affect eq. (1) relating x , y , p and q ?

Interestingly, eq. (1) still remains valid; however, p cannot be 0.5, but $(0.5 - r)$. r is an additional invariant (in time) parameter. Replacing p by $(0.5 - r)$ in eq. (1) we get

$$(1 + x)^y = (0.5 - r)/(0.5 - (r + q)). \tag{3}$$

Setting $q = 0.27$, the target value

$$(1 + x)^y = (0.5 - r)/(0.23 - r). \tag{4}$$

Given r , we can calculate the growth rate x required to achieve the OBC target ($q = 0.27$) in y years, using eq. (4). In Table 2 results are given for four values of r (0, 0.05, 0.10, 0.15) and $y = 1-10$.

From the row $y = 7$ (in bold), the required growth rate x is 11.7% for $r = 0$, but goes up to 17.4% for $r = 0.1$ and to 23.5% for $r = 0.15$. For $y = 7$, $x = 17.4%$, $r = 0.1$, the average growth rate for non-reserved seats is 9.0%. Note that even assuming $r = 0$, to achieve a quota of 27% in the first year itself, increase in the number of seats has to be 117.4%, not 54% as mistakenly stated by some.

The Supreme Court's ruling of not exceeding 50% for reservation of all categories put together, strikes a balance between (i) equal opportunity for all (avoiding discrimination on grounds of religion, race, caste, sex or place of birth) and (ii) affirmative action for uplifting the socially disadvantaged. Any reservation exceeding 50% can be deemed as a violation of fundamental rights enshrined in the basic structure of the Constitution and can be challenged in court. On 11 January 2007, a nine-member bench of the Supreme Court ruled unanimously that all laws, including the ones on reserva-

tion of quotas, inserted in the Ninth Schedule of the Constitution (beyond judicial scrutiny) after 1973 are indeed subject to judicial review, to determine if they violate the basic structure of the Constitution.

Using eq. (1), one can explore realistic combinations of achievable targets of parameters x , y , p , q consistent with any prescribed constraints. In eq. (3) we have assumed the maximum quota ($p + r$) is 0.5 according to the Supreme Court ruling. If this constraint is ignored, then 0.5 can be replaced by any desired number. This is important because, in political and legal terms, q (OBC quota) and the maximum permissible quota ($p + r$) are both in dispute. The question whether the economically advanced OBCs – the 'creamy layer' – should be included or not for quotas, is also not resolved. Our analysis bypasses this issue by defining OBCs as 'OBCs eligible for quota'.

Summarizing, the share of OBCs in Central higher educational institutions can be increased from nil to 27% in a phased manner over a period of 7–10 years, depending on the additional quota for other categories (Table 2). The strategy is to ensure sustained annual (compounded) growth and set apart one-half of the extra seats created every year for all reserved categories. This can be achieved without affecting the existing entitlements of non-OBC and general categories. Concurrently, the absolute strength of these categories also grows at a decent rate. Once the quota target is achieved, the reserved proportion of extra seats can be reduced from 50 to 27% to cap the reserved percentage at 27. Seven to ten years is also a reasonable time to plan for making education at lower levels inclusive for all classes of society, so that a smooth transition from a caste-based quota regime to a caste-less quota-free regime can be made. Considering that 50 years of our reservation policy has shown only modest results, it will be a major triumph if we can achieve the desired target in just seven to ten years.

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