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Impact of Grants-in-aid on Collegiate Education: Evidence and Implications of a Regional Study in India

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Abstract
This article estimates the impact of grants-in-aid (GIA) and other variables on students' performance (in terms of pass percentages) in aided private degree colleges, using panel data from sample colleges in Bangalore district of Karnataka State (India) from 1991-92 to 1997-98. In addition, sensitivity of a reduction in GIA on the estimated pass percent of students in the individual colleges and feasibility of financing a reduction in GIA through proposed changes in students' fee are analysed. The results show that (a) the impact of GIA is positive and significant in all estimations; (b) the estimated pass percentage of students does vary remarkably, especially if GIA is reduced by 50 percent or more; and (c) the proposed fee revisions can finance a reduction in GIA to all colleges by about 12 percent. The framework of analysis and implications of empirical results above are of relevance for other regions in India as well as for other developing countries in

assessing the policy impact of a reduction in public financing of higher education.

1. Introduction

Collegiate education in Karnataka State (India) comprises degree colleges which offer courses leading to the award of the Bachelor's degree in Arts/Science/Commerce/Education/Law by the University with which they are affiliated. The degree colleges include Government colleges and private aided and unaided colleges. An aided (or unaided) college is defined as that college which receives (or does not receive) grants-in-aid (GIA) from the State government. At present, the GIA is given only as a teaching/maintenance grant in the form of cent per cent reimbursement of salary for teaching and non- teaching staff. (Note 1)

The main objective of this article is to examine whether or not the current GIA policy has influence on educational performance of aided colleges, if that educational performance can be proxied by pass percentage of students in aided courses ? If so, what are the compulsions for the State Government to reducing the GIA? Whether or not a size reduction in the current GIA to colleges in the State is feasible? If feasible, how to implement such a policy of reduced GIA, without affecting the quality of education, through students' fee revision? (Note 2)

In this article, a simple and general policy framework for empirical analysis of the nature and magnitude of determinants of performance of collegiate education, with special focus on the GIA, is developed. Second, the empirically framework is implemented for data on sample colleges in Bangalore Urban district (in brief, Bangalore district). Third, alternative policy scenario are generated by the technique of econometric policy simulation as to how a reduction in the GIA can influence the changes in the performance of collegiate education in the sample colleges. In addition, the implications of financing a reduction in GIA through a revision in students' fee are analysed.

The Bangalore district is one of the developed districts in the State. (Note 3) Following the methodology of the UNDP in its human development reports, the Government of Karnataka (1999: p.218) has recently constructed the HDI by districts. For the year 1991, the value of HDI for Bangalore Urban district (or for the State as a whole) is 0.601 (or 0.470) with the value of life expectancy index of 0.680 (or 0.618), education index of 0.773 (or 0.596) and income index of 0.352 (or 0.196). Of the 20 districts, the rank of Bangalore Urban district is 2 in the value of HDI and in real GDP per capita (PPP$). This implies that the level of development of the district is above the State level and most of the districts in the State. And, this good performance of the district is largely contributed by education index. Thus, a study and role of educational sector is of special importance for the development of Bangalore district in the State. And, collegiate education is and cannot be an exception for it.

The main result of this article shows that the GIA policy has a positive and significant impact on educational performance of students in aided colleges. And, this result is valid for all estimated models of panel data. Surprisingly, college-specific effects are found to be positive and statistically significant for individual colleges, but not jointly significant for all colleges. Further, a cut in the size of GIA is shown to have differential impact on students' performance in different colleges. Hence, a uniform cut in GIA for all colleges may not be a plausible policy in the State. Finally, a proposed revision in the students' fee by the State government is shown to finance a reduction in GIA of only about 12 per cent. Thus, students' fee cannot be a single instrument for financing of entire reduction in the GIA.

The results above are obtained from a particular sample of colleges within a region in India. However, the framework of analysis and nature of problem are of general applicability for evaluation of regional education policy in other countries, especially if such countries are constrained to reducing public financing of their higher education, at present or in future. (Note 4)

The rest of the article is organised as follows. Section 2 gives a brief review of literature. Section 3 outlines a framework for empirical analysis. In section 4, data and variables for estimation are detailed. Section 5 presents the estimation results. In section 6, the results of econometric policy simulation analysis are discussed and major implications of financing a reduction in the GIA by revisions in students' fee are derived. Section 7 concludes the article with implications.

2. Review of literature

There exists a vast literature on the determinants or correlates of student achievement (or performance or attainment) in schools, if not in colleges, in India and in other countries. This literature provides a very useful information on various determinants and the nature and magnitude of effects of those determinants on student performance in schools. These information are helpful as general guidelines for current and future studies on determinants of student performance in schools in particular and in colleges in general.

In the context of India, Padma (1991) provides a neat and comprehensive review of studies between 1983-88 on correlates of achievement. Broadly, the review divides the studies into variable-wise, educational level-wise and subject-wise. For instance, the variable-wise review of studies show both multiplicity and diversity of variables used, such as, inherent variables (e.g. intelligence, personality, anxiety, feeling of insecurity, self-concept, motivation, academic interest, aptitude, habits and attitude), sociological variables (e.g. socio-economic status and environment) and other variables (e.g. age at admission, language ability, medium of instruction, homework and dropout). On reviewing studies under subject- wise, Padma observes that: "Each of the subjects is unique by itself. It is common experience to find a student achieving high in one subject of study while not doing so in some other. It is therefore necessary to study achievement in different scholastic subjects" (p.813).

Most recently, Duraisamy and Subramanian (1999) have estimated the determinants of higher secondary school attainment by courses and by management of schools, using the sample survey data from Chennai metropolitan area. Using the framework of attainment production function, the authors estimate, among others, the effects of child's sex and birth order, father's education, mother's education and family income, caste of the child, teacher's experience and sex, student-teacher ratio and management of school (i.e. whether private aided or unaided or public) on student attainment in English and Mathematics separately. The estimation results, for instance, in regard to attainment in English showed statistically significant effects of all variables except sex of student and teacher, student-teacher ratio. In particular, the positive and significant results in regard to management dummy-variable implied that "achievement scores of students from the private aided and unaided schools are much higher than those from the public schools" (p.45). In addition, the authors make sample separation between public, private aided and private unaided schools, and estimate the effects of the same set of determinants above for the respective courses. The results show remarkable differences in the nature and magnitude of determinants between schools by management.

Outside India, educational attainments are proxied by variables, such as, graduation rates (e.g. percent population graduated from high school) and scores in standard achievement tests (e.g. Scholastic Aptitude Test). The broad group of determinants is as follows. First, the school inputs or resources (e.g. pupil-teacher ratio, level of teachers education, length of teachers education, expenditure per pupil, class size, administrative inputs and facilities at schools). Second, family and/or parental background of students (e.g. parents income and educational level). Third, political and policy factors of the national and sub-national levels of governments (e.g. criteria for financing public schools).

Recently, Hanushek (1996) and Card and Krueger (1996) provided an excellent review of micro and macro studies on the effects of the school resources and family background on student performance in school in the context of USA. For instance, Hanushek's review summarizes, among others, the effects of teacher-pupil ratio and expenditure per pupil on student performance from 277 and 163 studies respectively. Surprisingly, of the studies using teacher-pupil ratio, only 15% (13%) of studies report statistically significant positive (negative) effects, whereas 27% (25%) of studies report statistically insignificant positive (negative) effects and 20% of studies do not report signs of the statistically insignificant coefficient. In the same way, of the studies using expenditure per pupil, only 27% (7%) of studies report statistically significant positive (negative) effects, whereas 34% (19%) of studies report statistically insignificant positive (negative) effects and 13% of studies report effects with unknown signs. An important conclusion of Hanushek's extensive review is that spending and commonly used resources of schools are not good measures of school quality and, hence, merely adding such resources may not bring significant improvement in student performance. Thus, "the challenge is to identify the characteristics that make certain schools and teachers better, remembering that these characteristics don't seem to have much to do with standard inputs, and then figure out how worse schools can take on these positive characteristics" (p.18).

Further, Hanushek's review makes a useful analysis of the specification bias in using teacher-pupil ratio and expenditure per pupil when data on them are used at spatially aggregated levels. For instance, of the 277 studies in which teacher-pupil ratio is used, 157 studies were single State samples with 12% of them reporting statistically significant and positive (negative) sign. The remaining 120 studies constituted multiple state samples with 109 studies which incorporate variation within each State. And, 14% of these studies report statistically significant and positive effect of teacher- pupil ratio. In the same way, the positive and statistically significant estimates of expenditure per pupil is shown to be disproportionately contributed by studies employing data from inter-state samples and data aggregated at state level.

Of late, Hammond (2000) has come out with a detailed review and a strong evidence for the role of school variables (i.e. teacher quality) in determining student achievement.

The review of studies on teacher quality includes measures of academic ability, years of education, years of teaching experience, subject matter and teaching knowledge, certification status, and teaching behaviour in classroom. Using a large sample survey data at the state level in USA, a multiple-regression model is formulated to estimate the effects of teacher quality and other variables on student achievement scores in mathematics and reading separately. The results show, among others, that the percent of well-qualified teachers has a positive and highly significant effects on the achievement scores in all the subjects and grades included in the estimations.

From the literature review above, the evidence for the role and importance of policy and non-policy factors in influencing student performance in schools is clearly mixed. Further, the evidence is relevant for particular socio-economic context, educational level, institutional setting and data availability in the respective countries. These evidence have two implications. First, empirical analysis on the determinants of student performance needs to be continued, as the available evidence (either supporting or confronting) are not conclusive. Second, unless the socio-economic context, educational level and institutional setting are comparable, a replication of previous studies may not be relevant for a current or future study. Third, there exists no econometric study on the impact of GIA on collegiate education in Karnataka State, or in other states of India, especially as they are related to the issues in the GIA policy above. (Note 5) In the same way, no published study on this topic of educational finance seems to be available outside India. Thus, an empirical analysis of effects of college resources on student performance in Karnataka needs a new framework, as no previous study exists on this topic to fill in these research gaps.

3. A framework for empirical analysis

We consider that the ultimate and sole objective of a college is to turn out the students with a successful graduation. Since passing the final examination, given that all other/previous examinations had been successfully passed, is a precondition for graduation, it is plausible to consider that the number of students passing the final year examination as a proxy for the number of graduates. From this viewpoint, a college should aim at achieving a 100 percent graduation of its students. Note that within the graduated students, there exists heterogeneity in terms of passing the degree examination with a I Class or II Class or III Class. Since class distinctions are not essential to obtain a degree, they are ignored throughout.

Let P_{it} be the total number of students who have passed the final year examination as a percentage of total number of students who appeared for that examination in the i-th college for the t-th year. Throughout, this percentage will be referred to as the pass percentage and would be the sole indicator of educational performance of a college.

We consider that P_{it} is a function of GIA and non- GIA variables. And, denote the non-GIA variables as $(X_{1it},\ldots,X_{mit})$ and the GIA variable as GIA_{it}. If data on P_{it} , $(X_{1it},\ldots,X_{mit})$ and GIA_{it} are available for N-number of colleges and T- number of years, the following panel data model may be formulated.

$$P_{it} = f[X_{1it}, \ldots\ldots\ldots, X_{mit}, GIA_{it}], \quad i = 1,2,\ldots\ldots\ldots, N; t = 1,2,\ldots, T$$

……….(1)

where the total number of observations equals to *NT*. (Note 6)

The panel data thus generated in (1) can be employed for estimation of alternative models, such as, a pooled regression model and fixed effects model. Assuming P_{it} is linear in both variables and parameters, a pooled regression model can be formulated as follows.

$$P_{it} = \beta_0 + \beta_1.X_{1it} + \ldots\ldots\ldots + \beta_k.X_{kit} + \lambda.GIA_{it} + \mu_{it}$$

$$i = 1,2,\ldots\ldots\ldots, n; t = 1,2,\ldots\ldots\ldots, T.$$

…..(2)

where both the intercept (β_0) and slope (β_j 's) coefficients are presumed to be constant, both across colleges and over time; and μ_{it} is the random disturbance term. It is assumed that the model in (2) satisfies all the standard assumptions of a multiple (linear, ordinary and normal) regression model. Hence, (2) is estimable by the technique of ordinary least squares.

In a fixed effects model (FEM), the coefficients (i.e. intercept coefficients) are considered to be non-random or fixed but unknown. And, the unknown parameters are to be estimated. A simple framework for estimation and testing of a FEM is as follows.

$$P_{it} = \alpha_i + \alpha_1.X_{1it} + \ldots\ldots\ldots + \alpha_k.X_{kit} + \phi.GIA_{it} + \varepsilon_{it}$$

$$i = 1,2,\ldots\ldots\ldots, N; t = 1,2,\ldots\ldots\ldots, T.$$

……….(3)

This model allows for the intercept to vary across colleges but not over time. And, the slope coefficients are assumed constant, both across colleges and over time. (Note 7)
In essence, the fixed effects in (3) are presumed to account for those omitted variables that are specific to individual-colleges. One possible explanation for the omission of such variables is lack of information on them for a researcher, such that they become totally unobserved. These unobserved variables might include dedicated teaching and non-teaching staff, commitment for learning on the part of the students, opportunities for professional inter- action and growth, and existence of benevolent college management.

In estimating the model in (3), we follow the least- square dummy-variable approach, where separate dummy- variables are introduced for each of the N-colleges. Thus, the total number of coefficients to be estimated in equation (3) is N-dummy coefficients + number of slope parameters.

In the ultimate analysis, the formulation above involves a choice between the pooled regression and fixed effects model. For this purpose, we adopt the following test in Green (1997). Let the estimated coefficient of determination or R^2 in (3) be denoted by R^2 (FEM) and R^2 (PRM) be the estimated R^2 in (2). Let M* be the number of explanatory variables excluding the intercept. Then, null hypothesis of whether the fixed effects are the same for all colleges can be tested by the following F-test

$$F = [\{R^2(FEM) - R^2(PRM)\}/(N-1)] / [\{(1 - R^2(FEM)\}/(NT - N - M)^*].$$

…..(4)

4. Data and variables for estimation

4.1. Data for estimation

Collegiate education in Karnataka includes general degree colleges, law colleges and education colleges. (Note 8) This study, however, is focused only on general degree colleges which are aided.

The panel data on the colleges for 7 years, from 1991- 92 to 1997-98, were collected by developing and canvassing a structured questionnaire to aided colleges in Bangalore district. (Note 9) According to Government of Karnataka (1998), there were 44 aided degree colleges in the Bangalore Urban district and 4 in Bangalore Rural district during 1997-98. In total, 35 colleges were randomly selected. Over a period of four months and by the end of December 15, 1998, the completed questionnaires were received from 30 colleges in Bangalore Urban district and 1 college in Bangalore rural district. Thus, the sample colleges essentially belong to Bangalore Urban district only. In addition, the sample comprises colleges of all types of private management in the district, viz., 2 SC/ST colleges, 9 Minority colleges and 20 other colleges (i.e. neither SC/ST nor Minority colleges).

4.2. Variables for estimation

To start with, from the sample survey of colleges above, the following variables are listed for consideration of estimations. Throughout, unless stated otherwise, by courses we mean only the aided courses and by colleges we mean only the aided colleges.

4.2.1. Dependent variable

The dependent variable in all estimations is the pass percentage of students in all courses (PASS%) in a college. This is defined as the total number of students in the courses who have passed the final year examination in B.A. B.Sc and B.Com as a percentage of total students in the final year of the B.A. B.Sc and B.Com.

In principle, pass percent of students in a college may be defined in two alternative ways. The notations to be used in these definitions are as follows. Let P_{jit} be the total number of students passing the final year examination of the j-th course in the i-th college and in the t-th year. And,
S_{jit} be the total number of students in the final year of the j- th course in the i-th college and in the t-th year, and T_{it} is the sum of students in all courses [i.e. $T_{it} = \Sigma_j (S_{jit})$]. Throughout, j=1,2,3; i=1,2,….,31; and t=1,2,….,7.

First, the pass percent of student by courses $(PASS\%)_{jit}$

$$(PASS\ \%)_{jit} = [(P_{jit} / S_{jit}) \cdot 100].$$

……(5)

Second, the pass percent of student for all courses in a college $(PASS\%)_{it}$

$$(PASS\ \%)_{it} = [\Sigma_{j=1}^{3} (P_{jit} / T_{it}) \cdot 100].$$

……(6)

In general, $(PASS\%)_{jit} \neq (PASS\%)_{it}$, unless j=1. Further,

$$[(S_{jit} / T_{it}) \cdot (PASS\%)_{jit}] = [\Sigma_{j=1}^{3} (S_{jit} / T_{it}).(P_{jit} / S_{jit}).100] = (PASS\%)_{it}$$

……(7)

Hence, $(PASS\%)_{it}$ is the weighted sum of $(PASS\%)_{jit}$, where the weight is the ratio of final year students in a course to total number of final year students in all courses in a college.

In my estimations, the dependent variable is $(PASS\%)_{it}$ in (6) rather than $(PASS\%)_{jit}$ in (7). This is due to the following institutional factors and data problems.

4.2.1.1.Institutional factors

In Karnataka State, colleges impart education leading to the award of Bachelor's degree in Arts, Science and Commerce (B.A. B.Sc and B.Com respectively) by the University with which they are affiliated. For instance, colleges in Bangalore districts are affiliated with Bangalore University. The major functions of the Universities include the preparation of common syllabus, conduct common examination and evaluation and award degrees for successful students in different courses.

Each of the degree courses contains different subjects. For instance, B.A. course contains all subjects under humanities and social sciences, such as, languages, history, economics, political science, philosophy and sociology.

Each of the subjects contains different papers. The number of papers in different subjects may be uniform within a course. The minimum marks to pass in a subject may be set by the University to a common level (e.g. 35%). Thus, to pass in a subject the minimum marks to be obtained is 35% in all subjects, and to graduate (or, to obtain a degree), the minimum marks to be obtained is 35% in all subjects. In short, the minimum marks for graduation is uniform for all courses within a college and in the University.

Consequently, my article has presumed that efforts to pass is uniform across papers, subjects and courses. Accordingly, pass percent of students for all courses (or graduation rate) in a college is considered to be a plausible specification of the dependent variable in my estimations.

Here I might add the fact that, as compared to collegiate education, school education is simpler in structure and uniform throughout the State. For instance, high school education in the State is a three year course, starting from the 8^{th} standard and ending with 10^{th} standard. In the 10^{th} standard, State level public examination is held with all students preparing for the same number of papers with common syllabus, and common examination and evaluation held at the same time throughout the State. There is no difference between a paper and subject in high school education, as each subject has only one paper. Thus, studies on determinants of student performance in Indian schools have used data by courses rather than for all courses together [e.g., Duraisamy and Subramanian (1999)].

4.2.1.2.Data problems

First, of the 31 sample colleges, only 9 colleges have all the three degree courses. In the remaining 22 colleges, B.A. course is given in 19 colleges, B.Com in 22 colleges and B.Sc in 9 colleges. Further, in many colleges, different courses are observed to have been started in different years. Thus, course-wise information on student performance is not constructable for all 7 years and for all colleges.

Second, the sample survey did not attempt to collect information on student performance by courses. Hence, course-specific determinants are not possible to be estimated from the information in my sample survey of colleges.

4.2.2. Independent variables

The independent variables include the GIA and non-GIA (in the form of qualitative and quantitative) variables.

(i) Year of starting a college (START): Colleges in Bangalore district have been started in different years and some of them have been in existence over 25. Such old colleges may have developed better infrastructure as compared to colleges which have been started more recently. To capture the impact of different years of starting of colleges on PASS%, START is introduced as a dummy- variable [=1 (or 0), if the college is started in or before 1970 (or if started after 1970].

(ii) Composition of students in a college (COM): Colleges are different in regard to the composition of students. For instance, there are women's colleges, men's colleges and co-education colleges. There is a presumption that, other things being equal, pass percentage of students is higher in women's colleges than in other colleges. To test the validity of this presumption, COM is introduced as a dummy-variable [=1 (or 0), if the college is a women's (or men's/co-education) college].

(iii) Courses offered (COURSE1): The nature and number of aided courses (apart from unaided courses, if any) differ between colleges. For instance, a college may offer only B.A. and B.Com courses, and another college may offer B.A. B.Com and B.Sc courses. Since the dependent variable is the pass percentage of students in all aided courses, it makes a difference whether or not a college has all the three aided courses. To capture the same, COURSE1 is introduced as a dummy variable. Its value is equal to 1 (or 0) if a college offers B.A., B.Sc. and B.Com courses (or if it offers only one or two of the three degree courses].

(iv) Course offered (COURSE2): The presence of B.Sc. course is often presumed to be a major contributory factor for the overall pass percentage of students in a college. To test this presumption, COURSE2 is introduced as a dummy variable. Its value equals to 1 (or 0) if a college offers B.Sc. and/or B.A., and/or B.Com courses (or if offers B.A. and/or B.Com course.

(v) Year of GIA (YGIA): As in the case of the year of starting of colleges, there is a considerable variation in the year of bringing the colleges under the GIA. If a college had been brought under the GIA before 1977, it might have been better endowed with teaching and non- teaching staff and facilities than colleges, which have been brought under the GIA since 1977. This is because of the fact that before 1977, the GIA was also given for assisting the non-staff requirements (e.g. purchase of site, construction of buildings and purchase of equipment) of the colleges. To capture the effects of difference in the year of receiving the GIA, YGIA is introduced as a dummy variable [=1 (or 0), if the year of bringing the college under GIA is in or before 1977 (or after 1977].

(vi) Ratio of final year students to first year students (RSFFY): This variable is defined as the number of students in the final year B.A. B.Sc and B.Com as a ratio of total number of students in the first year B.A. B.Sc. and B.Com course in a college. This variable is intended to capture the nature and magnitude of the impact of retention of students on the PASS% in the colleges.

(vii) Student-teacher ratio (STR): This is the ratio of total number of students studying in I, II and III year of B.A. B.Sc and B.Com course to the total permanent teaching staff who are involved in these courses. In short, STR is the total number of degree students per permanent teacher in the aided courses of a college. The STR is intended to capture the availability of per teacher services for students, which is a vital input for students' performance, in the colleges. (Note 10)

(viii) Amount of standardized GIA (SGIA): This is the amount of nominal GIA in the standardized form. That is, the actual observations on the nominal GIA are subtracted from its arithmetic mean and the resultant value is divided by the standard deviation of the GIA. The basic purpose of the standardisation is to convert the GIA into a dimensionless quantity such that it does not vary along with its unit of measurement.

This type of standardization is especially relevant since the observed values of the total GIA to individual college vary considerable in cross-section and time series data. These variations are accountable for many factors (e.g. number of aided courses and teachers, years of experiences of the teachers, allowances related to inflation and number of any part-time or temporary staff). Thus, using the absolute amount of the GIA may not be plausible. Further, any attempt to express the GIA in different units of measurement (e.g., in thousand or lakh of rupees) would result only in different magnitude for the estimated coefficient for the variable. Thus, it is necessary to standardize the variable such that its value does not vary with the unit of measurement.

(ix) Amount of standardized non-salary and wage expenditure (SNTE): This is the amount of nominal expenditure on non-salary and wages in a college and the nature of standardization is the same as explained in (viii) above. In addition, non-salary and wage expenditure per student (NTEPC) is considered as an alternative variable for SNTE.

It is important to note that not all the quantitative and qualitative variables above are included in the final estimations. For instance, the variables which are dropped from the final estimations, and the main reason for the same, are given below. First, there exists a perfect colinearity between START and YGIA. Thus, estimations including both the dummy-variables in the same equation is not possible. Second, inclusion (either separately or in combination) of PCNTE and SNTE did not improve the qualitative aspects of the trial estimation results and, hence, dropped from further estimations. Consequently, the following independent variables are chosen for final estimations: COM, COURSE1 or COURSE2, YGIA, RSFFY, STR and SGIA.

At the very outset, the inclusion of both STR and SGIA in the same equation may mean the double counting of the effects of GIA on the PASS%. This is due to the fact that a part of total permanent teachers in the aided colleges/courses are paid salary from the GIA. However, in our estimations, this problem of double counting is avoided by aiming to capture separate effects of STR and SGIA on the PASS% as explained below.

First, given the number of students, STR merely depends and varies between colleges on the number of teachers. Hence, it does not distinguish the quality of teachers in terms of their higher qualification and longer experience. Thus, if two colleges have equal number of total students and teachers, except that in one college there is a large number of experienced teachers, the STR will be equal between colleges although the quality of teaching may differ between colleges.

Second, the SGIA is intended to capture the incentives for and quality of teachers in a college as contributed by the GIA policy. For instance, apart from the basic salary, it captures the incentives (e.g. pay revisions) and compensations (e.g. inflation-linked DA payments) for the teaching staff. Thus, if two colleges have the same number of teaching staff but different amount of GIA, then a college, which has a larger GIA, may comprise more number of experienced staff. These effects of the GIA policy, however, would remain uncaptured if GIA were not included as a separate explanatory variable.

4.3. Predictions

First, we predict the sign for the coefficient for RSFFY to be negative. This result may be interpreted that, other things being equal, a decrease in the number of students in the final year as a percentage of students in the first year would have a negative effect on the pass percent of students in the final year examination. This is plausible since a decrease in RSFFY may be contributed by a higher number of good performing science students, who might have left the degree course to joining professional courses.

Second, we predict the sign of the coefficient for STR to be positive. This result may be interpreted that, other things being equal, an increase in the number of teachers would have a positive impact on pass percent of students in a college. This is plausible since, for a given number of students, an increase in the number of teachers means a greater amount of teaching time for and interaction with the students.

Third, we predict the sign of the coefficient for SGIA to be positive. This result may be interpreted that, other things being equal, an increase in one standard deviation of the GIA would have a positive impact on the pass percentage of students in aided courses. Such a result would clearly demonstrate that the present GIA policy is positively contributory for the educational performance in the colleges.

In regard to three dummy variables [COM, COURSE1 or COURSE2 and YGIA], the interpretation of estimated results depends on their assigned values (i.e. 1 or 0). Accordingly, the expected or mean value of the PASS% may be interpreted, either individually or for a combination of these dummy variables. For instance, the estimated coefficient for COURSE1 shows the extent by which the mean PASS% in a colleges, which offers all the degree courses, differs from the mean PASS% in college which offers one or two of the degree courses. Further, if COM=1; YGIA=1; and COURSE1=1, and other things being equal, we obtain the mean PASS% in a college, if that college were be a women's colleges, offering all the degree courses and brought under the GIA before 1977.

5. Results of estimation

5.1. Descriptive statistics

The descriptive statistics for the quantitative variables (i.e. PASS%, RSFFY, STR and SGIA) are given in Table 1. By definition, the mean and standard deviation of the SGIA is 0 and 1 respectively. Hence, coefficient of variation cannot be computed.

Table 1
Descriptive Statistics

Variables	Mean	Standard deviation	Co-efficient of variation	Maximum	Minimum
PASS%	42.45	21.85	51.47	97.73	3.21
RSFFY	0.70	0.26	37.14	1.00	0.11
STR	28.08	24.18	86.11	165.90	0.00
SGIA	0.00	1.00	0.00	2.92	-1.16

Simple correlation coefficients

Variables	PASS%	RSFFY	STR	SGIA
PASS%	1.00			
RSFFY	-0.04	1.00		
STR	0.05	0.25	1.00	
SGIA	0.39	0.23	-0.37	1.00

First, the largest variation (in relative terms) is evident for STR and the least variation is evident for RSFFY. Second, the range of STR is wide as the maximum (or minimum) value is about 165 (or 7). Most importantly, the range of values of SGIA is smallest among all the variables. This is the outcome of the standardization applied for the absolute GIA for sample colleges. Note that the minimum value for the SGIA is negative. This is possible if grants-in-aid to a college are less than the average value of grants-in-aid for all colleges.

Next, the simple correlation coefficients show the nature and degree of linear relationships between variables. For instance, the PASS% is positively (or negatively) correlated with STR and SGIA (or RSFFY). In fact, the correlation coefficient between PASS% and SGIA is the highest among all the positive coefficients. And, SGIA is negatively correlated with STR and RSFFY.

5.2. Estimation results of the pooled regression model

Table 2 summarizes the estimation results of pooled regression model.
The estimation results with COURSE1 show that the estimated coefficients of RSFFY, STR and SGIA have predicted signs and are statistically significant at 5 percent level. In addition, the estimated coefficient of the dummy variable, COM, is positive and highly significant. Thus, the mean pass percentage of students in women's college differs from the mean pass percentage of students in a men's or co-education college by 15.73 percent.
Further, the explanatory power in terms of R^2 is about 32 percent. This indicates that about 32 percent of variations in the PASS% are explained by the included variables in the model. This is supported by the highly significant F-statistic in the estimation.

Table 2
Estimation Results of the Pooled Regression Model

Dependent Variable :	PASS%	
Estimation for :	Model 1	Model 2
Independent Variables :		
Intercept	41.17	42.44
	(8.579)*	(8.143)*
COM	15.73	16.1
	(5.221)*	(6.032)*
COURSE1	0.58	
	(0.188)	
COURSE2		-1.46
		(0.450)
YGIA	3.92	3.93
	(1.241)	(1.250)
RSFFY	-17.36	-17.7
	(3.240)*	(3.37)*
STR	0.16	0.16
	(2.672)*	(2.594)*
SGIA	8.66	9.17
	(5.178)*	(4.886)*
R-Square	0.32	0.32
Standard Error of Regressio	18.27	18.26
F	16.49*	16.54*
Number of Observations	217	217

Note : [1] Figures in the parentheses are the absolute t-ratio.
[2] * significant at 5 percent level.

Interestingly, the estimation results above are qualitatively and quantitatively different when COURSE1 is replaced by COURSE2 as an explanatory variable. Thus, the presence or absence of B.Sc course does make a difference in the mean PASS% of students. Nevertheless, the estimated coefficient for COURSE 1 or COURSE2 is not statistically significant in both the estimations.

Further, in both the estimated equations, the coefficient of the YGIA remains insignificant. Thus, the year of the GIA in/before 1977 or after makes no difference for the pass percentage of students. Further, it is important to note that the estimated intercept term is positive and significant. To capture the variation in this coefficient between colleges is the focus of the following estimation of FEM.

5.3. Estimation results of fixed effects model

The results of the FEM in Table 3 show that the estimated coefficient for COM, RSFFY, STR and SGIA are significant. In addition, the estimated fixed effects are positive and significant for each of the 31 colleges. The magnitude of the estimated fixed effects is clearly different between colleges. This result offers evidence for the importance of college-specific effects (unobserved, however) on the pass percentage of students.

Table 3
Estimation Results of the Fixed Effects Model

Dependent Variable :		PASS%			
Independent Variables :					
COM				16.16	
				(5.649)*	
COURSE2				-0.88	
				(0.254)	
RSFFY				-14.05	
				(2.391)*	
STR				0.14	
				(2.196)*	
SGIA				9.23	
				(4.041)*	
YGIA				1.81	
				(0.483)	
Estimated Fixed Effects for individual colleges :					
1	36.15	11	38.17	21	34.64
	(4.072)*		(4.276)*		(3.825)*
2	43.04	12	34.05	22	51.79
	(4.627)*		(3.946)*		(5.743)*
3	38.6	13	39.64	23	36.53
	(4.453)*		(4.208)*		(3.900)*
4	48.83	14	35.73	24	48.4
	(5.469)*		(4.038)*		(5.751)*
5	34.37	15	44.3	25	40.45
	(3.866)*		(5.100)*		(4.572)*
6	37.11	16	38.7	26	40.82
	(3.891)*		(4.297)*		(4.457)*
7	33.17	17	40.83	27	43.34
	(3.656)*		(4.366)*		(4.915)*
8	30.19	18	43.19	28	38.14
	(3.344)*		(5.053)*		(4.230)*
9	43.86	19	38.68	29	50.29
	(4.732)*		(4.013)*		(5.767)*
10	41.07	20	44.61	30	47.15
	(4.694)*		(4.908)*		(4.959)*
				31	59.96
					(6.645)*
R-Square				0.40	
Standard Error of Regression				18.56	
F				3.31*	
Number of Observations				217	

Notes: [1] Figures in the parentheses are the absolute t-ratios.
[2] * significant at 5 percent.

As in the case of pooled regression, the estimated coefficient for RSFFY, STR and SGIA are significant and possess predicted sign. However, the magnitude of the estimated coefficient for RSFFY and STR (or SGIA) are smaller (or larger) in case of FEM. In the same way, the sign and magnitude of the estimated coefficient for COURSE2 is different between the pooled regression model and FEM. In particular, the estimated coefficients for COURSE and YGIA remain insignificant in both the estimation models. In addition, the R^2 for the FEM is 0.40, which is higher than the R^2 for the pooled regression model (=0.32). Thus, the explanatory power of the FEM is higher than the pooled regression model.

Using the framework in equation (4) above, we test whether or not the fixed effects are the same for all the colleges. The computed value of F-statistic is 0.79. Since the 5 percent critical value of F(30, 180) is about 1.46, we do not reject the null hypothesis that fixed effects are the same at the 5 percent level of significance. Thus, on empirical grounds, college-specific effects are individually significant but not jointly for all the aided colleges. This implies that the estimators of pooled regression in Table 2 are efficient as compared to the estimators of FEM in Table 3.

It should be emphasised that the impact of SGIA is positive and significant in the estimations above. This result offers empirical evidence for the positive role of the GIA policy on the educational performance of aided colleges in Bangalore district. Since the basic objective of the GIA policy is to improve the educational performance of colleges, the estimation results offer unambiguous evidence in favour of accomplishing this objective of the GIA policy in aided colleges of Bangalore district. (Note 11)

6. Impact of a reduction in GIA

A reduction in GIA may influence the PASS% in two important ways. First, by affecting STR through a reduction in the number of permanent teaching staff or number of teacher hours for a given number of students. Second, by affecting the quality of teaching through a reduction in incentives to work due to loss of regular salary and benefits as well as job security. However, if the teaching staff on the GIA is all permanent staff, then a reduction in GIA may not automatically translate itself into a reduction in number of staff or reduction in teaching work. Rather, it may affect those staff who are temporary or part-time basis and are paid by the college management. In this situation, a reduction in the GIA may not affect the STR as the denominator of the STR comprises only the permanent staff. Thus, in what follows, we attempt to capture the impact of a reduction in GIA only in terms of changes in SGIA but not through changes in STR.

The impact analysis below is framed as a simulation exercise to answering the following policy question. What would have been the pass percentage of students from 1991-92 through 1997-98, if the values of the SGIA were to be less than what were observed in those years and given the value of other independent variables as they were observed ? In particular, we determine the impact on the estimated PASS% if the SGIA to the colleges were to be reduced by 10 percent or 25 percent or 50 percent or 100 percent. This analysis helps in identifying the impact of SGIA on PASS%, separately for individual colleges. (Note 12)

The framework for the simulation analysis is as follows. First of all, we have the following estimated equation from the FEM, wherein the capped coefficients are the estimated coefficients from Table 3; and the capped P_{it} the estimated mean PASS% of students in the i-th college for the t-th year.

$$\hat{P}_{it} = \hat{\alpha}_i + \hat{\alpha}_1.(COM)_{it} + \hat{\alpha}_2.(COURSE)_{it} + \hat{\alpha}_3.(YGIA)_{it} + \hat{\alpha}_4.(RSFFY)_{it} + \hat{\alpha}_5.(STR)_{it} + \hat{\phi}.(SGIA)_{it}$$
$$i = 1, \ldots\ldots\ldots, 31 .$$

……….(8)

Thus, for each of the 7 years, the estimated PASS% may be computed for each of the 31 colleges.

It should be noted that the nature of changes in PASS% due to a reduction in SGIA depends on whether the actual GIA is above or below the arithmetic mean of the GIA to the colleges. For those colleges where the actual GIA is less (or greater) than the arithmetic mean of the GIA for all colleges, the value of SGIA is invariably negative (or positive). Hence, the impact of an increase or decrease in SGIA is negative (or positive) respectively. In view of this, the simulation results should only be considered for understanding the sensitivity of changes only in the absolute magnitude of PASS%.

6.1. Simulation results

Table 4 presents the simulation results for the year 1991-92, 1994-95 and 1997-98. Given the estimated coefficients and observed values of independent variables, the estimated PASS% is obtained. And, alternative values of estimated PASS% are obtained depending on the extent of assumed changes in SGIA. The major results and implications of the analysis are as follows.

Table 4
Impact of Changes in the GIA on PASS% During Select Years: Results of Econometric Policy Simulation Analysis

Colleges	1991-92				
	Estimated PASS%	Estimated PASS% if SGIA were to be reduced by 10%	Estimated PASS% if SGIA were to be reduced by 25%	Estimated PASS% if SGIA were to be reduced by 50%	Estimated PASS% if SGIA were to be reduced by 100%
1	41.564	41.796	42.144	42.724	43.883
2	42.229	42.877	43.849	45.469	48.709
3	26.334	27.406	29.013	31.692	37.050
4	48.887	47.780	46.120	43.352	37.818
5	60.373	58.996	56.931	53.490	46.606
6	40.377	41.104	42.195	44.012	47.647
7	45.522	45.387	45.185	44.848	44.175
8	25.699	25.075	24.138	22.577	19.455
9	42.514	42.142	41.586	40.658	38.802
10	40.018	40.765	41.885	43.752	47.485
11	31.476	31.666	31.950	32.425	33.374
12	24.515	25.587	27.194	29.873	35.231
13	53.697	52.954	51.839	49.981	46.265
14	50.494	50.258	49.904	49.314	48.135
15	45.847	46.914	48.514	51.182	56.516
16	29.062	29.873	31.089	33.115	37.169
17	51.769	49.826	46.910	42.052	32.335
18	31.091	31.470	32.038	32.984	34.877
19	20.623	21.305	22.328	24.032	27.442
20	37.848	38.205	38.742	39.636	41.424
21	20.523	21.594	23.201	25.880	31.238
22	52.550	52.025	51.238	49.926	47.302
23	46.278	46.699	47.331	48.383	50.488
24	57.547	57.946	58.544	59.541	61.535
25	32.076	32.659	33.534	34.992	37.908
26	33.213	33.990	35.154	37.095	40.977
27	71.130	69.416	66.847	62.564	53.999
28	35.222	36.293	37.901	40.580	45.937
29	51.398	51.946	52.768	54.137	56.876
30	37.066	37.825	38.962	40.858	44.649
31	45.268	45.743	46.456	47.644	50.020
Standard deviation	11.93	11.40	10.68	9.71	9.00

Table 4 (Continued)
Impact of Changes in the GIA on PASS% During Select Years: Results of Econometric Policy Simulation Analysis

Colleges	1994-95				
	Estimated PASS%	Estimated PASS% if SGIA were to be reduced by 10%	Estimated PASS% if SGIA were to be reduced by 25%	Estimated PASS% if SGIA were to be reduced by 50%	Estimated PASS% if SGIA were to be reduced by 100%
1	39.734	40.188	40.868	42.001	44.269
2	48.527	48.841	49.312	50.097	51.667
3	30.841	31.913	33.520	36.199	41.557
4	50.924	49.952	48.495	46.067	41.211
5	57.869	56.531	54.524	51.179	44.488
6	41.508	41.952	42.619	43.730	45.952
7	48.661	47.723	46.315	43.969	39.276
8	41.717	40.250	38.050	34.383	27.050
9	50.661	49.476	47.700	44.740	38.820
10	45.737	46.271	47.072	48.407	51.078
11	33.527	32.928	32.028	30.529	27.530
12	27.674	28.746	30.353	33.032	38.390
13	61.833	60.590	58.725	55.617	49.401
14	54.541	53.992	53.169	51.798	49.054
15	46.182	47.247	48.844	51.505	56.829
16	32.209	32.844	33.797	35.385	38.561
17	56.707	54.569	51.363	46.019	35.331
18	29.996	30.328	30.827	31.659	33.322
19	20.333	20.998	21.995	23.657	26.982
20	35.334	35.241	35.102	34.870	34.405
21	17.064	18.134	19.738	22.412	27.759
22	57.391	56.334	54.748	52.105	46.818
23	46.230	46.444	46.765	47.300	48.369
24	59.113	59.458	59.975	60.836	62.559
25	31.544	32.116	32.975	34.405	37.267
26	28.503	29.263	30.403	32.304	36.105
27	69.643	67.955	65.423	61.204	52.766
28	31.691	32.762	34.370	37.049	42.406
29	50.193	50.712	51.491	52.790	55.388
30	35.027	35.685	36.674	38.321	41.615
31	46.655	46.970	47.442	48.230	49.805
Standard deviation	12.57	11.93	11.06	9.87	8.99

Table 4 (Continued)
Impact of Changes in the GIA on PASS% During Select Years: Results of Econometric Policy Simulation Analysis

Colleges	1997-98				
	Estimated PASS%	Estimated PASS% if SGIA were to be reduced by 10%	Estimated PASS% if SGIA were to be reduced by 25%	Estimated PASS% if SGIA were to be reduced by 50%	Estimated PASS% if SGIA were to be reduced by 100%
1	43.593	43.611	43.639	43.685	43.777
2	50.077	50.320	50.686	51.295	52.513
3	45.944	46.618	47.628	49.313	52.682
4	50.762	49.482	47.564	44.366	37.970
5	61.432	59.318	56.148	50.865	40.298
6	47.294	47.451	47.687	48.081	48.867
7	54.240	53.074	51.325	48.410	42.581
8	44.871	42.802	39.698	34.524	24.177
9	46.644	45.846	44.650	42.656	38.669
10	42.329	42.766	43.422	44.515	46.700
11	38.317	37.411	36.053	33.789	29.261
12	28.047	28.903	30.187	32.328	36.609
13	66.708	64.804	61.949	57.191	47.674
14	59.305	58.277	56.735	54.165	49.025
15	49.367	49.991	50.928	52.490	55.614
16	33.387	33.687	34.138	34.890	36.393
17	62.877	60.179	56.133	49.390	35.903
18	35.093	35.210	35.387	35.681	36.270
19	22.465	22.948	23.673	24.881	27.297
20	40.762	40.247	39.475	38.188	35.614
21	22.498	23.350	24.627	26.757	31.017
22	64.719	62.850	60.047	55.375	46.032
23	42.848	42.936	43.067	43.286	43.725
24	56.702	56.837	57.039	57.375	58.048
25	32.261	32.648	33.228	34.196	36.131
26	26.559	27.173	28.092	29.625	32.691
27	42.088	43.159	44.767	47.445	52.803
28	30.932	32.004	33.611	36.290	41.648
29	52.570	53.066	53.809	55.049	57.528
30	36.927	37.485	38.322	39.718	42.509
31	48.466	48.569	48.724	48.981	49.497
Standard deviation	11.93	11.22	10.28	9.09	8.79

First, the estimated PASS% differs between years and between individual colleges. The maximum (or minimum) estimated PASS% is 71.13 (or 19.74) during 1991-92, 69.64 (or 17.06) during 1994-95 and 64.72 (or 19.44) during 1997-9. However, the estimated PASS% does not differ in absolute deviations. For instance, the value of the standard deviation is about 12 for estimated PASS% for all the select years. This implies that the absolute variation in the estimated PASS% remains the same, whether or not there are any individual variations in the SGIA.

Second, the reduction in SGIA does matter for the changes in the PASS% for individual colleges. This is reflected in the absolute difference between the estimated PASS% and estimated PASS% under alternative reduction in SGIA in all the years. In particular, in many colleges, the estimated PASS% does vary remarkably when the SGIA is reduced by 50 percent or more. These colleges include No.3, 4, 5, 17 and 27 during 1991-92; No.4,5,8,9 and 13 during 1994-95; and 4,5,8,13,14 and 22 during 1997-98. These colleges, however, may not be subject to a reduction in the GIA as the reduction may not be effected without compromising on the quality of education, or students' performance, in them.

6.2. Financing the reduced GIA by students' fee revision

The first report of Human Development in Karnataka 1999 [Government of Karnataka (1999)] has various agenda for future action in education in Karnataka. For instance, the agenda for Colleges and Tertiary education includes: "Make colleges more self-financing by enhancing fees". In fact, the need for fee revision in colleges/higher education has been argued frequently in Karnataka. For instance, the State Planning Board's paper on An Approach to Subsidies in Karnataka in 1997 has clearly noted: "It is estimated that hardly 1/5th of the Government expenditure on higher/university education in the country is recovered by way of fees etc. This means 80 per cent of the cost of the higher education is subsidized. It should be possible to reduce the extent of subsidy in higher education without affecting the services. It is therefore necessary to aim at revising upwards the fees and other payments for higher education in such a way that at least 75 to 80% of the cost of the services are recovered in the long run which can be attempted in phases" (pp.26-27). In the arguments above, there is an implicit assumption that self-financing is equivalent to full cost recovery through students' fee revisions, and such self-financing should ultimately aim at replacing State's budgetary support to higher education. However, the validity of this assumption is not tested with conclusive evidence. In what follows, we test this hypothesis by considering a case for financing of a reduction in GIA through students' fee revisions, as proposed by the State government, in the colleges. (Note 13)

The Government of Karnataka [Annexure to G.O.No.ED- 123-UEC-97, dated 21.06.1997] has proposed the following revisions to students' fee, as applicable from the academic year 1997-98, for both aided and unaided colleges. These rates are called proposed rates below as they are yet to be implemented. Figures in the parentheses are the current rates, [revised in and implemented since 1993-94]. (i) Application fee Rs.10 (Rs.5); (ii) Admission fee Rs.100 (Rs.10); (iii) Tuition fee Rs.600 (Rs.180); (iv) Laboratory fee Rs.400(Rs.80); (v) Reading room fee Rs.100 (Rs.30); (vi) Sports fee Rs.100 (Rs.30); (vii) Library fee including binding changes Rs.100 (Rs.5); (viii) Mid-term examination fee Rs.100 (Rs.5); (ix) Students Welfare Fund Rs.10 (Rs.5); (x) Teacher's Welfare Fund Rs.10 (Rs.5). In principle, the tuition and laboratory fee is permitted to be doubled. And, to lessen the burden of payment all fee at once, the total fee of Rs.1530 is to be paid in two installments. The first installment (Rs.1030) is at the time of admission. The second installment (Rs.500) is in October/November of the year.

In terms of the existing policy, tuition fee is totally exempted for SC/ST students. Further, there is no laboratory fee for students of B.A. and B.Com course. Hence, according to current rates (or proposed rates) the following total fee is applicable for students. First, according to current minimum rates, Rs.95 (or Rs.275) for SC/ST (or other) students in B.A. or B.Com; Rs.175 (or Rs.355) for SC/ST (or other) students in B.Sc. Second, according to proposed minimum rates, Rs.530 (or Rs.1130) for SC/ST (or other) students in B.A. or B.Com; Rs.930 (or Rs.1530) for SC/ST (or other) students in B.Sc.

In Table 5, a simple calculation is presented for the amount of fee income to the sample colleges, if they were to implement the revised rates at the minimum of tuition and laboratory fee during 1997-98. Column 2 through column 7 present the basic data on the number of SC/ST and other students, admitted to degree courses by individual colleges. These data are essential since the total fee collection depends on the number and nature of students by courses (especially non-SC/ST students in B.Sc. course).

Table 5
Financing of the Reduced GIA through Fee Revision: Some Alternative Policy Scenarios for 1997-98

College	Number of students admitted to I year during 1997-98						Total GIA to the College (in Rs. at current prices)
	B.A.		B.Com		B.Sc		
	SC/ST students	Other students	SC/ST students	Other students	SC/ST students	Other students	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	6	49	0	79	7	91	3835200
2	20	69	23	63	0	0	3022700
3	38	112	31	154	0	0	1448500
4	13	81	0	0	3	38	8560000
5	43	222	25	223	28	199	11597795
6	10	88	8	166	0	0	3329200
7	18	191	3	97	14	155	8147760
8	10	46	0	0	27	236	11438079
9	60	255	7	31	5	39	6806141
10	4	33	5	41	0	0	2305700
11	16	82	0	0	7	57	7500000
12	55	203	41	130	0	0	784000
13	3	102	5	181	6	218	10817900
14	16	113	8	92	17	128	7645500
15	0	0	10	149	0	0	1627000
16	23	179	18	57	0	0	2807300
17	0	0	36	196	70	284	13724645
18	12	47	3	40	0	0	3473370
19	0	0	4	25	1	29	2142500
20	0	0	7	93	7	111	5776600
21	0	0	4	38	0	0	799906
22	28	192	19	193	20	209	10707000
23	1	29	0	43	0	15	3583000
24	8	66	32	111	2	17	3399000
25	0	0	19	180	0	0	2492810
26	2	21	0	22	0	0	1669200
27	4	238	13	291	11	348	12247600
28	60	95	114	429	56	193	3230012
29	50	188	76	204	0	0	2096600
30	16	36	5	10	0	0	1869500
31	3	21	29	49	0	0	3526500
31	3	21	29	49	0	0	3526500
Total	519	2758	545	3387	281	2367	162411018

Table 5 (Continued)

Financing of the Reduced GIA through Fee Revision: Some Alternative Policy Scenarios for 1997-98

College	Total fee income (TFI) based on admissions to I year B.A., B.Sc and B.Com. during 1997-98: At current minimum rates	At proposed minimum rates	Growth in fee income from current to proposed rates (%)	TFI as a % of GIA at current minimum rates	TFI as a % of total GIA at proposed rate, based on admissions to I year B.A., B.Sc and B.Com during 1997-98: Case 1	Case 2	Case 3
(1)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1	69300	293560	323.61	1.81	7.65	9.08	9.15
2	40385	171950	325.78	1.34	5.69	5.69	5.69
3	79705	337150	323.00	5.50	23.28	23.28	23.28
4	37525	159350	324.65	0.44	1.86	2.13	2.14
5	204380	869400	325.38	1.76	7.50	8.53	8.62
6	71560	296560	314.42	2.15	8.91	8.91	8.91
7	138670	586740	323.12	1.70	7.20	8.34	8.41
8	102105	443470	334.33	0.89	3.88	5.12	5.21
9	99735	423010	324.13	1.47	6.22	6.56	6.59
10	21205	88390	316.84	0.92	3.83	3.83	3.83
11	45530	194860	327.98	0.61	2.60	3.05	3.09
12	100695	427170	324.22	12.84	54.49	54.49	54.49
13	157025	663150	322.32	1.45	6.13	7.34	7.36
14	107070	456020	325.91	1.40	5.96	6.97	7.06
15	41925	173670	314.24	2.58	10.67	10.67	10.67
16	68795	288410	319.23	2.45	10.27	10.27	10.27
17	170390	740180	334.40	1.24	5.39	6.63	6.84
18	25350	106260	319.17	0.73	3.06	3.06	3.06
19	17725	75670	326.91	0.83	3.53	4.34	4.36
20	66870	285140	326.41	1.16	4.94	6.09	6.14
21	10830	45060	316.07	1.35	5.63	5.63	5.63
22	188035	798330	324.56	1.76	7.46	8.63	8.70
23	25220	104840	315.70	0.70	2.93	3.18	3.18
24	58860	249080	323.17	1.73	7.33	7.63	7.65
25	51305	213470	316.08	2.06	7.33	7.63	7.65
26	12015	49650	313.23	0.72	8.56	8.56	8.56
27	272555	1149450	321.73	2.23	2.97	2.97	2.97
28	238945	1031710	331.78	7.40	9.39	11.09	11.13
29	119770	509740	325.60	5.71	31.94	35.53	36.22
30	14645	63110	330.93	0.78	24.31	24.31	24.31
31	22290	96060	330.96	0.63	3.38	3.38	3.38
31	22290	96060	330.96	0.63	2.72	2.72	2.72
Total	2680415	11390610	324.96	1.65	7.01	7.89	7.96

Table 5 (Continued)
Financing of the Reduced GIA through Fee Revision: Some Alternative Policy Scenarios for 1997-98

College	Total fee income (TFI) based on admissions to I, II & III year B.A. B.Sc.and B.Com. during 1997-98			TFI as a % of total GIA at proposed rates, based on total admissions to I, II and III year B.A. B.Sc. and B.Com during 1997-98		
	At current minimum rates	At proposed minimum rates	TFI as a % of GIA at current minimum rates	Case 1	Case 2	Case 3
(1)	(16)	(17)	(18)	(19)	(20)	(21)
1	207900	432160	5.42	11.27	12.69	12.76
2	121155	252720	4.01	8.36	8.36	8.36
3	239115	496560	16.51	34.28	34.28	34.28
4	112575	234400	1.32	2.74	3.00	3.02
5	613140	1278160	5.29	11.02	12.05	12.15
6	214680	439680	6.45	13.21	13.21	13.21
7	416010	864080	5.11	10.61	11.75	11.82
8	306315	647680	2.68	5.66	6.90	6.99
9	299205	622480	4.40	9.15	9.49	9.52
10	63615	130800	2.76	5.67	5.67	5.67
11	136590	285920	1.82	3.81	4.27	4.31
12	302085	628560	38.53	80.17	80.17	80.17
13	471075	977200	4.35	9.03	10.24	10.26
14	321210	670160	4.20	8.77	9.77	9.86
15	125775	257520	7.73	15.83	15.83	15.83
16	206385	426000	7.35	15.17	15.17	15.17
17	511170	1080960	3.72	7.88	9.12	9.32
18	76050	156960	2.19	4.52	4.52	4.52
19	53175	111120	2.48	5.19	6.00	6.02
20	200610	418880	3.47	7.25	8.40	8.45
21	32490	66720	4.06	8.34	8.34	8.34
22	564105	1174400	5.27	10.97	12.14	12.21
23	75660	155280	2.11	4.33	4.58	4.58
24	176580	366800	5.20	10.79	11.09	11.12
25	176580	366800	5.20	10.79	11.09	11.12
26	153915	316080	6.17	12.68	12.68	12.68
27	36045	73680	2.16	4.41	4.41	4.41
28	817665	1694560	6.68	13.84	15.54	15.58
29	716835	1509600	22.19	46.74	50.32	51.02
30	359310	749280	17.14	35.74	35.74	35.74
31	43935	92400	2.35	4.94	4.94	4.94
31	66870	140640	1.90	3.99	3.99	3.99
Total	8041245	16751440	4.95	10.31	11.19	11.26

Notes:
1. GIA for college No.8 refers to total salary for teaching staff.
2. The figure for fee other than tuition fee for college No.8 refers to 1994-95.
3. Case 1 refers to a situation when the proposed tuition and laboratory fee are at the minimum.
4. Case 2 refers to a situation when the proposed tuition fee is doubled.
5. Case 3 refers to a situation when the proposed tuition and laboratory fee are doubled.

Source: Computed by the author.

The total collectable fee income from admission to I year of all aided courses are presented in column 9 and 10, when the tuition and laboratory fee are at the minimum. Note that in these computations, the SC/ST students are exempted from the tuition fee by the colleges. These exemptions account for foregone fee income for the colleges and not reimbursed by the Government. If reimbursed, the total fee income to the colleges would be higher than what have been reported in column 9 and 10.

Next, the increase in total fee income for colleges in moving from the current rates to the proposed rates is remarkable, as shown by the numbers in column 11. However, there exists a wide variation in the absolute amount of total fee collectable by the individual colleges for differences in the number of courses and students.

Further, as a percentage of the GIA, total fee income under different rates shows considerable variations as reported in column 12 through column 15. The highest (or lowest) percentage is 12.84 (or 0.44) according to the current rates. For the proposed rates, three cases are considered. Case 1 is when the tuition and laboratory fee is at the minimum. Case 2 is when the tuition fee is doubled (or at the maximum). Case 3 is when both tuition and laboratory fee are doubled.

In the analysis above, the proposed fee were to be applicable only for new admissions during 1997-98. But for students who are already in II year and III year aided courses, the existing fee is applicable. Thus, the total fee collectable from the entire aided courses equals to the sum of (a) fee collectable according to the proposed rate from the I year students and (b) fee collectable according to the existing rates from II year and III year of the aided courses during 1997-98.

If, for the sake of simplicity, the number and composition of students is the same in all the three years of the course, then the total fee collectable from all students in all aided courses are given in column 16 through column 21. These figures indicate the upper limit for collectable fee as they are calculated by charging fee for all students and by assuming zero dropouts from the courses. Thus, the proposed rates, even if were to be totally implemented, cannot totally fill in the resource gap, except in case of college no.12, if such a gap is created by complete withdrawal of current GIA to the colleges.

Nevertheless, the figures in column 16 through column 21 indicate the extent to which the current GIA to colleges can be withdrawn in varying amount under the proposed rates, but to leave the colleges resource-neutral or quality-neutral. For instance, the sum of reduced GIA to all sample colleges equals to about Rs.80.41 lakh (1 lakh=100000) according the current rates; Rs.167.51 lakh under Case 1, Rs.181.72 under Case 2 and Rs.182.84 lakh under Case 3 of the proposed rates. As a ratio to total GIA for all sample colleges (=Rs.1624 lakh), the reduced GIA accounts for 4.95 percent according to current rates; 10.31 percent under Case 1, 11.19 percent under Case 2 and 11.26 under Case 3 of the proposed rates. Thus, if the revised rates are implemented under Case 2 or Case 3, about 12 percent of the current size of GIA can be reduced to the sample colleges.

It should be emphasized that total collectable fee and the amount of GIA vary between colleges. This, in turn, implies that the ability of individual colleges to finance a reduction in GIA by fee revision also varies between colleges. Hence, a uniform cut in GIA for all colleges may not be practicable. Second, at present, only GIA net of tuition fee is distributed to colleges. However, the entire analysis above takes both tuition and non-tuition fee as instruments of financing a reduction in the GIA. Interestingly, according to the current (proposed) rates, the tuition fee accounts for about 65 (50) percent of annual total fee for B.A. and B.Com courses, and 53 (39) percent of total fee for B.Sc course. From this viewpoint, the impact of fee revision on financing GIA will be far less than the figures in the Table 5.

7. Conclusions and implications

This article has developed alternative empirical frameworks for estimating the impact of GIA and non-GIA variables on the pass percent of students in all aided courses, viz., a pooled regression model and a fixed effects model. Further, a policy simulation framework is developed for assessing the impact and sensitivity of a reduction in GIA on the estimated pass percent of students in the individual aided colleges. In addition, impact of financing the reduced GIA within the framework of existing and proposed policy changes in regard to the students' fee in degree colleges is analysed.

The frameworks thus developed are estimated for data from 31 sample aided colleges in Bangalore districts. The estimation results show that, regardless of the nature of estimation in terms of pooled regression and FEM, the impact of COM, RSFFY, STR and SGIA on the PASS% is significant. Second, the impact of SGIA is positive and significant in all estimations. Given that one of the objectives of the GIA policy is to improve the educational performance of colleges (e.g. in terms of improving the pass percentage of its students), this result offers unambiguous evidence in favour of accomplishing this basic objective of the GIA policy in the State. Third, the college-specific effects are positive and significant for individual colleges but not jointly for all aided colleges.

The results of the econometric policy simulation analysis show that the estimated PASS% differs between years and between individual colleges in the State. And, these estimated PASS% do vary remarkably with variations in the SGIA, especially when the SGIA is reduced by 50 per cent or more. However, in many colleges, the variations are considerable. Such colleges are underlined to be sensitive to reduction in the GIA. Thus, a uniform cut in GIA for all colleges is not a realistic approach to reducing the GIA.

It is demonstrated that if the proposed fee revision is implementable, the GIA to a college can be cut proportionate to the increase in fee income. In this case, a reduction in GIA shall not affect the quality of education in the aided colleges. However, the proposed fee revisions can finance a reduction in GIA to all colleges only to the extent of about 12 percent. Thus, students' fee cannot be a single instrument for replacing GIA in the State. This suggests a need for exploring additional sources of financing the colleges, especially private funding for colleges. (Note 14)

Other things being equal, and if the present GIA is continued, there exists a lesser compulsion for the aided colleges to implementing the revised fee structure, provided the aided colleges have the complete freedom in implementing the revised fee. Rather, if the present GIA is to be gradually reduced, there may exist a natural compulsion for the aided colleges to implementing the revised fee, at least to recover the losses arising out of reduced GIA. From this viewpoint, a reduction in GIA can be an instrument for implementing the revised fee above.

The entire policy analysis in this article has been based on the supply side factors, given the demand for collegiate education including that all students are equally willing and capable of paying the proposed rates. In the absence of this assumption, effects on demand and distributional implications of implementing the proposed fee may have to be carefully worked out (especially, access to collegiate education for the poor students), before any revision to the current rates is effected. (Note 15)

In reality, many external effects may influence students' performance in a college. First, when a class comprises both merited and less merited students, there are external effects on each other within a class. Second, the presence of unaided courses along with aided courses in aided colleges may generate external effects on each other within a college. Third, presence of several colleges in close proximity may generate external effects on students' performance between colleges within an urban area. Exploration of these external effects is an interesting extension of this article. (Note 16)

The framework of analysis and nature of problem in this article are of general applicability for other developing countries where the governments are constrained to reducing public financing of higher education. If studies in other countries are undertaken, alternative evidence (either supporting or confronting) can be established for the hypotheses tested here.

Notes

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1. According to the GIA code of Karnataka's collegiate education [as detailed in Murthy (1993: pp.217-244)], the basic objective of GIA is to encourage private enterprise in higher education or to total cost of providing collegiate education for the State government, especially as compared to a hypothetical situation where all the aided colleges are to be totally established and run as government colleges. Further, because of GIA, the teaching and non-teaching staff is paid at par with the staff in government colleges, apart from equal service conditions and benefits. Thus, private management can attract the best of qualified and experienced staff for their colleges, which, in the ultimate analysis, is a critical input for improving the quality of education or students' performance in the colleges.
2. It might be added here that these policy issues are relevant at the national level as well. This is evident in discussions on the recommendations of the Report of the Committee of Funding of Institutions of Higher Education [Chairman: Justice K. Punnayya: 1995] and All India Council of Technical Education's Report on Mobilisation of Additional Resources for Technical Education [Chairman: D. Swaminadhan: 1995]. See, for instance, Tilak (1995) for a summary of discussion on these reports in a seminar on Funding of Higher Education [January 23-24, 1995: National Institute of Educational Planning and Administration (New Delhi)]. Further, the policy concerns are evident in discussions on Government of India's (1997) paper on Government Subsidies in India.
3. Up to 1986, Karnataka comprised only 19 districts. In 1986, Bangalore district was split into Bangalore Urban and Rural districts. From 1996-97, seven new districts have been created. Thus, at present, Karnataka has 27 districts. For a recent inter-district comparison of levels of economic development, see Government of Karnataka (1999).
4. For a discussion of public financing of higher education in developed countries, see Dolton et al (1997) for U.K. and Government of Ontario (1996) for Canada. And,

the papers in the symposium on economics of higher education, especially as they are related to USA, in Journal of Economic Perspectives (Vol.13. No.1, 1999). For studies on developing countries in general, see World Bank (2000), and for specific countries, see World Bank (1997a) for China and World Bank (1997b) for Vietnam.

5. This does not mean that studies on collegiate education in India are ignorant of the role of GIA. This is evident in Mathew (1991) and Azad (1988). For instance, Azad (1988) provides with a comparison of GIA in four States (i.e. Andhra Pradesh, Gujarath, Haryana and Orissa), underlines the desirable objectives of GIA in terms of quantitative expansion and qualitative development of colleges, and lists the criteria (i.e. equity, specificity, adequacy, elasticity, promotional, efficiency and administrative freedom) for evaluation of GIA. However, these studies do not assess the impact of GIA.
6. We are aware of alternative ways of assessing the impact of GIA on collegiate education. First, if the GIA is considered as a form of public investment in higher education for generation of human capital, then the impact of GIA is defendable if the returns to it are positive and its continuation is defendable if the returns are positive and increasing over a period of time. For recent empirical studies on estimation of returns to investment in education, see Psacharopoulos and Mattson (1998) and Nevile and Saunders (1998). And, for an excellent global review of studies in returns to investment in education, see Psacharopoulos (1994). Second, impact of GIA in aided colleges may be assessed in comparison with students' performance in unaided private colleges and Government colleges, provided that comparable data from both Government and private colleges are available. In this case, GIA is defendable if students' performance in aided private colleges is higher than in unaided private colleges and Government colleges. Recently, Duraisamy and Subramanyam (1999) have done such a study for estimating the factors affecting students' performance at higher secondary level, using sample survey data from Chennai (India).
7. For alternative estimation models for panel data, see, for instance, Chapter 2 and 3 in Hsiao (1995).
8. For a recent description of current status of collegiate education and GIA by districts in the State, see Narayana (1999).
9. A copy of the questionnaire is available from the author upon request.
10. It should be emphasised that the number of permanent staff included in the denominator for calculating STR in colleges refers to the number of full-time working staff, but not the number of sanctioned permanent full-time staff on GIA. If a sanctioned post is vacant due to factors, such as, retirement or death or resignation, it may take sometime before it is fill up. In the meanwhile, subject to the availability of workload and permission from the Government, one or two temporary staff may be appointed on GIA. Inclusion of these temporary staff might have made little difference to STR for their number is considered to be negligible.
11. A reformulation of the FEM above is a Random Effect Model (REM) where intercept coefficients are considered to be random and unknown as given below.

$$P_{it} = \alpha + \omega_i + \beta_1 X_{1it} + \dots\dots\dots + \beta_k X_{kit} + \lambda GIA_{it} + \varepsilon_{it}$$

$$i = 1,2,\dots\dots\dots,n;\ t = 1,2,\dots\dots\dots,7.$$

As compared to the formulation in (3), the REM above allows for the intercept to vary across colleges but not over time, such that the variation is random as characterised by the random disturbance (ω_I) for the i-th observation. Given the standard assumptions, among others, on and between ω_i and ε_{ij} , we may follow the two-step Generalised Least Square approach for estimation of parameters in the REM above, as given in Hsiao [(1995), 32-38]. Further, following Green [(1997), Chapter 14], the presence of random effects [i.e. variance of the random effects, ω_I , does not equal to zero] can be tested using a Lagrange Multiplier (LM) test; and a choice between a FEM and REM (in terms of testing whether or not the individual effects are uncorrelated with other regressors; if correlated the evidence is in favour of a FEM; if not, the evidence is in favour of a REM) can be made using the Hausman's test based on the Wald criterion.

Although a detailed analysis of the REM is beyond the scope of this article, we report only the result of the LM test and Hausman's test. That is, the computed value of the LM statistic is 0.925. Since the 5 percent critical value from the Chi-square distribution with one degree of free is 3.842, the LM statistic is insignificant at 5 percent level. Thus, the evidence in favour of a random effect model is absent. On the other hand, Wald statistic for the Hausman's test is 3.746. Since the 5 percent critical value from the Chi-squared distribution with 6 degrees of freedom is 11.07, the null-hypotheses that the individual/fixed effects are uncorreleted with the regressors (i.e. COM, COURSE, YGIA, STR AND RSFFY) is not rejected. Thus, on empirical grounds, the evidence is not in favour of the REM, or the FEM is preferable to the REM.

12. One important reason for a reduction in the size of GIA is to contain the growth government deficit. For instance, as reported in RBI (1999), the revenue deficit of the Government of Karnataka has increased from Rs.78.9 crore during 1990-91 to Rs. 116.4 crore during 1993-94 and to Rs.151 crore during 1998-98 (BE). And, the GIA as a percentage of revenue deficits was 70 during 1990-91, 75 during 1993-94 and 33 during 1997-98. From this view, the revenue deficit is substantially contributed by expenditure on the GIA over the years. However, the recent decline in the share of GIA in revenue deficit can explained by the following policy changes in the GIA. First, all new colleges, started during or after 1987-88, have been allowed only on permanently non-GIA basis. Second, since 1991-92, no new courses have been sanctioned on GIA. These changes have reduced the expenditure on GIA. And, given the increasing size of absolute revenue deficit, the ratio of GIA to revenue deficit has come down since 1991-92.
13. Apart from the State government, the degree colleges in Karnataka State are guided by the agencies below in regard to charging different fee. First, the University, with which the college is affiliated, in regard to (i) registration fee; (ii) examination fee; and (iii) sports development fee. Second, the concerned colleges in regard to students union; cultural activities; college magazine; and for issuing identity card of college/library.
14. For a discussion on private funding of higher education in India, see Mathew (1996).
15. The issue of access to higher levels of education in the context of private funding of education is recently raised in Mundle (1998: p.664). And, a framework for analysis of income distribution issues in financing education is in Fernandez and Rogerson (1998).
16. A related paper in this regard is by Rothschild and White (1995) wherein an

analytical framework is developed to financing higher education wherein students are considered not only as standard outputs but also as inputs. This framework helps in relating students' fee to the amount of human capital received and in internalising the external effects of students on each other within a class/college.

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