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Determinants of student performance in the introductory economics course in UP

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Determinants of Student Performance in the Introductory Economics Course in UP

by

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by

Gerardo P. Sicat and Kristine Joy Briones

ABSTRACT

Human capital formation in collegiate education can be partly measured by academic performance in a course. This study is based on students enrolled in the introductory course in the University of the Philippines under a single professor for the period 1998 to 2007. Data on the student's performance in the course are linked with a vast amount of collateral information, both collegiate and pre-collegiate, some traced to regional as well as other development factors associated with these backgrounds. Such pre-enrollment data include the student's performance in the UP college admissions test (UPCAT). Student performance in the course is predicted well by the entrance examination scores of the student in the university. Broken down into separate factors, the scores in mathematics, science and reading are highly significant explanatory variables. These factors affirm the importance of factors associated with the student's innate characteristics. In addition, gender does not play a distinctive role in academic performance although females tend to perform better as a group than males. There is a distinguishable difference in the performance of students coming from different course programs. Regional and other economic provincial variables such as mortality and malnourishment rates associated with the student's place of high school origin are a poor predictor of performance. A perceptible increase in performance of student is associated with the improvement of teaching technology that is linked with information technology and the internet.

Key words: Human capital formation, collegiate education, introductory economics, economic development, college entrance examinations

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I. Introduction

Collegiate education as a process of human capital formation is measured by the level of the student's performance by the end of a course. If grades are the output of the educational process, then the quality of the inputs matter. In this production function for educational output, various factors are important.

The characteristics of the school environment are an important factor in student achievement. From the physical state of the school to the classroom environment to the student-teacher relations, these features facilitate the learning process in school. Issues such as the

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appropriate number of students in a class, school attendance, and teacher characteristics, among others have been discussed in numerous studies (some mentioned in the bibliography) that try to determine possible factors of school achievement.

Characteristics of the household could also contribute to performance of the students. The presence of younger siblings in a number of ways could be a factor in uncertain ways. If the student assumes some time toward care of younger siblings, that might compete with study. On the other hand the presence of older siblings may be a boon for it might mean that financial, emotional or further tutoring support. The level of education of the parents may also contribute to performance as well as their occupation.

There are various advantages and disadvantages students bring with them when they go to school, some they don't have control of. This constitutes the students characteristics factor. This includes their gender, age, and their ability. Some students arrive to school more prepared than others. This could be due to their study habits or even their health. Performance could also be dependent of the student's level of interest regarding the subject matter.

Some of these factors cannot yet be fully studied due to lack of further associated demographic data. However, these factors are important and a subsequent paper will be presented in the future utilizing two surveys about the students that were made during school year 2008-2009. For the moment, only factors that are associated with student information derived from entrance examination and registration data will be used. This study therefore focuses on the pre-collegiate factors and collegiate affecting a student's performance associated with these available information. A number of measures identified above shall be grouped under pre-collegiate and collegiate determinants and shall be tested of their significance.

Introductory Economics as proxy for academic performance

The students who enrolled in Economics 11 represent the sample of this study beginning in 1998. The course is a three unit introductory course on Economics. The course has evolved over this period. Also, the textbook used also evolved. The senior author needed the lectures of the early years to guide him in the revision of the textbook that he had written for Filipinos studying introductory Economics. Such a textbook had been in use since 1984 when he published the book. When he returned to the

country in 1998,¹ he taught the elementary course as part of a master plan to revise the book and bring it up to date. The revision was successfully undertaken in 2003 when the revised textbook was published and supplanted the old one. Before the completion of the revisions a few Teaching Notes that were later incorporated in the revised textbooks were circulated as readings to the students then enrolled. The inclusion of many Philippine examples in the elementary text plus its ordering of subject matter which is more applicable in the country context makes the book different from foreign textbooks on the subject.²

In 2002, as a result of a realignment of educational philosophy on General Education, the course instead of being an optional course for all students became part of the general education curriculum. Although the course was required in a number of courses before, this move of the school authorities made the course even more required for a number of courses taught in the University.³ This has altered the emphasis of the course. Instead of being a straightforward introduction to Economics, the importance of the role of the state or the government is taken into account in pursuing the analysis of market behavior. Also, the composition of students taking the course has changed somewhat. Fresher and younger students now dominate the recent enrollments in the course.

More than 1,000 students have been handled by the same professor in this course. By focusing on this population of students, the teacher becomes a given and no longer a variable in the study. Even though the teacher also learns and improves as time goes by, this factor is effectively controlled for the study. For one, the evaluation methods are set more uniformly.

For instance, the grading method for the course has remained relatively intact. The final grade is attained from averaging three major unit examinations that are given at different points in the course. Students perform well in the three examinations get the option of not taking the final examination, provided their standing meet the minimum standards of performance for exemption from that final test. For purposes of the study (and in view of the limitations of the data gathering prior to the intense data analysis) only about 700 of the students who took the course in the earlier years up to 2004 are included.

¹ The senior author worked abroad for almost thirteen years in a major international development institution. He had tried to revise his book while in Washington D.C. but found the task too demanding and postponed it upon his return to the country.

² For a review of the textbook shortly after its publication, see Hal Hill (2004).

³ See Appendix 1: Courses that require Econ 11

Examinations are multiple choice objective questions. In this setting, the importance of preparing different questions each time the course is given in a semester is a constant challenge for the professor. His teaching assistants are required to prepare suggested questions, dividing up the topics. But in all cases, the main professor prepares the questions to make sure that each examination for each term is unique from the others. An experienced teacher can ask the same question in a number of different ways so that a question is unique. About 50 questions per unit test and 75 questions per final examination are given. A review of these test questions are filed and openly shared with all students enrolled in the Economics class in the UP School of Economics Library. At least one typical unit exam in the past is posted in the website for the course to make sure that all the students face a level playing field for studying and preparing for the examination.

One major development that changed the environment of the class is the development of teaching technology. The lectures – two one hour lectures per week – of the course are given to around 200 students in the large lecture hall-theater of the School. The big class is broken up into small discussion classes of 20 to 30 students for the third class hour of the week. It is led by a teaching fellow. In the early years, the technology for teaching had the professor lecturing through microphone and using slide projections and transparencies where he would make his drawings and charts. The microphone and the teacher have for the set of students have not changed but a lot of things have.

Before the advent of these improvements some decades back, the blackboard was the primary visual. By the 2002, PowerPoint presentation became the mode. The PowerPoint slide presentation accompanies the lecture and has become the effective means of demonstrating graphical work. Graphs could be drawn in steps to demonstrate a process in doing the elementary part and then some graphs can be pulled back for recall easily. This process of change has made the teacher adept and fulfilled in manipulation of point and click technology to change the image projected.

To emphasize recall, each of the PowerPoint lectures is summarized in form of handouts presented as an Adobe .pdf file. This file is posted to the class website within the University Virtual Learning Environment (UVLE). The UVLE is a web-based learning system in the UP that enables all students enrolled in a course to avail of a communication system between teacher and students. Its usage depends initially on the professor's inclination to make it a communication system for exchanging information, ideas, class readings, and other interactive materials. Unfortunately, the system is only gradually being utilized by students who

have computers.⁴ By the last count 70 percent of all enrolled in the course students access the UVLE although the intensity of access for each student varied. To be sure that those who are excluded out of the UVLE for lack of computers still get the web-based storage of teaching materials, lecture handouts are also copied to the UP Economics Library where students could avail of the same and Xerox them for their use if necessary.

II. A model of student performance

To understand the factors that determine the grade performance of the student, this study tries to estimate regression models taking into consideration possible pre-collegiate and collegiate determinants of grade in introductory economics (Econ11) course under a single professor. Analyzing the data for only one professor would let the authors focus more on other determinants while holding the impacts the educators have for student achievement fixed. Putting these various characteristics together, academic performance (**AP**) of student *i* would be dependent on a number of distinct factors that can be as treated as a set of vectors representing the student's grouping of

⁴ Also, and more importantly, the UVLE's usefulness is also constrained by the professor's computer literacy. This is a new system and, as in all innovations, not all professors have the same degree of use of the facility.

specific attributes, as follows:

$$AP_i = F(\text{vectors of } X1_{ij}, X2_{ik}, X3_{il}, e)$$

where **X1** refers to the set of individual characteristics, both collegiate and pre-collegiate, that are associated with the student i , and the corresponding indicator j to the specific characteristic; **X2** to provincial/regional attributes of student i among island groups associated with i ; **X3** to the college environment when the student i took the course; and **e** to the error term.

Pre-collegiate factors

Initially, the paper singles out pre-collegiate factors affecting student achievement in Econ11. Some studies done in the US in the 1980s identify the introductory economics course, like any other business subject, as a "male" course. More male students tend to study the course and are found to do better than females. In the case of the Philippines, more females enroll in business courses like economics and males tend to move towards degrees in engineering or the natural sciences.

The university predicted grade (UPG), specifically the four components of the UPCAT (mathematics, science, language proficiency, reading comprehension percentile rankings) serve as proxies for students' ability. These also measure the preparedness of the students as they enter college. Type of high school can also be a factor in determining performance in Econ11. In the country, while public science high schools especially in the National Capital Region (NCR) have proved themselves in producing excellent students, when looking at the national average, private schools, especially at the high school level, are still seen to provide better education to students.

Regional and provincial as well as development factors related to the student's origin are also looked into to test whether or not are good predictor of student's performance. These include variables for poverty, nutrition, and health indicators.

Collegiate Factors

Collegiate factors are those associated with college life activities and environment. A student's course or college may affect his performance in a subject. For example, students from the School of Economics where Econ11 is offered would be expected to do better than other students since this is a major subject and is assumed to be the subject of interest. First year students are expected to perform less than other students since they haven't adjusted yet to their new environment.

With the introduction of general education curriculum around three years ago, Econ11 became part of the general education course and this change in pattern of the course has partly altered the composition of the students. The course content has also changed, with emphasis on the interaction of markets and government. From 1998 to 2002, the textbook used for the course was the Economics book by G. P. Sicat. But with the revision of the book in 2003, dividing the original book into three volumes, the first two volumes became the main text used for the course since 2003.

Technological improvement has perhaps overcome the large lecture hall environment. With the introduction of the University Virtual Learning Environment (UVLE), lecture notes of the professor became available to the students. With access to the internet, students are able to ask questions to the teaching assistant. Time constraints for both teaching assistant and student were overcome. Students don't need to go to the teaching assistant's office to ask questions. Teaching assistants are also able to answer the question anytime or be able to prepare and answer the questions in class.

Data

Students who enrolled in the introductory course in economics under a single professor from the second semester of academic year 1998-1999 to second semester of academic year 2004-2005 and who have earned a bachelor's degree in the University of the Philippines form the population for this study. Their academic performance in the subject measured by the students' final grades was linked with a vast amount of collateral data, both collegiate and pre-collegiate.

Final grades originally in the UP system grading style are transformed into percentages so as to match the scales used in the UPG scores. Within the class grading period, these are allocated in ranges of upper and lower bounds covering the recorded grades of the students in various exams adjusted for other variables like quizzes and other discussion performance. The main source of the grades is based on exam performance. The midpoint of this range serves as the dependent variable in the regression estimation using ordinary least squares. The grades and their interval values in percentage are presented Table 1. Table 2 presents the various explanatory variables to be used in this study whereas Table 3 provides summary statistics of all variables.

Table 1: Grades and their corresponding percentage intervals

Grade	Range		Midpoint of range
	Lower bound	Upper bound	

1	96	100	98.0
1.25	92	95	93.5
1.5	88	91	89.5
1.75	84	87	85.5
2	80	83	81.5
2.25	76	79	77.5
2.5	71	75	73.0
2.75	66	70	68.0
3	60	65	62.5

Table 2: Dependent and explanatory variables for the regressions

VARIABLE	DESCRIPTION
DEPENDENT VARIABLE	
E11_grade	Student's grade in the introductory course in economics (Econ11)
A. STUDENT CHARACTERISTICS VARIABLES	
Female	indicator variable equal to 1 if student is female and 0 if male
UPG	University Predicted Grade ⁵
Math	mathematics percentile ranking based on the UPCAT scores (1 to 100)
Science	science percentile ranking based on the UPCAT scores (1 to 100)
Language	language proficiency percentile ranking based on the UPCAT scores (1 to 100)
Reading	reading comprehension percentile ranking based on the UPCAT scores (1 to 100)
Econ Course	indicator variable equal to 1 if student is from the School of Economics, 0 otherwise
Art_Letter	indicator variable equal to 1 if student's course falls under the Arts and Letters cluster, 0 otherwise ⁶
Mgt_Econ	indicator variable equal to 1 if student's course falls under the Management and Economics cluster, 0 otherwise
Sci_Tech	indicator variable equal to 1 if student's course falls under the Science and Technology cluster, 0 otherwise
Socsci_Law	indicator variable equal to 1 if student's course falls under the Social Sciences and Law cluster, 0 otherwise
Required	indicator variable equal to 1 if Econ11 is a required subject for the students course ⁷
Yearlevel	number of years in the university when student took Econ11
High School	
Public	indicator variable equal to 1 if student comes from a public high school, 0 otherwise
B. PROVINCIAL VARIABLES	
NCR	indicator variable equal to 1 if high school is located in the National Capital Region
City	indicator variable equal to 1 if high school is located in a city
High_urban	indicator variable equal to 1 if high school is located in a highly urbanized city ⁸
Cityclass1	indicator variable equal to 1 if high school is located in a city belonging to income class 1 ⁹

⁵ $UPG = 2.8101 - 0.047147*(\text{Mathematics}) - 0.046402*(\text{Reading Comprehension}) - 0.1381*(\text{Language Proficiency}) - 0.15531*(\text{High School Weighted Average}) - 0.025178*(\text{Science})*(\text{Language Proficiency})*(\text{High School Weighted Average})$; UPG takes on the values 1 to 5 with 1 being the highest grade but for ease of interpretation, the reversed grades (5 is highest) in the regression.

⁶ See Appendix 1 for course listing for every cluster.

⁷ See Appendix 2 for a list of courses where Econ11 is a required subject.

⁸ Defined as cities with a minimum population of 200,000 inhabitants, as certified by the National Statistics Office, and with the latest annual income of at least Fifty Million Pesos based on 1991 constant prices.

⁹ Defined as cities with at least an average annual income 300 Million Pesos.

VARIABLE	DESCRIPTION
Malnutrition00	Proportion of malnourished 0-6 yr old children of type 1, classified as underweight using weight-for-age as indicator, i.e., the child's weight is less than that of normal children of the same age
Mortality00	Mortality rate per 1000 0-5 yr old children
C. SCHOOL ENVIRONMENT VARIABLES	
Secondsem	indicator variable equal to 1 if student took Econ11 during the second semester, 0 otherwise
Year	
e11_1998	indicator variable equal to 1 if student took Econ11 in 1998, 0 otherwise
e11_1999	indicator variable equal to 1 if student took Econ11 in 1999, 0 otherwise
e11_2000	indicator variable equal to 1 if student took Econ11 in 2000, 0 otherwise
e11_2001	indicator variable equal to 1 if student took Econ11 in 2001, 0 otherwise
e11_2002	indicator variable equal to 1 if student took Econ11 in 2002, 0 otherwise
e11_2003	indicator variable equal to 1 if student took Econ11 in 2003, 0 otherwise
e11_2004	indicator variable equal to 1 if student took Econ11 in 2004, 0 otherwise

On average, a student's grade in Econ11 is 79 percent. Majority of the students in the introductory economics course are female. In a usual lecture class of 200, around 145 of them would be female. Since entrance is UP is determined by the components of the UPCAT, it can be surmised that students in the course will have high percentile rankings in all four components. From the table, it can be seen that mean percentile rankings are above 81.

Seventy one percent of the students come from cities with more than half of them coming from NCR. For every 5 student in Econ11, around 3 of them come from private schools.

Sixteen percent of students from the sample are economics majors while 50 percent come from colleges under the management and economics cluster other than the school of economics. Students with courses where Econ11 is a required subject cover 67 percent of the sample.

Before 2002, students, on the average, took Econ11 in their second or third year and during the second semester. After the introduction of the course in the general education curriculum, many freshmen undergraduates were allowed to enroll in the course. So in this sense, the student body also changed in terms of collegiate schooling maturity. In a sense, this allowed for a change in circumstances that could also be statistically tested.

Table 3: Summary Statistics (Number of observations = 503)

VARIABLE	MEAN	STD. DEV	MIN	MAX
DEPENDENT VARIABLE				
Econ11	79.0875	9.7046	62.5	98
A. STUDENT CHARACTERISTICS VARIABLES				
Female	0.7256	0.4466	0	1
UPG	3.6598	0.1288	3.134	4.128
Math	81.5487	16.2557	8	99
Science	82.1630	14.6636	23	99
Language	87.3559	9.9012	42	99
Reading	84.3340	14.0933	26	99
Econ	0.1610	0.3679	0	1
Course				
Art_Letter	0.1233	0.3291	0	1
Mgt_Econ	0.6620	0.4735	0	1
Sci_Tech	0.1213	0.3268	0	1
Socsci_Law	0.0934	0.2913	0	1
Required	0.6700	0.4707	0	1
Yearlevel	2.8131	1.3511	1	8
High School				
Public	0.4394	0.4968	0	1
B. PROVINCIAL VARIABLES				
NCR	0.4115	0.4926	0	1
City	0.7117	0.4534	0	1
High_urban	0.4831	0.5002	0	1
Cityclass1	0.5348	0.4993	0	1
Malnutrition00	0.2646	0.1546	0.2030	3.4740
Mortality00	25.4598	6.5012	8.9159	55.9397
Severity97	0.0115	0.0156	0.0012	0.0902
C. SCHOOL ENVIRONMENT VARIABLES				
Secondsem	0.7058	0.4562	0	1
Year				
e11_1998	0.1988	0.3995	0	1
e11_1999	0.0159	0.1252	0	1
e11_2000	0.1988	0.3995	0	1
e11_2001	0.1849	0.3886	0	1
e11_2003	0.2207	0.4151	0	1
e11_2004	0.1809	0.3853	0	1

Data on economic variables relating to provinces – fiscal and development data pertaining to provinces and cities – are national data.

III. Results

To test the significance of the variables in determining academic performance, three separate models are estimated. Two were done using ordinary least squares and the results are presented in table 4.

Table 4: Determinants of academic performance
(Dependent variable: Econ11 grade; estimation is by ordinary least squares)

VARIABLE	MODEL 1		MODEL 2	
	COEFFICIENT	STD ERRORS	COEFFICIENT	STD ERRORS
A. STUDENT CHARACTERISTICS VARIABLES				
Female	0.6621	0.8109	8.2532*	4.3107
UPCAT				
Math	0.0620**	0.0251	0.0605**	0.0251
Science	0.0753***	0.0287	0.0755***	0.0281
Language	0.0673	0.283		
Reading	-0.0609**	0.0400	0.0669**	0.0278
Lang X Female			-0.0891*	0.0479
Econ	6.2606***	1.2148	6.6355***	1.2736
Course				
Art_Letter	2.1777*	1.1229	2.0351*	1.1087
Sci_Tech	2.7416**	1.2924	2.4756*	1.2906
Socsci	-1.1334	1.4665	-1.8053	1.4724
Required	-2.4764**	1.0197	-2.8864***	1.0186
Yearlevel	-1.5780***	0.2943		
yrlevel2			0.4099	1.2623
yrlevel3			-1.5850	1.4814
yrlevel4			-3.0081**	1.5146
yrlevel5above			-7.5948***	1.6444
High School				
Public	-0.8257	0.7579		
public_sci			0.6369	1.1433
public_nonsci			-1.3365*	0.8088
B. PROVINCIAL VARIABLES				
NCR			0.3951	1.1060
City			-0.8068	0.8963
Malnutrition00	11.6799	15.3887	13.2581	15.1735
Mortality00	0.0451	0.0719	0.0402	0.0711
C. SCHOOL ENVIRONMENT VARIABLES				
Secondsem	5.5413***	1.4812	5.4146***	1.4630
Year				
e11_1999	8.2127***	2.9812	8.6104***	2.9741
e11_2000	7.6643***	1.1131	7.5111***	1.1127
e11_2001	12.3606***	1.8029	11.8952***	1.8430

VARIABLE	MODEL 1		MODEL 2	
	COEFFICIENT	STD ERRORS	COEFFICIENT	STD ERRORS
e11_2003	12.2199***	1.0920	12.0852***	1.1095
e11_2004	12.6446***	1.3652	12.7865***	1.3603
CONSTANT	57.3262***	5.0941	50.1264***	4.4391
R squared	0.4203		0.4423	

Pre-collegiate determinants of course achievement

Looking at the pre-collegiate student characteristics in two models above, gender and the UPCAT components are significant determinants of academic performance.

From Model 2, female students have higher grades than males by 8 percentage points. Mathematics, science, and reading comprehension percentile rankings also constitute significant determinants of achievement. Students with better preparation in mathematics and science during their high school days perform well in Econ11. The coefficients at first glance may look small but note that the variables have values ranging from 1 to 100.

Taking the science percentile ranking as an example, *ceteris paribus*, a student with a percentile ranking in science of 99 is expected to have a grade in Econ11 higher by 2 points than a student with a percentile ranking of 75.

Language proficiency, on the other hand, is not significant. Separate tests for mean and variance comparison between genders shows that mean and variance of language proficiency percentile ranking for males is statistically significant from females.¹⁰

This heterogeneity between genders is accounted for in the model by the introduction of the interaction variable of language proficiency and dummy variable for females. It shows that for females, language proficiency negatively affects Econ11 grade. But the robustness of language proficiency variable can be questioned since in other regressions it is insignificant. Also, since all four exams in the course are multiple-choice type, it may be the case that language proficiency may indeed not be a determinant compared to when there are essay-type exams.

¹⁰ Mean language proficiency percentile ranking for female is significantly higher than males while variance of language proficiency percentile ranking for female is significantly lower than females.

Another pre-collegiate determinant of academic performance is the type of high school where the student graduated from. Including the dummy variable for public schools¹¹ can measure how the public school system fare compared with private high schools. From the Model 1, the variable is shown to be a negative but insignificant determinant of academic achievement. In Model 2, more detailed attention is given to the diversity of the public school system in the country—public schools are further classified into public science schools and public non-science schools. Public science schools are not significantly different from private schools. Students from public non-science schools, on the other hand, have lower grades compared to students from private schools by 1.34 percentage points.

Development factors related to the student's origin are also entered as explanatory variables. It is to be recalled that such regional and development factors did not prove significant in explaining the academic performance of students.¹² In this study, further exploration on the influence of local government expenditure and on the status of demographic information such as health data indicated by malnutrition levels and by child mortality rates for the region of location of the high school or residence of the student does not yield significant results. All these development variables are part of the pre-collegiate factors that help to characterize the student's regional and local backgrounds.

The conclusion from the regression estimates is that other important factors account for the student's performance.

Collegiate factors: (1) Other important student characteristics:

The collegiate environment might account for some of these factors. The college of the student and the number of years spent in the university when the student took Econ11 proves to be important factors in determining his success in the course.

Colleges in UP Diliman can be classified into four major clusters. These clusters are (1) arts and letters, (2) management and economics, (3) science and technology, and (4) social sciences and law. The colleges in their respective clusters are presented in the appendix. The grades of students from the Social Sciences are not significantly different from those under Management and Economics. Both models show that students from the Arts and Letters and Science and Technology cluster outperform

¹¹ See G.P. Sicat and Marian Panganiban (2009) for a more detailed treatment of the high school factor.

¹² See Sicat and Panganiban elaboration of this point (2009).

students from the Management and Economics cluster by more than 2 points.

Students from the School of Economics who enroll in Econ 11 on their own volition outperform those students from the nine courses where they are required to take Econ11. Students coming from the other nine courses have Econ11 grades that are around 3 points lower than other students, *ceteris paribus*.

The yearlevel variable indicates the number of years the student has spent in the university at the time he took Econ11.¹³ Model 1 indicates that the students who spent longer years in the university have lower grades compared with the mainline students. There is no way of identifying these students but they could represent those who needed the course as an required elective in their major course and took it in the later years. Or more significantly, they could represent poor performers in the course who were finally taking the course on repeat basis.

Further elaborating on the issue, the year levels are entered into Model 2 as separate dummy variables with year level 1 as the base variable. Looking at the coefficients, second year students do, in fact, have higher grades (albeit a small magnitude) compared to first year students. On the other hand, third year students have lower grades compared to first year students by 1.6 points and this difference increase as year level increase with those in fifth year and above having grades around 7.6 points lower than the first year students, *ceteris paribus*. It would therefore seem that taking the course early during the student's college years did not pose a major problem in terms of academic performance.

Collegiate factors: (2) School environment and the role of technological advancement

The last component looked into is the role of the school environment in achievement. Other studies (see many of the studies on the teaching of Economics in the American classroom cited in the bibliography) have included under this component the different impact of different teachers, class size, and even ordering of questions in a multiple-choice exam (where in it was hypothesized that students who took a scrambled exam performs poorer compared to students who took the exam where in questions are ordered the same way how topics in the

¹³ The yearlevel variable becomes less relevant in later years after the revision of the curriculum for General Education when Economics 11 became a requirement for specific courses in the university. As a result, younger and more freshmen students have become predominant in the class composition.

lectures were discussed). This is not a problem in the current study. All classes were held under a single professor and test items are not scrambled, instead the ordering of choices in the multiple-choice test are the ones scrambled.

An issue of interest is whether there is a difference in outcome with regard to the time of school year when the course was taken. Secondsem is an indicator variable for students who took Econ11 during the second semester and it is highly significant with a positive coefficient (5.41 in Model 2). One major distinction of the second semester from the first is the presence of a break, the Christmas break. This gives the students time to unwind and recharge and even spend more time to review.

A set of indicator variables is added to represent the year when the student took Econ11. The professor started teaching course in 1998. That is used as the base year for the class dummy variable. All year indicators for the class years are significant. Also, their coefficients have a rising value. One possible hypothesis for this is that grade inflation has been a phenomenon. The professor might have become more tolerant or kinder. Before accepting this conclusion however, it is well to examine the changing classroom environment.

Major changes in the teaching environment have taken place. First, in the early years, the professor relied on lectures with the use of a projector through which his graphical illustrations (when these were needed) were projected through transparencies that were drawn in class or sometimes prepared ahead of time). This was done in a large lecture hall with the lecturer speaking through a microphone that was amplified. During one of these school years, the auditorium suffered through typhoon damage and flooding and had to be repaired so that lectures were held in the third floor of the Economics Library with the use of multiple blackboards.

By school year 2002-2003, the teaching in the lecture hall shifted with the use of PowerPoint presentation. The slides, although prepared ahead of time, were presented needed, sometimes the graphs would be presented slowly as if being drawn when the topic is initially introduced. There was therefore occasion to phase the discussions slowly in dynamic form rather than only present finished slides. Lecture outlines and main lecture points were also introduced into the slide presentation. PowerPoint's dynamic features are therefore exploited topic by topic. Such lecture presentations were learned over time. Across the semesters, the professor also learned to improve these presentations.

Moreover, the university's teaching infrastructure also improved. The UVLE became available as already discussed at the beginning. With this added facility, it became possible to link the lecture system with internet

access through which the UVLE could be accessed by students who have computers at home or elsewhere.

Thus, teaching technology has improved. Increasingly but not yet totally, technology has enhanced the learning process and hence the performance of students. The PowerPoint presentations are compressed into summary .pdf files so that these summary notes could be accessible to the students. Students who are shy and would not normally ask questions increased the options to improve their review and learning of the subject through the lectures.

And last, but not the least, since examinations are given as objective tests of multiple choice questions, the professor has leveled the playing field by making sure that all examinations in the previous years are made available to students through the compilation of such questions at the UP Economics Library. The lecture files in .pdf are also made available to the Library at the same time that they could be accessed directly through the UVLE system of the university that is linked through the internet.

In situations where grades are given within grade intervals, the midpoints of the intervals are used as the dependent variable and the usual ordinary least squares regression is applied as what was done in Models 1 and 2 above. One drawback of ordinary least squares regressions (OLS) is that uncertainty relating to the nature of the exact values within each interval is not reflected in the regression. To resolve this problem, an interval regression – designated as Model 3 – is administered using the same variables used in Model 2.¹⁴ The results are shown in Table 5.

Model 3 with robust standard errors has an R squared value of 0.447. While significance of the variables remained the same as in model 2, there are differences in the coefficients (although most with just few difference in decimal values). For example, the coefficients for the dummy variable for students under the School Economics, students in their fifth year and above, and students who took the course in the second semester are actually lower when interval estimation is applied.

Table 5: Determinants of academic performance
(Dependent variable: Econ11 grade in intervals; estimation is by interval regression)

VARIABLE	MODEL 3	
	COEFFICIENT	ROBUST STD. ERRORS

¹⁴ Interval regression is similar to an ordered probit regression but with the cut points fixed and the coefficients of the explanatory variables and variance of the dependent variable estimated by maximum likelihood.

VARIABLE	MODEL 3	
	COEFFICIENT	ROBUST STD. ERRORS
A. STUDENT CHARACTERISTICS VARIABLES		
Female	8.2594*	4.5353
UPCAT		
Math	0.0606**	0.0246
Science	0.0754***	0.0286
Reading	0.0669**	0.0293
Lang X Female	-0.0892*	0.0499
Econ	6.6070***	1.2321
Course		
Art_Letter	2.0275*	1.1049
Sci_Tech	2.4683**	1.2283
Socsci	-1.8070	1.4698
Required	-2.8815***	0.9915
Yearlevel		
yrlevel2	0.4035	1.2475
yrlevel3	-1.5748	1.4359
yrlevel4	-3.0103**	1.4524
yrlevel5above	-7.5797***	1.5471
High School		
public_sci	0.6440	1.0570
public_nonsci	-1.3349*	0.7785
B. PROVINCIAL VARIABLES		
NCR	0.3904	1.1073
City	-0.8182	0.8801
Malnutrition00	13.2997	14.7118
Mortality00	0.0406	0.0705
C. SCHOOL ENVIRONMENT VARIABLES		
Secondsem	5.3931***	1.3190
Year		
e11_1999	8.5252***	2.0918
e11_2000	7.4613***	1.1518
e11_2001	11.8415***	1.7761
e11_2003	12.0249***	1.1388
e11_2004	12.7180***	1.3094
CONSTANT	50.2250***	3.9828
Wald chi2(26) = 489.69		
Prob > chi2 = 0.0000		
Log pseudolikelihood = -1085.2173		
McKelvey and Zavoina's R ² = 0.447		

IV. Conclusion

This study attempts to relate regional, economic, pre-collegiate educational background of the students with factors that influence the student's performance in the collegiate classroom. Students who enrolled in the introductory course in Economics under a single professor for the period 1998 to 2007 in the University of the Philippines form the population for this study. Their academic performance in the subject was linked with a vast amount of collateral data, both collegiate and pre-collegiate. Pre-enrollment data included the student's gender, his performance in the UP college admissions test, and demographic, economic and social information that are associated with the student's regional and community origins.

The findings of the study cover a wide range of factors. Gender plays a distinctive role in academic performance. Female students perform better than males in the course. Components of the UPCAT were also included in the model and were found to be significant determinants. How well the student performs in the course can be predicted on how well he did in the UPCAT. The type of high school where the student graduated has also an important role in determining how well he does in the course. While students from public science schools do no better than those from private schools, students from public non-science schools do poorly compared to those from private schools. Regional and other economic provincial variables such as mortality and malnourishment rates are a poor predictor of performance.

Differences in course enrollment of students often accounted for significant group performance. A perceptible increase in performance of student is explained by the improvement of teaching technology – in this particular case, the introduction of teaching guides using slide presentation, access to the internet, and the wider circulation of course content, including that pertaining to exercise on economic test questions.

Further light on academic performance could be unraveled if more direct demographic information were available beyond those derived from registration and admissions data used in the present study. During the school-year 2008-2009, a special survey of the enrolled students was conducted precisely to generate such additional demographic data. As a result, more pertinent issues about the student's economic, family and other backgrounds can be isolated and examined in relation to the student's performance in the course. The analysis of that additional information would be the subject of a subsequent paper.

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Appendices

Appendix 1: List of Courses according to Cluster

CLUSTER	COURSES
Arts and Letters	College of Architecture College of Arts and Letters College of Fine Arts College of Human Kinetics College of Mass Communications College of Music Institute of Library and Information Science
Social Sciences and Law	Asian Center Institute of Islamic Studies College of Education College of Law College of Social Work and Community Development College of Social Sciences and Philosophy
Management and Economics	Asian Institute of Tourism College of Business Administration College of Home Economics School of Economics School of Labor and Industrial Relations School of Urban and Regional Planning National College of Public Administration & Governance
Science and Technology	College of Engineering College of Science Statistical Center

Appendix 2: Courses where Econ11 is a required subject and college where they are offered

Courses where students are required to enroll in Econ11

B.A. Communication Research
B.A. Public Administration
B.S. Business Economics
B.S. Clothing Technology
B.S. Economics
B.S. Family Life & Child Development
B.S. Home Economics
B.S. Hotel, Restaurant & Institution Management
B.S. Mining Engineering