Analysing the impact of interventions on the performance of first-year Economics students from 2008 - 2012: A Panel data analysis

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Abstract

In most Bachelor of Commerce degrees in South Africa, Economics 1 is a compulsory module and consists of Introductory Microeconomics and Introductory Macroeconomics. It is also a known fact that the success rate of Economics 1 students is low. The challenge is to increase the success and retention rate of students and to improve the success rate without dropping the standard of a module. The main aim of this paper is to report on a systematic and stepwise introduction of intensive (I) and continuous (C) interventions in Economics 1 from the period 2008 till 2012. The paper includes an explanation of the different interventions introduced in Economics 1, such as continuous assessment opportunities, tutorial classes incorporating active learning techniques and the introduction of digital technology through assignments and weekly self-evaluations with MyEconlab.

Panel data analysis was done and feedback on the students' participation in and performance after the interventions were provided. The methodology takes account of unobserved heterogeneity among students and in so doing constitutes an improvement over cross-section regression results also interventions were introduced yet. The impact on the success rate of Microeconomics and Macroeconomics were compared and the results indicate that the interventions are more successful in Microeconomics. There are also clear benefits for students through the introduction of interventions, and more specifically assignments. The comparison of the results of the students with a control group with a higher Mathematics entrance requirement clearly shows the importance of a higher mathematical prerequisite to study economics.

Keywords: Interventions, Success rate, Panel data, Introductory Microeconomics, Introductory Macroeconomics

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1. Introduction

In the days when university classes contained highly selected students, at the university by choice, the traditional lecture seemed to work well enough. Today, with a diversified the student population, many students seem not to be coping, while lecturers feel they are being unfairly put upon. Some believe that these students should not be at university at all. The high failure rate of especially first-year Economics students has become a concern at most South African Universities (Edwards, 2000). Many lecturers see major difficulties in maintaining academic standards in today's larger and more diversified classes.

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Different teaching and learning strategies are in place to support both the lecturer and student in this struggle. Lecturer-focused strategies are transmission theories of teaching: knowledge is conceived as being transmitted from expert lecturer to inexpert student, usually by lecturing and the lecturer's task it to "get it across" (Biggs 1999). The focus is on what the lecturer does. Lecturers accept that there are the good students and the poor students. Their own responsibility as lecturers is to know the content well and to expound it clearly. Getting complex understandings across requires much more than chalk-and-talk, so the performance of the students rests to a significant extent on what the lecturer does. Resource limitations are often seen to limit large-class teaching to "passive" methods such as mass lecturing, and assessments such as multiple choice testing. Lecturers strive to manage their lectures well and to get as much teaching competencies as possible. Thereafter, it's up to the student to attend lectures; to listen carefully; to take notes; to buy the prescribed text book, to read the recommended readings; and to study for assessments and to perform well. Basically, this conception holds teaching constant, so that variability in student learning is accounted for by individual differences between students, which make this a “blame-the-student” theory of teaching (Biggs 1999). When the students don't perform well, it is due to a student’s deficit: a lack of ability; attitude; study skills; motivation or poor preparation on a school level.

Student-focused strategies see the focus as being on bringing about conceptual change in students' understanding of the world, and it is what students do to achieve understanding that is important, not what lecturers do. Here the lecturer focuses on what the student does; on what learning is or is not going on. This implies a view of teaching that is not just about facts, concepts and principles to be covered and understood, but about what it means to understand those concepts and principles in the way we want them to be understood and what kind of teaching/learning activities are required to reach those kinds of understandings. The lecturer’s job is to organise the student activities leading to appropriate learning.

Shuell (1986) puts all this together thus:

“If students are to learn desired outcomes in a reasonably effective manner, then the teacher's fundamental task is to get students to engage in learning activities that are likely to result in their achieving those outcomes.

... It is helpful to remember that what the student does is actually more important in determining what is learned than what the teacher does” (p. 429).

Two well-know "approaches to learning" exists. A surface approach refers to activities of an inappropriately low cognitive level, which yields fragmented outcomes that do not convey the meaning of the encounter. The deep approach refers to activities that are appropriate to handling the task so that an appropriate outcome is achieved. The goal is therefore for surface learning to be replaced by deep learning, as indicated by Marburger (2005) to improve the throughput rate without dropping the standard of a module.

A retention formula developed by Seidman (2005) summarizes the available retention theories and will be used as the theoretical base for this paper:

RET = EID + (E + I + C) IV……(1)

Retention = Early Identification + (Early + Intensive + Continuous) Intervention

This paper follows on a study by Van Zyl and Blaauw (2012), where they tested for the impact of early identification (EID) and early intervention (E).Their findings indicate that the throughput rates of students who attended the orientation sessions were consistently higher than those of students who did not make use of the opportunity to attend the sessions.

There may well be endogenous limits to what students can do that are beyond any lecturer's control, but there are learning-related aspects that are controllable. Capitalising on them is what good teaching is about. Good teaching is getting most students to use the higher cognitive level processes that the more academic students use spontaneously (Biggs 1999:57). Good teaching narrows the gap**.**

The main aim of this paper is to report on a systematic and stepwise introduction of intensive (I) and continuous (C) interventions in Economics 1 from the period 2008 till 2012. The paper includes an explanation of the different interventions introduced in Economics 1A and 1B, such as continuous assessment opportunities, tutorial classes and active learning and the introduction of digital technology through assignments and weekly self-evaluations with MyEconlab.

The aim of the research was to examine the impact of various interventions in the teaching and learning of first-year economics. The specific research questions were:

1. Do intensive and continuous interventions improve the success rate of first-year Economics students?

2. Which interventions are the most successful?

3. How much do these interventions contribute to the learning process and student performance?

The remainder of the paper is organised as follows. A short overview of theories linking interventions and performance is provided in Section 2. In Section 3 the model of the relationship between interventions and performance is presented. The data used to estimate the model are described in Section 4. In Section 5 the model specification and results of the estimation are presented and interpreted. Finally, Section 6 summarises the conclusions of the study.

2. A brief overview of the theories

The theoretical relationships between attendance and academic performance have been analysed extensively in the literature following the widely cited study where Romer (1993) reported evidence on absenteeism in undergraduate economics courses at three major US universities, finding an average attendance rate of about 67 per cent. On the basis of these findings, Romer suggested that measures aimed at increasing attendance, including making attendance mandatory, could be considered. Following the controversial conclusions of Romer (1993), a number of empirical studies in the economic education literature have examined the relationship between student attendance and academic performance. The following review of the literature is based on Stanca (2004).

Durden and Ellis (1995) investigate the link between economics students over three semesters. Their results, based on OLS controlling for ability and motivational factors indicate that attendance matters for academic performance. In particular, whereas low levels of absenteeism have little effect on the eventual outcome, excessive absenteeism has a large and significant effect. Devadoss and Foltz (1996) examine attendance in a sample of about 400 agricultural economics students at four large U.S. universities. They find that, even after controlling for both prior grade point average and the degree of motivation, on average students who attended all classes achieved a full letter grade higher than students who attended no more than 50 per cent of the same classes. A positive and significant relationship between attendance and academic performance is also found by Chan et al. (1997) in a sample of 71 Principles of Finance students. More recently, Marburger (2001) investigates the relationship between absenteeism and exam performance in a sample of 60 students of a Microeconomics course. In this study, records on student attendance at each class during the semester are matched with material corresponding to each question covered in the classes. The results indicate that students who miss class on a given date are significantly more likely to respond incorrectly to questions relating to material covered that

day than students who were present. Rodgers (2001) finds that attendance has a small but statistically significant effect on performance in a sample of 167 introductory statistics course. Kirby and McElroy (2003) study the determinants of levels of attendance at lectures and classes and the relationship with exam performance in a sample of 368 first year economics students, finding that hours worked and travel time are the main determinants of class attendance, and that travelling time has a positive and diminishing marginal effect on grade.

All of these studies, with the exception of Marburger (2001) and Rodgers (2001), are based on cross-sectional data sets. As a consequence, as observed by Romer (1993), the possibility that the estimated relationship between attendance and exam performance reflects the impact of omitted factors rather than a true effect cannot be ruled out.

There is no dispute on the results and conclusions of these studies and it can be accepted that class attendance contribute positively to the performance of students. Class attendance is compulsory at the University of Johannesburg and students not attending 80% of tutorial classes are refused entrance to the final assessment irrespective their academic performance.

3. Model and economic variables used

Academic performance is hypothesised to be a function of the teaching and learning interventions available to students and other variables some of which are unobservable, such as the student's motivation and aptitude for the subject matter. These variables are likely to affect the student's propensity to successfully incorporate interventions in their learning experience, leading to an upward bias in estimates of the effect of interventions on performance obtained from regression analyses of cross-section observations. This potential problem should be taken into account when results are interpreted. The teaching and learning strategy followed in Economics 1 is a combination of traditional lectures and interactive learning approaches, primarily co-operative learning (through small-group tutorial sessions), multiple short class tests to improve class attendance, a challenging interpretation assignment at the end of the semester covering all the work and electronic self-study tasks on a weekly basis, thereby ensuring active participation by students. Lectures are usually teacher centred and students are expected to do independent study outside contact hours with the lecturers. The teaching and learning process in Economics 1 is reflected in figure 1.

Place Figure 1

- Lecture attendance

Lecture attendance is an aspect of the programme that may have contributed to the success in academic achievement. Van Walbeek (2004) conducted a study at the University of Cape Town on the impact of attendance on the performance of first-year Economics students. He found that students who attended all lectures were likely to perform better than students who attended none at all. Horn and Jansen (2007) found that lecture attendance contributed positively to students' final marks. Although a study by Schmulian and Coetzee (2011) found a significant positive correlation between class attendance and academic performance, the correlation was low and not very meaningful. These findings suggest that the large class environment, its situation in South Africa's cultural and economic environment or a combination of the two may reduce the effect of class attendance on academic performance.

- Tutorials

In a tutorial programme students are involved in active learning. Active learning is defined as the engagement in meaningful tasks where students have ownership of the content (McCown, Driscoll & Roop, 1996: 236). According to McCown et al. (1996), active learning improves the learning process, especially if the tasks are authentic to the specific discipline. Various authors indicate the importance of active learning on student performance, e.g. Marburger (2005) points out that active learning requires the student to be actively involved in the learning process.

Tutoring techniques were geared towards actively involving the students in their own learning process. Students are assigned to small problem-solving groups and begin interacting with lecturers, peers and tutors; they build up a knowledge base of relevant material and learn where to go to seek out more. Students meet with a tutor and discuss the case in relation to the knowledge they have obtained. The knowledge is applied, the case is treated. Subsequently there is a review process to ensure that learners develop self-management and self-monitoring skills.

- Technology

Using technology for teaching and learning is unavoidable, but its benefits are unclear. If technology is used purely to support traditional forms of teaching such as acting as a dumping site of factual (oral or text) information then at best it will be used as a poor alternative to lectures. It will enforce the belief that knowledge is passively transmitted from

one individual to another for the sole purpose of memorisation and replication. On the other hand, the affordances of technology can provide the tools for creating authentic learning environments and fostering the communication channels that support the social construction of knowledge and understanding (Massingham 2006). Technology has had a significant impact on the way we teach and the way students learn. The introduction of computers in most teaching environments has led to the widespread use of 'power-point' slides to deliver lectures. Students expect to have this material available online through learning management systems such as uLink or Blackboard. The introduction of on-line databases and 'e-readings' has made visits to the physical library irrelevant. Research into 'e-learning' found that the main reason for absenteeism at university was 'whether enough other study material was available' (Naber & Köhle, 2004, p.1). If students can access the lecture slides and the audio on-line, why should they come to lectures? If they can access necessary readings online, why even bother coming to the University campus at all.

Accepting all the possible difficulties, technology is still used relatively intensive in the teaching of Economics 1, and more specifically due to the big class environment. All communication to students is duplicated on uLink and power-point slides are made available to students before the formal lecture to assist the pre-reading-process. As a teaching intervention electronic worksheets were introduced on a weekly basis. Students were expected to assess MyEconLab and to attempt the weekly revision exercises. An electronic assignment was made available weekly and only a limited number of submissions contributed to the semester mark. This information was communicated to the students. All the attempts of the students were however recorded and the total number of attempts was used in this paper to test the impact of this intervention on the performance of the students.

4. Data and variables used

The data used in this study were collected from 2008 till 2012 over two semesters in Introductory Microeconomics (first semester) and Introductory Macroeconomics (second semester) taught to undergraduates. The sample size is approximately 2200+ students from different qualifications per annum. The entrance requirements (Mathematics and English) for the first-year economics were unchanged for the whole period of study. The same prescribed text book was used during the period under investigation, with the exception of 2012 where a new book was introduced for both semesters, but both books covered basically the same content.

The first-year groups are taught by a group of specialised undergraduate lecturers with extensive teaching experience. The classes are presented with identical study material in the form of Power Point slides, a learning guide and communication through the electronic system called uLink. There were two 50-minute lectures per week for 14 weeks delivered to classes of approximately 400 students using the PowerPoint presentations. The class is repeated about six times on different times and days to accommodate the whole group.

Each student was also required to attend one 50-minute tutorial in each of Weeks 2 through 14. Tutorial groups consisted of 50 or fewer students. A tutorial is a small group of students who gather together under the guidance of a tutor to discuss a topic or problem that they may or may not have to prepare for in advance. The purpose of the tutorial is not the delivery of a “mini lecture”, or to just duplicate the work done in the formal lectures. The goal of a tutorial is to provide the students the opportunity to express their opinions and to provide an opportunity to apply the theory which they learned during the formal lecture.

The tutorial forms a crucial and central part of the teaching model followed in the Department of Economics and Econometrics. The tutorial is the linkage between the formal lecture and the application in either the practical classes or through the assignments. To get maximum benefit out of the small class environment, the model of teaching that take place in tutorials encouraged active learning with a lot of participation and doing. The tutorial are always conducted after the formal lecture, which is basically only passive learning, consisting of verbal and visual receiving and more lecturer-centred. The model recommended for tutorials is “cooperative learning”. Cooperative learning is a method of small group learning that places the responsibility for learning on the students or more student-centred instruction.

The performance of the students is tested through two formal assessments during the semester, through several smaller class tests /short quizzes held at the end of either randomly chosen lectures or announced in the previous lecture. The class tests provided a mechanism for estimating attendance during the lectures and also the understanding of individual components. A comprehensive assignment covering all the work is conducted electronically at the end of the semester. The assignment is quite challenging and students normally have a week to complete the assignment.

The semester assessments were based on approximately six weeks of lectures. It consisted of a combination of multiple-choice and shorter discussion questions and included calculation and interpretation questions. The final examination was worth 50 percent and covered all material covered during the semester. It consisted of both multiple-choice questions and problems.

All students had access to detailed lecture notes and past exam papers on the modules web site (uLink), so that interventions did not reveal any private information. In addition, lectures and classes followed very closely the textbooks, so that all exam questions could be answered correctly by students not attending lectures or classes, who had relied exclusively on the texts to prepare for the tests and exams. It should also be observed that the marking scheme was fully objective, so that assessment scores could not be used to reward students for applying interventions.

Place table 1 and table 2

In relation to performance, students were classified into four groups, depending upon their final grade for the subject: A range of 1 – 39% (students not qualifying for exam), 40 -49% (students failing the final assessment), 50 – 74% (students passing the module and 75%+ (students passing the module with a distinction). Descriptive statistics for each performance band are presented in Table 1 for Introductory Microeconomics and Table 2 for Introductory Macroeconomics.

Results to be observed from Table 1: Introductory Microeconomics:

- The introduction to learning interventions positively contributed to a smaller number of students in the range 1 – 39%, changing from 11.72% of the total number of students in 2008 to 5.40% in 2011 and 7.09% in 2012. The number of students in the range 40-49% also decreased from 23.36% in 2008 to 11.19% in 2012.
- The number of students in the range 50 -74% increased from 59.64% in 2008 to 65.05%. This is a much improved pass rate of more than 5 percentage points.
- The number of distinction candidates also increased from 4.55% to 10.34% in 2012.
- The interventions had a positive effect on both the test 1 and test 2 results increasing from 2008 till 2012. Continuous assessments, tutorials and the assignment on smaller pieces of content make a positive contribution on the knowledge of the subject.
- The semester mark of the ranges 40 – 40% increased with 7 percentages points from 2008 till 2011; 50 – 74% with about 6 percentages points and even distinction candidates improved their semester marks through the introduction of the interventions, but the students in the lowest range 1 – 39% showed very little improvement.
- The table indicates that the performance on the final examination was consistently lower than on the formative semester assessments and semester mark. Even after the introduction of the interventions the difference between the exam mark and semester marks is still in the order of between 4 to 10 percentages points, with the biggest discrepancy find in the range 50 to 74%. The students therefore improved their performance during the semester, but were still unsuccessful to improve in the final assessment on all the work.
- An important observation is the positive correlation between the number of tutorials attended and the performance of the students. The tutorials are purely a learning

intervention and not part of the assessment process or end scores. This correlation is an indication of the contribution of tutorials to the learning process.
- The electronic self-assessment results indicate a low motivation by the students for self-study.

There are some interesting differences between the results of Introductory Microeconomics and Introductory Macroeconomics, although similar interventions were introduced over the different years.

Results to be observed from Table 2: Introductory Macroeconomics:

- The impact of the interventions is much more visible in the introductory microeconomic module than the introductory macroeconomics module.
- The students perform better from test 1 and although there is nearly the same percentage of students in both the 1 – 39% range (Micro: 7.09% and Macro: 6.08%) and the 75% range (Micro: 10.34% versus Macro: 9.96%) the big difference is the bigger percentage of students for Macro in the 50 -74% range (Micro: 65.05% in 2012 and Macro: 76.49%).

5. Model specification

This paper uses the panel data model to explore the association and casual relationship between academic performance and interventions. The advantages of using panel data are that it can exploit the time dimension of the data set, assuming that the omitted variables do not change over time, to eliminate the effect of unobservable factors using a *panel estimator.*

The approach followed in this paper is to exclusively observe the impact of interventions on performance of students and to model the unobserved heterogeneity among students using fixed-effects and random-effects regressions in which the dependent variable is performance by student i and the independent variables are interventions assessments by student i on which assessment performance t is based.

The fixed-effects model is:

$$EMit = \alpha i + \beta_1 T1it + \beta_2 T2it + \beta_3 Ait + \beta_4 ClassTit + \beta_5 Tutit + \beta_6 EAit + \varepsilon it \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where i=1,2, .. n; t=1,2, .. T. εit is an error term that is identically and independently distributed with $E(\varepsilon it) = 0$, $Var(\varepsilon it) = \sigma\varepsilon 2$. The coefficients, β, reflects the impact of interventions on performance in any given assessment.

The random-effects model is:

$$EMit = \alpha i + \beta_1 T1it + \beta_2 T2it + \beta_3 Ait + \beta_4 ClassTit + \beta_5 Tutit + + \beta_6 EAit + \varepsilon it + ui \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where i=1,2, .. n; t=1,2, .. T. εit + ui is an error term with E(εit) = E(ui) = 0; Var(εit + ui) = σ2 = σε2 + συ2; Cov(εit , uj) = 0 for all i, t and j; Cov(εit , εjs) = 0 for t ≠ s or i ≠ j; and Cov(ui , uj) = 0 for i ≠ j. Cov(εit + ui , εis + ui) = ρ = συ2 / σ2 for t ≠ s, that is, for a given student the errors on different assessment tasks are correlated because of their common component, u.

6. Modelling results

The immediate question arising from the observations in section 4 is how statistically significant the observed differences in academic performance are. Cross-sectional regressions were done for all the years and presented in Table 3 and Table 4.

Place table 3 (Introductory Microeconomics) and table 4 (introductory macroeconomics).

This section presents the estimation results. We start by estimating equation (1) by OLS, and examine the impact on the estimated coefficients for interventions introduced in a step-wise fashion. Next, we present estimates obtained for panel data estimators (random effects and fixed effects). Finally, we examine the respective effects of lecture and class attendance on performance. The fixed-effects model(FEM) was estimated using LSDV's least squares dummy variable routine and the random-effects model (REM) was estimated using LSDV's generalized least squares routine (Greene, 1998, pp.318-325).

Table 3 and 4 report OLS estimates of alternative specifications of the relationship between academic performance in the exam and interventions introduced over time from 2008 till 2012 in Introductory Microeconomics and Introductory Macroeconomics respectively. All specifications produce a coefficient estimate for interventions that is positive and statistically significant at the one per cent level. Table 3 indicates that in the basic specification (2008), the point estimate indicates that one additional percentage point in Test 1 and Test 2 corresponds to a 0.30 and 0.50 percent improvement in performance in the exam.

A general conclusion of the results in Table 3 and 4 is that despite the introduction of a set of interventions, the relationship still reflects the impact of omitted factors correlated with regressors: to the extent that, despite the control factors, there are still unobservable fixed effects correlated with interventions.

Given that OLS estimation does not provide a solution to the omitted variable bias, we now turn to estimates obtained by exploiting the panel structure of the data set. Table 5 and 6 presents estimates of the fixed effect model (column1) and the random effect model

(columns 2-4) for Introductory Microeconomics and Introductory Macroeconomics respectively.

Place Table 5 and 6

Evaluation to follow

7. Conclusion

The high failure rate in Economics, as experienced at most South African universities, has become an increasing concern. Such failure increases the number of repeaters and has financial implications for universities and the country.

The introduction of the different interventions showed an increase in the number of students that passed the modules as well as the number of distinctions. The median of the performance moved positively to a higher pass rate over time. Weaker or at-risk students can improved their performance through these interventions and be successful. The results of the inter-module comparison indicate that Introductory Macroeconomics benefit from being offered in the second semester and that the overall performance of students are better than in the first semester.

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Table 1: Descriptive statistics: Introductory Microeconomics

		Mean of:								
YEAR	**% N**	**FM**	**T1**	**T2**	**SM**	**EM**	**As**	**CT**	**Tut**	**E S**
2008	100	51	47	46	52	53				
2009	100	49	57	46	53	48	58			
2010	100	58	62	49	61	56	70	77		
2011	100	53	54	53	59	50	71	55	76	
2012	100	53	61	57	58	54	57	66		57
Range 1 - 39										
2008	11.72	25	35	30	33	33				
2009	12.16	24	42	31	34	31	32			
2010	6.34	21	45	20	31	31	18	46		
2011	5.40	27	33	24	38	28	52	52	50	
2012	7.09	24	47	28	32	31	37	42	25	12
Range 40 – 49										
2008	23.36	44	40	39	46	42				
2009	27.09	44	51	41	48	40	55			
2010	11.76	45	54	38	50	39	56	61		
2011	18.54	44	45	42	53	36	70	55	73	
2012	11.19	45	56	48	47	41	43	49	35	18
Range 50-74										
2008	59.64	57	50	50	58	57				
2009	57.60	56	63	51	59	53	65			
2010	68.24	58	58	57	63	53	75	57		
2011	66.58	58	58	57	63	53	75	57	81	
2012	65.05	59	66	63	64	54	58	69	65	43
Range 75+										
2008	4.55	78	68	74	78	78				
2009	2.47	78	80	74	79	77	84			
2010	12.88	80	75	74	80	81	90	97		
2011	6.63	78	77	85	80	75	78	61	92	
2012	10.34	78	79	83	80	76	74	82	83	63

Table 2: Descriptive statistics: Introductory Macroeconomics

		Mean of:								
YEAR	**% N**	**FM**	**T1**	**T2**	**SM**	**EM**	**As**	**CT**	**Tut**	**E S**
2008	100	58	58	53	60	60				
2009	100	55	55	59	61	51	61			
2010	100	63	57	55	61	68	70	78		
2011	100	52	62	47	55	52	58	42	39	
2012	100	57	56	56	57	61	70	53	67	44
Range 1 - 39										
2008	2.92	16	32	19	26	33				
2009	9.71	22	31	26	31	27	31			
2010	2.64	17	23	13	23	37	24	51		
2011	10.05	27	43	28	35	29	35	20	14	
2012	6.08	15	38	37	25	40	23	10	21	12
Range 40 – 49										
2008	7.25	45	44	39	47	43				
2009	13.81	44	47	50	53	35	53			
2010	6.23	45	38	38	44	46	59	67		
2011	17.47	45	55	40	48	41	55	30	31	
2012	5.21	45	41	44	42	48	60	27	35	17
Range 50-74										
2008	78.06	60	58	53	61	59				
2009	64.38	59	58	63	65	53	65			
2010	64.43	58	68	51	60	55	64	48		
2011	62.92	58	68	51	60	55	64	48	45	
2012	76.49	60	56	56	60	60	75	56	69	45
Range 75+										
2008	9.63	78	74	70	76	79				
2009	10.29	79	75	82	81	76	81			
2010	23.96	81	77	72	78	84	83	90		
2011	6.47	78	81	68	75	80	77	72	59	
2012	9.96	78	74	73	78	77	87	82	90	71

Table 3: Determinants of academic performance: OLS estimates
Introductory Microeconomics, 2008 - 2012

Independent variable	2008	2009	2010	2011	2012
T1	0.2953 (17.58)	0.3088 (23.47)	0.3552 (18.79)	0.3250 (20.26)	0.2734 (13.14)
T2	0.5027 (32.35)	0.4257 (27.92)	0.5079 (32.70)	0.4442 (33.03)	0.3250 (17.02)
A		0.0630 (7.32)	0.08079 (8.10)	0.0075** (0.79)	0.1397 (7.44)
CT			0.0603 (8.14)	0.0083** (0.76)	-0.0473** (-2.06)
Tut				0.0441 (4.60)	-0.0495** (-1.83)
ES					0.1321 (2.99)
constant	14.4517	6.2315	-2.6982	2.4351	8.779
Adjusted R^2	0.5156	0.4759	0.6032	0.6370	0.5153

Note: Dependent variable: exam mark (EM).
t-statistics reported in brackets (robust standard errors).
** Denotes economic/statistical insignificance at the 5% level

Table 4: Determinants of academic performance: OLS estimates
Introductory Macroeconomics, 2008 – 2012

Independent variable	2008	2009	2010	2011	2012
T1	0.3397 (23.28)	0. 2589 (9.89)	0. 3008 (18.65)	0. 3932 (18.43)	0. 2322 (13.58)
T2	0. 4587 (29.94)	0. 3471 (13.23)	0. 3940 (21.39)	0. 4652 (21.60)	0. 2829 (15.05)
A		0. 3600 (7.72)	0. 0378 (3.07)	0. 1157 (9.53)	0. 0714 (3.95)
CT			0. 0657 (3.40)	0. 0678 (7.96)	-0.0101** (-0.38)
Tut				0. 0315 (4.40)	-0.0902** (-4.90)
ES					0. 1406 (4.05)
constant	15.4249	-8.1503	19.2443	-7.6603	26.8021
Adjusted R^2	0. 5449	0. 6007	0. 5970	0. 6080	0. 4703

Note: Dependent variable: exam mark (EM).
t-statistics reported in brackets (robust standard errors).
** Denotes economic/statistical insignificance at the 5% level

Table 5: Determinants of academic performance: panel estimates
Introductory Microeconomics

Independent variable	RE	FE
T1	0.2742416 (35.88)#	0.2723083 (30.05)
T2	0. 5045914 (71.28)	0.5143941 (62.02)
A	-0.0556737 (-17.43)	-0.0631063 (-17.56)
CT	0.0497778 (18.01)	0.0508919 (16.68)
Tut	-0.0637981 (-22.68)	-0.0662349 (-22.29)
ES	-0.0553323 (-9.48)	-0.0639278 (-10.24)
constant	13.01864	13.08049
Adjusted R^2 within	0. 5322	0.5329
Adjusted R^2 between	0.5041	0.5004
Adjusted R^2 overall	0.5271	0.5265

z values

Table 6: Determinants of academic performance: panel estimates
Introductory Microeconomics

Independent variable	RE	FE
T1	0.3153917 (38.32)#	3077372 (32.46)
T2	0.4881776 (57.11)	0.4964095 (50.13)
A	-0.1200536 (-33.01)	-0.128702 (-33.07)
CT	0.1895598 (59.03)	0.1938678 (55.98)
Tut	-0.08159 (-17.44)	-0.0912526 (-18.06)
ES	0.0895801 (11.75)	0.1065365 (12.99)
constant	12.89467	13.27344
Adjusted R^2 within	0. 5860	0. 5867
Adjusted R^2 between	0.5460	0.5434
Adjusted R^2 overall	0.5695	0.5689

Figure 1: Teaching and learning process in Economics 1