Determinants of Malaysian and Singaporean Economics Undergraduates' Academic Performance

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Abstract

This study examines the determinants of economics undergraduates' academic performance in the top national universities of Singapore and Malaysia: the National University of Singapore (NUS) and the University of Malaya (UM). Using three basic components of economics as the dependent variable, i.e. basic microeconomics, basic macroeconomics and statistics/econometrics, it was found that students' pre-university grade is the most important determinant in undergraduates' performance. However, unlike in some previous studies which suggest that taking economics and mathematics before university does have a major impact on students' higher economics grades at undergraduate level, in this study, it was found that the type of subjects taken before university, including both economics and mathematics, has no significant impact on students' academic performance. The type of pre-university programme taken prior to admission, and ethnicity were found to be important determinants among UM students, but not NUS. This is a significant finding since Malaysia does practice a modified quota system based on ethnicity in one of the pre-university programmes. The study also found no significant distinction between male and female performance in economics controlling for other socioeconomic and attitudinal effects.

JEL classification: A21, A22, I21, I23

1. Historical motivation

This study examines the performance of students from two sister institutions with a shared history but subsequently independent paths in the development of their economics' programmes. The University of Malaya (UM) was established in April 1949 in Singapore. The population of the university grew and hence the need for a larger campus resulted in the establishment of an additional campus in Kuala Lumpur. In 1962, the government of Malaya[1] and Singapore[2] agreed that these two campuses should be autonomous universities and thus the campuses in Kuala Lumpur and Singapore were renamed the University of Malaya and the University of Singapore respectively. This was followed by the formation of the Federation of Malaysia in September 1963, comprising of Malaya, Singapore, Sabah and Sarawak. Singapore left the federation in August 1965 to become the Republic of Singapore. However the political evolution of both countries did not bring about great changes to the structure of the two universities. Only in 1980, the University of Singapore

[1] Malaya had already gained its independence from Britain in August 1957.
[2] From 1959 to 1963, Singapore was a self-governing state under the colonial rule of the British Empire.

merged with Nanyang University in Singapore and the National University of Singapore (NUS) was formed (UM, 2007; NUS, 2007).

Economics was initially taught under the Faculty of Arts and Social Sciences in both universities. The economics department at NUS remains relatively unchanged. However, the economics department at UM branched out of the Faculty of Arts and Social Sciences and developed into a separate faculty, the Faculty of Economics and Administration (FEA).[3] UM students in this faculty pursue a Bachelor of Economics with specialisation and focus in various aspects of economics, while those at NUS pursue a Bachelor of Social Science with specialisation in economics. Therefore the structural change from a department into a faculty has also brought about changes to the approach and focus of the teaching of economics at UM (UM, 2006).

Both Singapore and Malaysia inherited the Cambridge A-Levels education system from the British as the mode of pre-university education. However, since the independence of both countries, their pre-university education paths have taken quite different routes. On the one hand, the A-level programme continues to be dominant in Singapore's pre-university system. A-level programmes are taught in Junior Colleges and administrated under the Ministry of Education of Singapore. In addition, there are also a small number of students who study the International Baccalaureate (IB) Programme or the Integrated Programme.

By contrast, the development of the Malaysian pre-university system has been more diverse. For admission into a public university, such as UM, there are generally three routes of admission. The first route is the *Sijil Tinggi Persekolahan Malaysia*[4] (STPM), taught in secondary schools and administrated by the Malaysian Examinations Council. The STPM is relatively similar to the Cambridge A-levels system but is modified and adapted to the local context. Second, there is the Matriculation Programme,[5] taught in full-time Matriculation colleges with compulsory boarding arrangements operated under the Malaysian Ministry of Education. It is important to note that the Matriculation Programme admits a significant proportion of *Bumiputera*[6] or Malay students. Third, there is the admission route for those with a diploma in a relevant field such as accounting, business or commerce from a polytechnic. Besides the STPM, Matriculation Programme and diploma routes, other types of pre-university education, such as IB, Cambridge A-levels or South Australian Matriculation (SAM), are taught in private colleges but these qualifications are not considered for local admission into Malaysian public universities, and therefore, remain beyond the discussion of this paper.

It is this historical background of the two universities, as well as the pre-university programmes, which provide an interesting backdrop to comparing the two campuses and the determinants of economics undergraduates' performance. Of particular note, is the fact that this study looks specifically at both the basic microeconomics and macroeconomics courses. Whereas other studies have to contend with agglomeration effects of having to consider both the study of microeconomics and macroeconomics in an introductory course in the first year, we are specifically looking at how pre-university performance may have persistent effects further on as students progress towards a Bachelors degree in economics.

[3] FEA consists of the Department of Economics, the Department of Development Studies, the Department of Administrative Studies and Politics, and the Department of Applied Statistics. Initially the departments in the faculty also included the Department of Business Studies and the Department of Accounting (which later branched into a separate faculty), while the Department of Economics was merged in 2006 from the Department of Analytical Economics and the Department of Applied Economics.

[4] Malaysia Higher School Certificate.

[5] Will be known as Malaysian Matriculation from this point onwards.

[6] Literally means "Sons of the soil"; this also refers to the indigenous Malay ethnicity.

2. Previous literature

The determinants of academic performance have been widely researched. Many studies have been conducted to examine the factors that influence students' academic performance. Some of these studies have concentrated on specific subjects while others focus on more general topics across the disciplines. With regards to methodology, economists usually apply an educational production function to explore these relationships, where academic achievement is a function of student ability, time devoted to learning, various attributes on an individual level (see for example, Schmidt, 1983; Park and Kerr, 1990; Durden and Ellis, 1995; Parker, 2006; and Opstad and Fallan, 2010) and on an aggregate level the relationship between school resource variables, student background characteristics and school outcomes (see for example, Hanushek, 1996; Hedges *et al.*, 1996; and Hãkkinen *et al.,* 2003).

In most of these studies, students' academic performance has been measured by a variety of methods. The principal variables used to capture academic performance are grade point average (GPA), percentage grades, cumulative average points (CAP), degree classification or the grade in the targeted subject (Pseiridis *et al*., 2005; and Swope and Schmitt, 2006). However, it is important to point out that this approach only highlights the post-test or output performance of the students, and the theoretical assumption is based upon an economic production function. As Parker (2006) illustrates, this method of assessing educational effectiveness is essentially a "black box" approach where determinants are applied to the students in the box to yield some type of output.

Alternatively, students' academic performance could also be measured by a pre-test and post-test comparison based upon educational evaluation principles. For example, Ballard and Johnson (2004) incorporated an elementary mathematics skills test at the beginning of the course, reflecting a measurement of the pre-test abilities of the students. Other similar analysis could focus on pre-university economics grades or prior performances, as the pre-test indicators to compare with the post-test performance.

As for the determinants, a large number of studies have been conducted to study the effect of various factors. The frequently examined factors can be categorised into individual characteristics, academic background, institutional characteristics and environment (see Anderson *et al*., 1994; Birch and Miller, 2007; Crowley and Wilton, 1974; Harbury and Szreter, 1968; Krohn and O'Connor, 2005; Pseiridis *et al*., 2005; Reid, 1983; and Swope and Schmitt, 2006). However, the determinants of economics students' performance are said to be few and their effect is not unanimously supported (Pseiridis *et al*., 2005). For example, Anderson *et al*. (1994) and Krohn and O'Connor (2005) found that gender was a determinant favouring the male students, while Borg and Stranahan (2002) and Lawson (1994) found no such difference in their studies. Moreover, although there has been substantial research to support the argument that more exposure to and proficiency in mathematics improves student performance in economics courses at university (Anderson *et al*., 1994; and Ballard and Johnson, 2004), the study by Cohn *et al*. (1998) revealed no significant effect. Similarly, while other determinants such as ethnicity, family background and personality, continue to have varying effects on the academic performance of students, it is fair to conclude, as Opstad and Fallan (2010) point out, that such results and findings are not universal.

However, there has been little cross-country or cross-university comparison of students' performance in economics in the literature. Therefore, it is the intention of this paper to examine more closely what determines undergraduate performance in economics of these two sister institutions, which have branched out onto different paths from common roots, and to see how different pre-university subjects and results as well as students' characteristics affect undergraduates' performance in economics in both microeconomics and macroeconomics courses.

3. The data

For the purpose of this study, a two-page survey questionnaire[7] was distributed at NUS and UM between September 12 and October 5, 2007. A total of 269 second and third-year economics students from the two universities participated in the survey. The survey was done after a pilot survey of 24 students was conducted at NUS on August 29, 2007, after which the survey was revised in order to be more cognizant. The variables surveyed in the questionnaire are categorised in Table 1. Table 2 summarises the subjects taken by UM and NUS undergraduate economics students prior to university admission and their average grades.

Table 1: Categorisation of Variables in Questionnaire

Categories	Specific Variables
Individual Characteristics	Age, Gender, Ethnicity, Nationality, Birth order, National service, Working experiences, Level of interest in Economics
Academic Background	Pre-university qualification and the grades
Institutional Characteristics	Accommodation in university
Environment	Place of study and its environment, Effort devoted to study, Source of financial allowances, Participation in extra-curricular activities

Table 2: Subjects Taken at Pre-University Level and its Average Grade

Subject	Percentage (No. of Students)	Average Grade
Economics	88% (197)	3.542
Mathematics	70% (156)	3.295
Business Studies	33% (75)	3.649
Accounting	24% (53)	3.675
Languages (Malay, English, Chinese or Tamil)	24% (54)	3.537
Chemistry	24% (53)	2.819
Physics	20% (44)	2.720
History	15% (33)	3.427
Geography	13% (29)	3.224

Note: some subjects were excluded due to small sample.
Grade calculated as follows: *A(4.0); A–(3.7); B+(3.3); B(3.0); B–(2.7); C+(2.3); C(2.0); C–(1.7); D+(1.3); D(1.0);* and *F(0.0)*

[7] See Appendix 2.

A general overview of the data revealed that out of the 269 respondents, 55 percent were from UM, compared to 45 percent from NUS, while females outnumbered males by a ratio of three-to-one. Sixty-five percent of respondents were Chinese[8] students, followed by 25 percent Malay, while the remaining 10 percent were categorised as other ethnic groups (see Appendix 1).

At this point of the study, it is important to note that Singapore and Malaysia have differences in their grading systems and their type -university admissions requirements. Malaysian universities commonly accept three major pre-university entry qualifications, namely STPM, Diploma and Malaysian Matriculation while the respondents from NUS predominantly have A-level qualifications, with a small percentage entering with STPM, Diploma or other pre-university qualifications from neighbouring countries. For the purpose of standardisation, the grading system of each pre-university programme has been restructured to enable comparison of students' pre-university academic performance (see footnote of Table 2).

Table 3: Wilcoxon-Mann-Whitney Test on Pre-university Grade

		N	Mean Rank	Sum of Ranks
Pre_U Grade	UM	138	155.08	21400.50
	NUS	106	80.09	8489.50
	Total	244		

	Test Statistics	Pre_U Grade
	Mann-Whitney U	2818.500
	Wilcoxon W	8489.500
	Z	–8.241
	Asymp. Sig. (2-tailed)	0.000

Subsequently, the Wilcoxon-Mann-Whitney[9] non-parametric test was conducted to identify whether the pre-university grades of students from the two universities were comparable. The Wilcoxon-Mann-Whitney test ranks the pre-university grades and then counts the rank according to the university. If there are no differences between the universities, the average ranks in each of the two groups are expected to be about equal (Siegel and Castellan, 1988). However, Table 3 reveals that the pre-university scores of UM were significantly higher than NUS, with the mean rank of UM almost doubling that of NUS. The test also indicates that when the Wilcoxon (W) statistics are asymptotically normally distributed, the probability of accepting the notion that the pre-university scores of both universities are similar is 0.0001 percent (as shown by Asymp. Sig. column). Therefore the differences are significant.

[8] "Chinese" is strictly referring to Malaysians and/or Singaporeans of Chinese descent. Nationalities of the PRC are included in other ethnic groups.

[9] The Wilcoxon-Mann-Whitney Test is an independent proposed nonparametric test to examine whether two independent groups of samples have been drawn from the same population.

To overcome the differences, the pre-university grade index was formulated based on the average value of both samples, as illustrated in Equation (1).

$$Index = \frac{score}{mean} \times 100 \quad (1)$$

The dependent variable, students' performance at university, was based on self-reporting of students in the questionnaire. Six essential modules were listed specifically for students to indicate their grades, with the remaining eight slots allocated to other modules taken during their first year. The six essential modules were basic microeconomics, basic macroeconomics, statistics and econometrics, quantitative methods and mathematics, sociology, and principles of accounting (refer to Appendix 2).

The students' performance indicator is tabulated based on results in basic microeconomics, basic macroeconomics, and statistics/econometrics. The consistency in microeconomics and macroeconomics was expected because both modules were compulsory for economics majors at both universities. Statistics is also compulsory at UM while basic econometrics is essential for those who major in the NUS economics programme. Although quantitative methods, sociology and principles of accounting are also compulsory at UM, the responding percentage were drastically reduced because these modules are not compulsory at NUS. Therefore the academic performance indicator (known as CAP3) only tabulates three modules - microeconomics, macroeconomics, and statistics/econometrics at each respective institution.

Table 4: Wilcoxon-Mann-Whitney Test on CAP3

		N	Mean Rank	Sum of Ranks
CAP3	UM	143	146.16	20900.50
	NUS	118	112.63	13290.50
	Total	261		

Test Statistics	CAP3
Mann-Whitney U	6269.500
Wilcoxon W	13290.500
Z	–3.577
Asymp. Sig. (2-tailed)	0.000

Similar to the pre-university score, the Wilcoxon-Mann-Whitney Test was conducted on CAP3 to identify differences between the samples. The result in Table 4 indicates that the CAP3 for UM is again significantly higher than NUS (asymptotic significance is smaller than 0.0001 percent) and therefore the performance indicator is also formulated into an index score (as Equation 1), known as grade index, to enable comparison between the universities.

National Service, a mandatory two-year military attachment for all Singaporean males prior to entering university, was included as a variable in the survey. This was motivated by the 2005/2006 and 2006/2007 cohorts from UM, who were the first two batches of Malaysians to undergo a three-month National Service,

drawn randomly, after their 11th year of education. Therefore, the variable was included with the objective of exploring whether National Service has an effect on students' academic performance. However, the sample that completed National Service in Singapore and Malaysia were merely 15 percent and 4 percent respectively.

Information on students' involvement in extra-curricular activities during their first year at university was also collected. However, due to the complexity of the types of extra-curricular activities that students participated in and the incomparable differences within and across both institutions that could not be captured within a Likert scale, as well as the subsequent insignificant results gathered from the primary analysis, this variable was excluded from the model.

The hometown variable, studying the differences in students' background was only surveyed among UM students. This was due to the fact that NUS is located in the city-state of Singapore and therefore the suburban and rural categories become irrelevant.

4. The model

The full specification multiple regression model comprising of all the variables collected was regressed with the grade index as the dependent variable. The independent variables in the full model explained 59 percent of the variations in the dependent variable (R^2 = 0.592). Although the *R*-squared was acceptable, the significance of individual independent variables was below the expected level[10]. As Greene (2003) highlighted, the downward reduction from a full model to the preferred specification poses two advantages, which the general-to-simple approach enables, the elimination of "by accident" significant variables that might exist in a big model and the reduction of the possibility of mis-specifying the model.

Therefore, using the downward reduction method, the model is specified as in column 1 of Table 5, while columns 2 and 3 are specific models for UM and NUS respectively. Column 4 is the model with the inclusion of the university-specified dummy. Similarly, column 1 of Table 6 illustrates the logarithm model and columns 2, 3 and 4 are the university-specified logarithm models and the addition of the university-specified dummy.

Although the results in column 4 of both Table 5 and Table 6 reflected higher *R*-squared and *F*-values, the problem of multicollinearity is suspected to be due to the high correlation between the university-specified dummy variable and the type of pre-university programme (r = 0.812), as mentioned in Greene (2003). Therefore, the models in column 1 are assumed to be the better specified model.

In deciding between the level model and logarithm model, the regression specification error test, Ramsey's RESET test was employed. The *R*-squared of both the level model (Table 5) and logarithm model (Table 6) were used for the tabulation of the *F* value. The results indicated that both models were adequately specified, where the *F* value (0.0737) was statistically insignificant. Therefore, the analysis of the determinants of the students' academic performance will be based on the logarithm model in Table 6, due to the higher *F* value that explains the variability of the independent variables in the model.

[10] In the situation whereby the coefficients have low significance levels and the R^2 is high, the problem of multicollinearity might exist (see Greene, 2003, p. 57).

Table 5: Determinants of Grade Index

Grade Index-Dependent Variable	Level Model			Level Model (UM)			Level Model (NUS)			Level Model with University Dummy		
(Constant)	111.035		(23.150)	127.517		(45.577)	76.925		(30.153)	101.272		(21.874)
PreU_indexscore	0.473	**	(0.058)	0.599	**	(0.149)	0.356	**	(0.067)	0.436	**	(0.055)
Male	1.919		(2.564)	4.043		(2.874)	–3.942		(5.200)	2.561		(2.416)
Malay	–10.473	**	(2.786)	–11.047	**	(2.968)	–4.076		(12.528)	–13.194	**	(2.679)
Other Ethnic	–0.051		(3.423)	–7.823		(5.299)	5.488		(4.544)	0.887		(3.226)
Age	–2.541	**	(1.007)	–3.351	*	(1.713)	–1.650		(1.295)	–2.669	**	(0.948)
Alevels	–6.587	**	(3.295)				15.480		(9.919)	11.033	**	(4.733)
OtherPreU	–10.827	**	(4.581)	–12.517	**	(5.219)	10.120		(12.814)	–6.472		(4.400)
National Service	3.715		(2.735)	–0.257		(3.633)	7.210		(5.376)	2.625		(2.583)
JobExperience	–2.543		(1.981)	–3.109		(2.583)	–4.344		(2.910)	–3.666	*	(1.878)
PhoneBill	–0.045		(0.030)	–0.023		(0.029)	–0.070		(0.070)	–0.048	*	(0.028)
Econ_yn	3.674		(3.056)	4.567		(6.004)	4.007		(3.569)	3.724		(2.876)
Math_yn	–0.946		(2.978)	–1.511		(3.090)	0.844		(6.345)	–0.556		(2.803)
Phy_yn	0.147		(2.681)	–7.297		(14.922)	4.138		(3.234)	2.190		(2.557)
Chem_yn	1.583		(2.771)	15.103		(12.668)	6.199	*	(3.303)	3.253		(2.629)
Geo_yn	–5.689	*	(3.304)	–7.205	**	(3.558)	1.266		(6.094)	–5.841	*	(3.109)
Bus_yn	–2.285		(2.755)	–3.690		(2.912)	–9.117		(10.976)	–5.590	**	(2.678)
Hist_yn	–7.007	**	(3.169)	–11.227	**	(3.531)	5.946		(6.469)	–8.286	**	(2.993)
AC_yn	–0.285		(3.157)	–1.615		(3.233)	3.257		(13.596)	–3.528		(3.043)
Interest_moderate	3.809		(4.753)	–5.923		(10.400)	1.572		(5.586)	1.111		(4.506)
Interest_good	7.173		(4.567)	–3.312		(10.295)	5.795		(5.185)	3.733		(4.354)
Interest_vgood	9.199	*	(5.360)	–1.190		(10.771)	9.658		(6.760)	6.400		(5.076)
UM										25.072	**	(5.088)
R-squared	0.522			0.656			0.557			0.579		
F value	9.357			8.110			4.428			11.190		

Note: Standard error in parentheses; ** Significance at 5% level; *Significance at 10% level

From the model in Table 6, it was clear that students' pre-university grades are the most important determinant in their university academic performance. A student, who scored 10 percent higher in their pre-university index score, will most likely also achieve a higher grade index by four percent at university, *ceteris paribus*. This finding is consistent for the entire sample from both UM and NUS, whereby UM and NUS students achieved six percent higher and three percent higher grades respectively. However, the particular type of pre-university education in contributing to the students' performance was only significant in the

combined model and the UM model. The significance of this variable in the combined model might explain specific institutional differences, other than students' related variables. Therefore, it is interesting to note that there are statistical differences between STPM and other pre-university qualifications in the UM model. Students with other qualifications scored about 12 percent lower in their grade point index compared to those with STPM pre-university qualifications.

Table 6: Determinants of Logarithm Grade Index

Logarithm Grade Index-Dependent Variable	Log Model			Log Model (UM)			Log Model (NUS)			Log Model with University Dummy		
(Constant)	4.808		(0.783)	4.155		(1.508)	4.454		(1.035)	4.897		(0.734)
LogPreUindexscore	0.390	**	(0.055)	0.622	**	(0.163)	0.287	**	(0.064)	0.359	**	(0.052)
Male	0.026		(0.028)	0.049		(0.030)	–0.029		(0.059)	0.034		(0.026)
Malay	–0.107	**	(0.031)	–0.111	**	(0.031)	–0.006		(0.142)	–0.137	**	(0.029)
Other Ethnic	–0.004		(0.038)	–0.080		(0.055)	0.060		(0.052)	0.008		(0.035)
LogAge	–0.619	**	(0.236)	–0.725	*	(0.372)	–0.435		(0.317)	–0.657	**	(0.221)
Alevels	–0.065	*	(0.036)				0.183		(0.112)	0.138	**	(0.052)
OtherPreU	–0.103	**	(0.051)	–0.119	**	(0.054)	0.112		(0.148)	–0.055		(0.048)
National Service	0.039		(0.030)	–0.002		(0.037)	0.069		(0.061)	0.026		(0.028)
JobExperience	–0.021		(0.022)	–0.031		(0.026)	–0.038		(0.033)	–0.034	*	(0.020)
LogPhoneBill	–0.029		(0.019)	–0.009		(0.020)	–0.038		(0.034)	–0.033	*	(0.018)
Econ_yn	0.043		(0.034)	0.041		(0.061)	0.042		(0.041)	0.043		(0.031)
Math_yn	–0.024		(0.033)	–0.026		(0.032)	–0.014		(0.072)	–0.020		(0.031)
Phy_yn	0.003		(0.029)	–0.066		(0.153)	0.043		(0.037)	0.026		(0.028)
Chem_yn	0.012		(0.030)	0.125		(0.130)	0.059		(0.037)	0.031		(0.029)
Geo_yn	–0.074	**	(0.036)	–0.086	**	(0.037)	–0.010		(0.070)	–0.075	**	(0.034)
Bus_yn	–0.020		(0.030)	–0.037		(0.030)	–0.131		(0.119)	–0.056	*	(0.029)
Hist_yn	–0.082	**	(0.035)	–0.124	**	(0.036)	0.048		(0.075)	–0.096	**	(0.033)
AC_yn	0.000		(0.035)	–0.018		(0.033)	0.048		(0.154)	–0.036		(0.033)
Interest_moderate	0.055		(0.052)	–0.070		(0.107)	0.031		(0.064)	0.024		(0.049)
Interest_good	0.090	*	(0.050)	–0.046		(0.106)	0.081		(0.059)	0.051		(0.047)
Interest_vgood	0.112	*	(0.059)	–0.028		(0.110)	0.128	*	(0.078)	0.080		(0.055)
UM										0.284	**	(0.055)
R-squared	0.477			0.648			0.521			0.544		
F value	7.812			7.822			3.840			9.694		

Note: Standard error in parentheses; ** Significance at 5% level; *Significance at 10% level

In addition to pre-university qualification and performance, the model also included dummy variables on the pre-university subjects taken by students for admission into university. The model showed that students who took geography and history performed worse compared to their peers who studied languages (the control variable in the model) prior to attending university. Similar results could be observed for the UM model but not the NUS model. The model also highlighted that a pre-university background in economics and mathematics had no implication on the grade index of economics undergraduates' academic performance, based on our sample. This can be explained by understanding that many of the economics examinations at undergraduate level include essay components, which may favour those with a higher proficiency in languages, as well as the economics programme in UM which is, in general, also less mathematically-oriented.

In addition to pre-university background, ethnicity and age also showed a high level of significance in the combined model and the UM model. Again, these variables were insignificant in the NUS model. In terms of the grade index, Chinese students performed 11 percent better than their Malay peers, while the differences between Chinese and other ethnic groups were statistically insignificant. The insignificance of the NUS model in terms of ethnicity could be largely due to the small sample of non-Chinese NUS students in the survey. On the other hand, younger students tend to score higher in the grade index compared to their more mature peers, with differences of six percent declination in grade index when age increased by 10 percent, *ceteris paribus*.

Regarding students' level of interest in economics and their performance, the combined model revealed that level of interest does have an effect in motivating students to perform better. Students who indicated "good" and "very good" in their level of interest in economics tended to score about nine percent and 11 percent higher compared to their peers whose level of interest were either "very bad" or "bad". This is not a causal inference though and likely reflects co-movement between these variables. However, the university-specified models for UM and NUS do not show significant levels of difference between interest and student performance, with the only exception being that those at NUS who indicated "very good" tended to score better grades than those with other levels of interest.

Subject-specified models

Progressing ahead, subject-specified models comprising of the same explanatory variables in the grade index model were examined. The subject-specified models sought to identify specific determinants in affecting the grade of microeconomics or macroeconomics, which might have been manifested differently under the grade index model (Krohn and O'Connor, 2005).

Table 7: Determinants of Logarithm Microeconomics Grade Index

Logarithm Microeconomics Grade Index	Log Model			Log Model (UM)			Log Model (NUS)		
(Constant)	5.574		(1.104)	5.291		(2.767)	4.966		(1.315)
LogPreUindexscore	0.421	**	(0.078)	0.818	**	(0.299)	0.304	**	(0.080)
Male	0.010		(0.040)	-0.001		(0.054)	0.037		(0.075)
Malay	–0.074	*	(0.043)	-0.075		(0.056)	-0.008		(0.179)
Other Ethnic	–0.033		(0.053)	-0.080		(0.100)	0.036		(0.065)
LogAge	–0.914	**	(0.333)	-1.475	**	(0.683)	-0.613		(0.403)
Alevels	–0.107	**	(0.050)				0.148		(0.141)
OtherPreU	–0.016		(0.071)	-0.032		(0.099)	0.076		(0.186)
National Service	0.082	*	(0.042)	0.054		(0.069)	0.018		(0.077)
JobExperience	0.017		(0.030)	0.023		(0.049)	-0.008		(0.041)
LogPhoneBill	–0.017	*	(0.026)	0.031		(0.037)	-0.056		(0.043)
Econ_yn	0.046		(0.047)	0.102		(0.113)	0.046		(0.051)
Math_yn	–0.078	*	(0.046)	-0.097	*	(0.058)	-0.017		(0.091)
Phy_yn	0.034		(0.042)	-0.029		(0.280)	0.075		(0.046)
Chem_yn	0.010		(0.043)	0.275		(0.238)	0.060		(0.047)
Geo_yn	–0.047		(0.051)	-0.061		(0.068)	0.038		(0.087)
Bus_yn	–0.043		(0.043)	-0.057		(0.055)	-0.157		(0.149)
Hist_yn	–0.054		(0.049)	-0.076		(0.067)	0.065		(0.094)
AC_yn	–0.050		(0.049)	-0.071		(0.061)	0.100		(0.193)
Interest_moderate	0.003		(0.073)	-0.073		(0.196)	0.011		(0.080)
Interest_good	0.079		(0.070)	0.027		(0.194)	0.072		(0.074)
Interest_vgood	0.051		(0.082)	-0.006		(0.203)	0.077		(0.097)
R-squared	0.360			0.357			0.427		
F value	4.787			2.363			2.591		

Note: Standard error in parentheses; ** Significance at 5% level; *Significance at 10% level

Table 7 and Table 8 illustrate the logarithm microeconomics grade index model and logarithm macroeconomics grade index model respectively. Column 1 is the combined model and columns 2 and 3 are the university-specified models. The combined model and the UM model generally reflect identical results. The most significant determinant in students' microeconomics and macroeconomics performance is their pre-university performance, consistent over all models. As explained previously, the significance of the A-level dummy variable in the combined model also reflects the differences between UM and NUS in terms of the nature of pre-university admissions qualifications. However, the A-levels effect is only observable in the microeconomics model.

Table 8: Determinants of Logarithm Macroeconomics Grade Index

Logarithm Macroeconomics Grade Index	Log Model			Log Model (UM)			Log Model (NUS)		
(Constant)	5.142		(1.253)	4.965		(3.193)	4.721		(1.467)
LogPreUindexscore	0.403	**	(0.088)	0.621	*	(0.347)	0.289	**	(0.090)
Male	0.038		(0.046)	0.087		(0.065)	-0.075		(0.083)
Malay	–0.256	**	(0.050)	-0.233	**	(0.067)	-0.089		(0.199)
Other Ethnic	0.027		(0.060)	-0.055		(0.116)	0.078		(0.073)
LogAge	–0.720	*	(0.378)	-0.912		(0.787)	-0.518		(0.450)
Alevels	0.036		(0.057)				0.220		(0.157)
OtherPreU	–0.213	**	(0.081)	-0.273	**	(0.114)	0.064		(0.208)
National Service	–0.004		(0.048)	-0.075		(0.079)	0.095		(0.086)
JobExperience	–0.022		(0.035)	-0.057		(0.056)	-0.021		(0.046)
LogPhoneBill	–0.057	*	(0.030)	-0.068		(0.043)	-0.025		(0.048)
Econ_yn	0.032		(0.053)	-0.066		(0.130)	0.063		(0.057)
Math_yn	–0.007		(0.052)	0.009		(0.068)	-0.086		(0.101)
Phy_yn	–0.010		(0.047)	-0.097		(0.324)	0.051		(0.052)
Chem_yn	–0.002		(0.049)	0.034		(0.277)	0.067		(0.053)
Geo_yn	–0.110	*	(0.058)	-0.132	*	(0.079)	-0.048		(0.097)
Bus_yn	–0.054		(0.049)	-0.060		(0.063)	-0.136		(0.167)
Hist_yn	–0.124	**	(0.055)	-0.188	**	(0.077)	0.104		(0.104)
AC_yn	0.044		(0.055)	0.030		(0.070)	0.138		(0.215)
Interest_moderate	0.088		(0.083)	0.047		(0.226)	0.046		(0.089)
Interest_good	0.104		(0.080)	0.018		(0.224)	0.087		(0.083)
Interest_vgood	0.197	**	(0.094)	0.107		(0.234)	0.210	*	(0.109)
R-squared	0.452			0.579			0.423		
F value	6.988			5.774			2.550		

Note: Standard error in parentheses; ** Significance at 5% level; *Significance at 10% level

Students' performance in macroeconomics is significantly worse for undergraduates who took geography and history in their pre-university studies. All other subjects taken previously, including economics and mathematics at pre-university level do not seem to have provided a head-start for students to perform better in macroeconomics. Concomitantly, students' performance in microeconomics also does not seem to be correlated with pre-university subject selection. Only mathematics in the combined model and the UM model shows a negative relationship, of significance levels of 10%, to the students' performance if he or she has taken the subject at pre-university level. The results of the NUS model do not show any significant relationship.

The age-factor, comparing between the dependent variable of microeconomics or macroeconomics, indicated that the effect is greater on microeconomics. With an increase in students' age by 10 percent, the microeconomics grade index will decrease by nine percent, at significance levels of 5%, while the macroeconomics grade index only decreases by seven percent at significance levels of 10%.

5. Discussion

General pre-university performance matters

It is important to note that this study represents further evidence that performance prior to university entrance significantly determines how students perform in economic courses in the early stages of their university career.

Using average grade index - comprising of basic microeconomics, basic macroeconomics and statistics/econometrics - as the indicator of students' academic performance, it was apparent that students' pre-university performance has the most significant impact on their undergraduate performance. This variable has been found consistent as a positive explanatory variable (Anderson *et al*., 1994; Krohn and O'Connor, 2005; Harbury and Szreter, 1968). Previous studies using the Scholastic Aptitude Test (SAT) and Grade 13 performance also yielded similar significant results. Indeed, pre-university performance is the best measurement of students' academic ability because it captures not only the intellectual ability to qualify for tertiary education but also other important characteristics of student's' background that enable them to succeed until pre-university level. Therefore this variable has been used as the most important criteria for admission into university and this study validates this practice.

Pre-university subjects matter less

Previous studies such as that by Anderson *et al*. (1994) have argued that economics and mathematics (specifically calculus) results in pre-university have a major impact on the results of basic economic modules at university. However, this study shows that the type of subjects taken at pre-university level were relatively unrelated to students' first-year performance, except for geography and history which are negatively related to the grade index. This finding again contradicts the discovery of Harbury and Szreter (1968) that these two subjects (geography and history) have no significant effect on economics performance in first year as an undergraduate. Generally, the finding of this study that subjects taken at pre-university level have no effect on economics undergraduates' performance was further reinforced through the subject-specified analysis for microeconomics and macroeconomics grades.

Ethnicity or types of pre-university qualifications?

Ethnicity, in the UM model, seems to be an important determinant. The Chinese ethnic students significantly outperformed the Malay ethnic students in the overall grade performance. However, the level of significance was reduced from 5% to 10% in the macroeconomics grade, and was non-significant in the microeconomics grade. Although many studies at Malaysian universities have concluded that Chinese students perform better than students from other ethnic groups (Alfan and Othman, 2005; and Ismail and Othman, 2006), there is an additional variable in this framework that allows a more detailed examination of this notion about ethnic differences.

There are three different routes of entry for students into the UM economics course, with the majority of the respondents from UM entering through the STPM and the Matriculation Programme. From the results, it is apparent that students who entered the economics programme with the STPM qualification performed significantly better than those who entered under the Malaysian Matriculation programme or Diploma. The difference between STPM and other pre-university qualifications also needs to take into account the ethnicity

factor. From the Malaysian Ministry of Education website (accessed August 2007), the Matriculation is a pre-university programme with a modified quota system, specifically to cater for the needs of the *Bumiputera*[11]. It is a two-semester pre-university programme, which arguably has a more intensive curriculum due to a shorter semester. Students in this programme are evaluated by two end-of-semester examinations, which are internal examinations between all the Matriculation colleges. STPM, on the other hand, is a one and half year pre-university programme accessible to all students, who are selected based on their SPM[12] examination results. STPM is commonly taught in public secondary schools and students sit a central examination at the end.

While it is clear from our results that both the different pre-university systems in Malaysia and ethnicity are important determinants on the academic performance of economics undergraduates in UM, it remains inconclusive as to whether the differences between students' performance in UM resulted from the ethnicity factor or the nature of each pre-university programme, which suggests potential for future research.

Pre-university performance and its effect on microeconomics and macroeconomics performance

Students' performance in macroeconomics is significantly worse for undergraduates who have taken geography and history in their pre-university studies. All other subjects taken previously, including economics and mathematics at pre-university level do not seem to have provided a head-start for students to better perform in macroeconomics. Concomitantly, students' performance in microeconomics also does not seem to be correlated with pre-university subject selection. Only mathematics in the combined model and the UM model shows a negative relationship, of significance levels of 10%, on the students' performance if they have taken the subject at pre-university level. The results of the NUS model do not show any significant relationship. This seems counterintuitive to how many departments are running their economics programmes with an increasing emphasis on mathematical rigour. The results shown here suggest that pre-university competence in mathematics does not lead to better performance in either basic micro or macro-economics. In fact there is weak evidence to show that it may even hinder (see Table 3). There may be a disconnect between the tools that students are required to know in these courses versus the intuition that economics itself conveys to solve everyday problems in the Asian context. We do not suggest generality in these results but offer more contrary evidence to the role mathematics plays in undergraduate performance in economics (see Cohn *et al.*, 1998).

6. Conclusion

In conclusion, the most important determinant of an economics undergraduate's academic performance is his or her pre-university results. The importance of this factor clearly outweighs other determinants, be it personal background, or environmental or other institutional characteristics of the university.

However, determinants such as ethnicity, the types and subjects taken at pre-university level, have a highly significant influence on the students' performance in the UM model but such influence did not exist in the NUS model. A plausible explanation is that NUS is less diverse compared to UM in terms of the students' ethnicity for this difference to be statistically significant.

[11] Literally means "Sons of the soil"; also refers to the indigenous Malay ethnicity.
[12] Malaysian Certificate of Education, taken at the end of High School. Equivalent of O-levels or Grade 10.

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Appendix 1: Descriptive statistics of variables in the model

Variable	Description	Mean	Std Dev	Minimum	Maximum
Gender	Dummy variable for Female	0.74	0.442	0	1
	Dummy variable for Male	0.26	0.442	0	1
School	Dummy variable for NUS	0.45	0.499	0	1
	Dummy variable for UM	0.55	0.499	0	1
Ethnicity	Dummy variable for Malay	0.25	0.433	0	1
	Dummy variable for Chinese	0.65	0.477	0	1
	Dummy variable for Other Ethnic	0.10	0.295	0	1
Age	Continuous variable for student's age	21.42	1.161	18	25
Nationalities	Dummy variable for Singaporean	0.35	0.479	0	1
	Dummy variable for Malaysian	0.59	0.493	0	1
	Dummy variable for Other Nationalities	0.06	0.240	0	1
Hometown[13]	Dummy variable for Urban	0.45	0.499	0	1
	Dummy variable for Sub-urban	0.32	0.469	0	1
	Dummy variable for Rural	0.20	0.398	0	1
Birth Order	Continuous variable for student's birth order in his/her family	2.15	1.534	1	12
Entry Qualification for University	Dummy variable for STPM	0.41	0.492	0	1
	Dummy variable for A-Levels	0.35	0.479	0	1
	Dummy variable for Diploma	0.11	0.310	0	1
	Dummy variable for Malaysian Matriculation and others	0.11	0.315	0	1
Subjects Taken at Pre-U	Dummy variable for Economics	0.88	0.331	0	1
	Dummy variable for Mathematics	0.70	0.458	0	1
	Dummy variable for Business Studies	0.33	0.472	0	1
	Dummy variable for Accounting	0.24	0.426	0	1
	Dummy variable for Languages	0.24	0.429	0	1
	Dummy variable for Chemistry	0.24	0.428	0	1
	Dummy variable for Physics	0.20	0.398	0	1
	Dummy variable for History	0.15	0.355	0	1
	Dummy variable for Geography	0.13	0.341	0	1
Pre-U Score	Continuous variable on the Pre-U entry score	3.34	0.600	1.67	4.00
	Index score on Pre-U entry score	100.0	17.976	49.92	119.80
National Service	Dummy variable for National Service (1=yes)	0.21	0.406	0	1
Working Experiences	Dummy variable for Working Experience	0.70	0.460	0	1
	Continuous variable on the working duration (months)	5.45	3.758	1	24
Accommodation	Dummy variable for staying in Hall/Residential College	0.66	0.476	0	1
	Dummy variable for staying at home	0.34	0.474	0	1
	Dummy variable for other arrangement	0.02	0.123	0	1
Roommate	Dummy variable for Roommate (1=No)	0.46	0.499	0	1
	Dummy variable for Bad or Moderate Roommate	0.08	0.273	0	1
	Dummy variable for Good Roommate	0.25	0.433	0	1
	Dummy variable for Excellent Roommate	0.21	0.409	0	1

[13] This question only applies to students in UM

Study Location	Dummy variable for Library	0.66	0.476	0	1
	Dummy variable for Own Room/House	0.34	0.474	0	1
	Dummy variable for Other Locations	0.02	0.123	0	1
Study Environment	Dummy variable for Very Bad and Bad	0.10	0.300	0	1
	Dummy variable for Moderate	0.48	0.501	0	1
	Dummy variable for Good and Excellent	0.42	0.495	0	1
Hours devoted to Study (per week)	Dummy variable for less than 5 hours	0.34	0.474	0	1
	Dummy variable for 5 to 10 hours	0.40	0.491	0	1
	Dummy variable for 11 to 20 hours	0.18	0.385	0	1
	Dummy variable for more than 20 hours	0.08	0.273	0	1
Hours devoted to Study before exam (per week)	Dummy variable for less than 5 hours	0.03	0.183	0	1
	Dummy variable for 5 to 10 hours	0.26	0.438	0	1
	Dummy variable for 11 to 20 hours	0.38	0.485	0	1
	Dummy variable for more than 20 hours	0.33	0.472	0	1
Source of Allowances	Dummy variable for Parents or Family	0.55	0.498	0	1
	Dummy variable for Scholarship	0.13	0.341	0	1
	Dummy variable for Study Loan	0.35	0.479	0	1
	Dummy variable for Part-time Job or Savings	0.20	0.397	0	1
Average Spending per month	Continuous variable on expenditure per month (excluding tuition fees and accommodation)	302.32	167.412	30	1500
Average Monthly Mobile Phone Bill	Continuous variable on average monthly phone bill	46.57	29.784	6	200
Reason in Choosing Economics	Dummy variable for Personal Interest	0.51	0.501	0	1
	Dummy variable for Useful Subject	0.26	0.438	0	1
	Dummy variable for Good Career Prospect	0.37	0.484	0	1
	Dummy variable for No Other Choices	0.03	0.173	0	1
Problems Faced	Dummy variable for Financial Problems	0.25	0.435	0	1
	Dummy variable for Health Problems	0.22	0.417	0	1
	Dummy variable for Environment	0.43	0.496	0	1
	Dummy variable for Family Problems	0.14	0.349	0	1
Extra-Curricular Participation	Dummy variable for No Involvement	0.23	0.419	0	1
	Dummy variable for Minimal Involvement	0.21	0.406	0	1
	Dummy variable for Moderate Involvement	0.26	0.440	0	1
	Dummy variable for Active Involvement	0.24	0.426	0	1
	Dummy variable for Very Active Involvement	0.06	0.233	0	1
Grade Point	Continuous variable on the Grade Point for 3 major modules in Economics	3.2165	0.545	1.65	4.00
	Index Score on the Grade Point	100.0	16.957	51.30	124.36

Appendix 2: Questionnaire

This voluntary survey is conducted by Wan Chang Da (wanchangda@nus.edu.sg), which is part of EC5660 Independence Study Module. Your cooperation in completing the questionnaire is much appreciated. All information provided will be kept strictly confidential and will only be used for statistical analysis. Thank you for your kind cooperation.

Please tick (√) appropriately. **Gender:** ☐Male ☐Female

Ethnicity: ☐Malay ☐Chinese ☐Indian Others:_____

Age: _____ **Nationality:** _____ **Hometown:** ☐Urban ☐Sub-urban ☐Rural

Birth order: I am the _____ child in my family. (*e.g. 1st child*)

Entry qualification for university:
☐STPM ☐A-levels ☐Malaysian Matriculation (MM) ☐Diploma Others: _____

Subjects taken at STPM/A-levels/MM and Grades:
(*Diploma holders proceed to next question*)
E.g. *General Paper* *A*
_____ ___ _____ ___
_____ ___ _____ ___
_____ ___ _____ ___

Cumulative Academic Points for university entrance: _____ on the scale of _____
(*For diploma holders only*)

National Service:
☐ ≈ 2 years ☐3 months ☐Deferred ☐Not applicable

Working experiences before entering university:
☐Yes ☐No If yes, total working duration is _____ months

Accommodation during Year 1 in university:
☐Stayed in hall/residential college ☐Rented accommodation near campus
☐Stayed at home ☐Stayed with friends/relatives

If you have roommate(s) during Year 1 in university, how would you describe the relationship with him/her/them?
☐No roommate
☐Very bad ☐Bad ☐Moderate ☐Good ☐Excellent

Where was your usual study place during Year 1 in university?
☐Library ☐Own Room ☐Study Room in Faculty
Others: _____

How would you rate your study environment during Year 1 in university?
☐Very bad ☐Bad ☐Moderate ☐Good ☐Excellent

No. of hours devoted for revision/study during the semester (per week) in Year 1:
☐<5 hours ☐5–10 hours ☐11–20 hours ☐>20 hours

No. of hours devoted for revision/study two weeks before exam (per week) in Year 1:
☐<5 hours ☐5–10 hours ☐11–20 hours ☐>20 hours

During Year 1 in university, what is your source of allowances (pocket money)?
☐Parents/Family ☐Scholarship ☐Study Loan ☐Part-time job Others: _____

On average, how much do you spent within a month during Year 1 in university? (*excluding tuition fees and accommodation*) $ _____

On average, how much do you spent on mobile phone bill (including SMS, MMS etc.) within a month during Year 1 in university? $ _____

Reason in choosing to study Economics:
☐Personal interest ☐Useful subject ☐Good career prospect Others: _____

What is your level of interest in economics?
☐Very bad ☐Bad ☐Moderate ☐Good ☐Excellent

List of Modules and their Grades:
Microeconomics (EC 2101 or EXEE 1103) _____
Macroeconomics (EC 2102 or EXEE 1104) _____
Statistics / Econometrics (EC 2303 or ESEE 1103) _____
Quantitative Methods / Mathematics (MA 1101/1102 or ESEE 1101/1102) _____
Sociology (SC 1101 or EXEE 2106) _____
Principles of Accounting (FNA 1002 or EXEE 1105) _____
Other Modules taken in Year 1 and their Grades:
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

I have faced the following problems in Year 1 *(possible to tick more than one)***:**
☐Financial (*e.g. financial difficulties*)
☐Health (*e.g. stress, frequently falling sick, depression*)
☐Environment (*e.g. difficulties adjusting to lifestyle, getting along with friend*)
☐Family (*e.g. home-sickness*)
Others:_____

Participation in extra-curricular activities during Year 1 in university:
☐No involvement ☐Minimal ☐Moderate ☐Active ☐Very active

Thank you for your participation.

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