

THE IMPACT OF PRIOR STUDY IN ECONOMICS AND MATHS ON FIRST YEAR PERFORMANCE

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1. Introduction

This study examines the performance of 1st year undergraduate students in an introductory economics module called Economic Environment of Business (BS1102). One of the key difficulties with teaching this module is that whilst some students are seeing economics for the first time, a number of the students have already studied economics before. Indeed, a significant amount of the content covered is included in A-Level Economics. The key research question in this paper is whether prior study in Economics and Mathematics before enrolment at Aston has any impact upon student module performance. This is important because it has implication for pedagogy in terms of differentiation. Perhaps unsurprisingly, there is almost no literature concerning differentiation in higher education. In contrast there is a huge literature at the primary and secondary level. For this reason it seems appropriate to use a definition of differentiation as defined by two of the key scholars in this field. Tomlinson and Allan (2000) define differentiation as:

“a teacher reacting responsively to a learner's needs. A teacher who is differentiating understands a student's needs to express humour, or work with a group, or have additional teaching on a particular skill, or delve more deeply into a particular topic, or have guided help with a reading passage—and the teacher responds actively and positively to that need. Differentiation is simply attending to the learning needs of a particular student or small group of students rather than the more typical pattern of teaching the class as though all individuals in it were basically alike.” (Tomlinson & Allan, 2000)

The results of this study have important implications in terms of streaming students based on prior ability in order to allow practitioners to differentiate their pedagogic approach. In addition, the results may also be applicable to other modules across all schools at Aston, in particular in those modules that use pre-university mathematics.

There are a number of past studies that look at the impact of prior study in economics and mathematics on student degree performance (see below for details). The evidence appears to be quite mixed. One of the key contributions of this paper is to analyse performance on a particular module as opposed to overall degree classification. In addition, this is the first paper to analyse performance in an Economics module for Business School students - students who have not chosen to study pure Economics or even do an Economics based degree.

The remainder of this paper is set out as follows: in Section 2 we briefly discuss the sample size, module assessment and descriptive statistics of the student cohort. In Section 3 we present the empirical methodology and report the results. Finally, in Section 4 we compare our findings with the related previous literature and make some suggestions for professional practice.

2. Data

Economic Environment of Business (BS1102) is worth ten credits and comprises 20 lecture hours and five tutorial hours. The majority of the students on this course are not from single honours business programmes. They comprise students from Marketing, Human Resource Management, Combined Honours Business, International Business & Modern Languages, Law with Management and Computing for Business. All of the data is taken from the Students Information System (SITS). Descriptive statistics for this module in 2009 and 2012 are presented in **Table 1** and **Table 2** below.

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In 2009 the examination for BS1102 lasted two hours and consisted of 100 multiple choice questions. As can be seen in **Table 1** there were 406 students who studied BS1102. The average mark was 55%. The sample is split evenly across gender and the average age was just over 20 years. Approximately 33% of the students were registered as overseas. In total 17% of students had some form of Economics training prior to enrolment at Aston. This training could have been from a range of qualifications with the most prominent being A-Level/AS-Level Economics or as a module of the International Baccalaureate. In addition, 24% of students had some training in Maths directly prior to enrolment at Aston¹.

Table 1: Descriptive Statistics 2009

Variable	Observations	Mean	Min	Max
Mark	406	55.02	40	83
Maths	406	0.24	0	1
Economics	406	0.17	0	1
Age	406	20.10	18	36
Home	406	0.67	0	1
Male	406	0.54	0	1

In 2012 the examination for BS1102 consisted of a multiple choice test worth 40% and an essay component worth 60% (split between Microeconomics and Macroeconomics). As can be seen in **Table 2** there were 413 students who studied BS1102. The average mark was 53.3%. Approximately 15% of the students were from overseas. The number of students who had a background in Economics prior to enrolment at Aston is similar to 2009 at 15%. In addition, the number of students who have training in mathematics directly prior to enrolling at Aston was 22%.

Table 2: Descriptive Statistics 2012

Variable	Observations	Mean	Min	Max
Mark	413	53.34	0	95
Maths	413	0.22	0	1
Economics	413	0.15	0	1
Age	413	19.19	17	42
Home	413	0.85	0	1
Gender	413	0.47	0	1

3. Empirical Methodology and Results

This paper tests two hypotheses concerning the impact of economics and maths on modular performance:

H1: Students who have studied Economics at A-Level (or an A-Level Equivalent) prior to joining Aston University perform better in an Introductory Economics module than students who have not studied Economics before.

H2: Students who have studied Mathematics at A-Level (or an A-Level Equivalent) prior to joining Aston University perform better in an Introductory Economics module than students who have not studied Mathematics before.

¹ In 2012, 28 out of 413 students have a background in both Maths and Economics, suggesting that there is a small amount of overlap.

In order to test **H1** and **H2** we run two Ordinary Least Squares regressions (OLS). OLS allows the researcher to consider the impact of a unit change in an explanatory variable on the dependent variable of interest. In our model, the dependent variable we are interested in is student performance (measured by % module score). Most of the control variables included are called dummy variables, for instance the variable “Economics” equals 1 if a student has studied economics prior to enrolment at Aston, and it equals 0 otherwise. In this case, each coefficient estimate tells us the average impact (%) switching the variable from 0 to 1 has on a student’s module score holding all of the other control variables constant. For the variable Economics, the coefficient estimate is a direct test of **H1**. When reading the results the most important thing to look at is the sign and the significance level as indicated by the stars next to the estimate. If there are three stars then the estimate is highly statistically significant. The additional control variables included are as follows: (1) Maths is a dummy which equals 1 if the student has studied Mathematics prior to enrolment at Aston or 0 otherwise – the coefficient estimate here is a direct test of **H2**; (2) the students age; (3) the students gender; (4) whether the student is from home or overseas; (5) the students socio-economic status (measured via parental occupation); (6) the students ethnicity; (7) the students school background; and (8) the programme the student is enrolled on.

To ease the burden on the reader, we do not report estimates for a number of our control variables (instead we simply record below that they were included). In addition, we only report results for 2 model specifications. In practice a number of robustness tests were run to check the consistency of the results². **Table 3** reports the results for the two years under investigation

The results in **Table 3** suggest that there is unqualified support for hypothesis H1. Studying Economics prior to enrolment at Aston improved module performance by 8.3 percentage points in 2009 and by 7.9 percentage points in 2012 holding all of the other control variables constant. This is a significant result and suggests that prior study in economics may improve a student’s module performance by nearly a whole degree classification (But, we might expect the effect of prior knowledge to wear off in later years)³. Indeed it is interesting that the result is similar across both years given the fact that the assessment changed in 2012 to an examination with an essay component which tests a deeper level of learning.

There is no support for hypothesis H2. Studying Maths prior to enrolment at Aston has no impact on module performance for BS1102⁴. It would be interesting to run this model for one of the mathematics modules. This result is somewhat surprising given the fact that much of the module’s content includes the inclusion of a number of equations and graphical interpretations that prior training in mathematics would in all likelihood prepare students for.

The coefficient estimates for the other variables tend to all be statistically insignificant. This suggests that age, gender, whether a student is from overseas, ethnicity, parental class, school background and the programme a student is on has no impact upon module performance. In many ways this is ideal. It suggests that Aston’s recruitment policy does not seem to be impacting upon student performance in a discriminatory way.

² These are all available on request.

³ It would be desirable to use a student’s past result in their pre-university economics studies. Unfortunately it is difficult to control for this due to missing data and the fact that students do different types of qualification which may have been assessed differently.

⁴ Running the models without the Economics dummy and including only the mathematics dummy still results in a statistically insignificant coefficient estimate.

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Table 3: Results

Variable/Year	2009	2012
Economics	8.309*** (1.238)	7.907*** (2.658)
Maths	1.335 (1.092)	1.371 (2.317)
Age	-0.281 (0.293)	-1.646*** (0.575)
Home	-0.86 (1.081)	-1.833 (3.583)
Male	-0.045 (0.934)	-1.811 (1.834)
School Dummies	Yes	Yes
Ethnicity Dummies	Yes	Yes
Programme Dummies	Yes	Yes
Socio-economic Class Dummies	Yes	Yes
Constant	59.68*** (6.083)	83.78*** (11.10)
Observations	406	413
R-squared	0.118	0.186

Notes: Standard errors are provided below the coefficient estimates; *** indicates significant at the 1 per cent level, ** indicates significance at the 5 per cent level and * indicates significance at the 10 per cent level.

4. Related Literature and Implications for Professional Practice

There is a growing body of literature which tries to assess the impact of a number of student characteristics on degree performance in Economics. Borg and Stranahan (2002) find that race and gender matters when it is interacted with a measure of temperament. Soper and Walstad (1988) and Heath (1989) find that males tend to outperform females in Economics. Durden and Ellis (1995) look at attendance and find a positive and non-linear effect – as non-attendance becomes excessive, performance drops significantly. Kherfi (2008) looks at nationality and finds that students from countries within the Gulf Cooperation Council perform less well in comparison to their peers; he attributes this to differing labour market incentives once degrees have been completed. Horn, Jansen and Yu (2001) look at the impact of 1st year performance as a predictor of second year performance. They find that the first year is a good predictor, particularly dependent on performance in 1st year economics modules.

In addition to these factors, there are a number of studies that look at the impact of the prior study of maths and economics on degree performance. There seems to be a lot of evidence to suggest that maths has a significant impact on economics degree performance (see Ballard and Johnson (2004) and Cohn *et al.* (1998)). This is consistent with other studies that look at the impact of maths on degree performance across all degrees (see Smith and Naylor (2001)). The evidence which looks at the prior study of Economics on performance on degree performance however, is quite mixed. Anderson, Benjamin & Fuss (1994) find that prior study in Economics has a positive impact on performance if a student was successful in their economics prior to the start of their degree. Naylor & Smith (2004) find no evidence that past study in Economics impacts upon degree performance. Whereas Wan & Cheo (2012) find that all though pre-university grades matter, studying economics has less of an impact.

There are almost no studies that look at the impact of prior pre-university study in Economics on 1st year modular performance. This is surprising considering the likely effects of past study are likely to be felt more prominently in the year directly after pre-university education. Indeed most of the above studies deploy regression analysis with the dependent variable measured as overall degree classification. This is a significant weakness, even more so considering Horn, Jansen & Yu (2001) finding that the 1st year is a very important determinant of second year performance. One might expect that second year performance is also likely to be a key predictor of final year performance. Because of this, performance in the 1st year might be crucial. More research is needed in this area.

The results of this analysis show that prior study in Economics has a very large and statistically significant impact on performance by a magnitude of around 7-9 percentage points. This suggests that prior study can move a student up a degree classification. The result is important because, in contrast to other studies, it does the analysis for Business School students that have not specifically chosen to study economics – economics is only a component of their degree. The implication of these results for professional practice comes on two fronts and may be applicable to other modules in the Business School and in other Schools of the University. Firstly, if timetabling is possible, it might be desirable to stream students based on pre-university study of Economics for lectures and tutorials. And secondly, once streaming has been implemented, it may be desirable for the practitioner to differentiate pedagogy and assessment to suit the needs of students with different backgrounds.

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Example used with Undergraduate Students
on module BS1102 Economic Environment of Business