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Factors influencing the performance of non-economics majors in an introductory economics course

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ABSTRACT

This research compares factors which influence success for economics and non-economics majors in an introductory economics course. Results show economics majors achieve 5% higher grades which may indicate increased motivation and interest by these students. Performance at secondary school and prior economics study are positively related to success, and mathematics ability is the largest determinant of success across both economics and non-economics majors. History, politics and law majors do significantly better in macroeconomics than microeconomics and overall outperformed all other non-economics majors. Computer science and sociology students were the least successful with computer science students doing particularly badly in macroeconomics.

Teaching introductory economics to students who have not chosen to major (or minor) in economics is a component of teaching at most Economics Departments, and in many cases this introductory economics course is compulsory with the majority of students not continuing with economics in their degree program (Siegfried, 2000a,b). Problems with these courses often include large classes with very diverse skills and interests, high failure and disengagement rates, and often little actual interaction with the subject material (Riemann, 2004; Caviglia-Harris, 2003).

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Despite these acknowledged challenges associated with teaching economics to students who have not chosen economics as part of their degree program, there is little evidence in the literature on the factors influencing performance on a compulsory course which is unrelated (in the students' minds) to their chosen course of study. In particular, despite the large number of introductory economics courses offered to non-economics majors around the world, there has been very little research into factors influencing performance by these students in economics courses and how they differ from students who have chosen to major or minor in economics.

This article examines performance (measured by final grade) in a large 'Introduction to Economic Policy' course over a four year period. This course has on average 320 students each year, of whom, on average, just 11.5% have chosen to study economics as part of their degree program. These students are referred to throughout this paper as economics majors. None of the remaining students continue with economics beyond this first introductory course (these students are referred to as 'non-economics majors' throughout this paper, however, it should be noted that these students are not minoring in economics either, their degree programs do not include any economics components other than this first introductory module). This module is a compulsory module for all students regardless of whether they have chosen to major in economics or in other subjects. This research will examine the relationship between student performance in this course and student attributes such as performance at secondary school and subject choice at secondary school for both cohorts of students. The research also examines if there is a difference between the Micro and Macro elements of the course in terms of factors influencing student performance and examines whether the choice of major for the non-economics students impacts on performance in this course.

The following section discusses the existing literature in this area which is followed by the methodology, a description of the institutional setting, the course itself and the data available. The results and discussion section is then presented with the main conclusions.

1. Literature review

Given the high levels of non-engagement by students in introductory economics courses, a large body of literature has developed surrounding performance on these courses. In this paper the focus is on the performance of students majoring in disciplines other than economics, but this research considers many of the same factors influencing success at economics which have been identified in the literature such as general performance at secondary level, maths ability, and prior study of economics. In addition factors such as gender, micro versus macro economics grades and other subject selection at secondary level (such as business or accountancy) is considered. This section discusses the relevant literature on each of these factors. For the most part, all of the literature reviewed focuses on students who have chosen to study economics as part of their degree programs, thus, one of the key contributions of this paper will be to explore whether these same relationships hold for non-economics majors taking an economics course.

It is widely accepted that higher GPA scores lead to better results in economics courses, for example see Clauretie and Johnson (1975), Park and Kerr (1990), and D'Agostino and Bonner (2009). Perhaps more interesting than previous academic success is the impact specifically of mathematics ability on introductory economics grades (Ballard and Johnson, 2004; Johnson and Kuennen, 2006). According to Lagerlöf and Seltzer (2009), the level of and performance in secondary-school math has strong predictive power for students' performance in university-level economics, a result which is supported by Swope and Schmitt (2006). Anderson et al. (1994) showed the importance of secondary school calculus in later economics performance and Ballard and Johnson (2004) show that quantitative skills are the most important determinant of success in microeconomics.

In terms of the importance of prior economics study on introductory economics success, Faulk et al., 2012 find a somewhat counterintuitive result that performance in high school economics is not a significant determinant of University economics grade. This result corroborates findings that students taking high school economics have a relatively low level of achievement as measured by the *Test of Economic Literacy* (Walstad, 2001). Similarly Ballard and Johnson (2004) find a negative (but not significant) relationship between introductory economics grades and whether economics was taken at high school. It is possible that this result is driven by overconfidence and lower levels of motivation

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from students who have already taken economics courses, a result which is supported by Grimes (2002).

Research has also been conducted to investigate the role of gender in economics success, however, the results are not as consistent when compared with other explanatory factors. While gender has been found to play an important role in the choice to study economics (Emerson et al., 2012) there are inconsistent results in terms of success once enrolled in the economics program. According to Johnson and Kuennen (2006), female students earn significantly higher grades than male students in a statistics class whereas, in contrast, Ballard and Johnson (2004) find that male students outperform female students in introductory economics, however, Arnold and Straten (2012) find that gender is unrelated to success in a first year economics course.

Other factors which may influence economics success but which are not explicitly examined in this paper include the impact of attendance on student performance (for example Cohn and Johnson, 2006; Chen and Lin, 2008; Stanca, 2006; Self, 2012; Kirby and McElroy, 2003; Massingham and Herrington, 2006), the role of class size (Raimondo et al., 1990; Bradley and Taylor, 1998), departmental resources (Hanushek, 1997), study approach (Davidson, 2002), exam structure (Caudill and Gropper, 1991; Krieg and Uvar, 2001) and funding source (Riggert et al., 2006; Faulk et al., 2012). Some more longitudinal studies also consider the impact of social background, prior qualifications, and tuition fees (Smith and Naylor, 2001).

This paper compares factors influencing success in economics across two different cohorts of students – economics majors and students majoring in non-economics disciplines. Thus, one of the key differences between these two groups of students is motivation and interest in economics. While motivation is not explicitly modeled in this paper, it is hypothesized that it is captured in the differences in results between the two student cohorts. Motivation has been shown to be an important general determinant of study success (Boekaerts et al., 2010; Bruinsma, 2003). Although motivational research applied to the economics discipline is scarce, there is some evidence that motivation is an additional determinant of study success in economics (Arnold and Straten, 2012). In particular, Clauretie and Johnson (1975) find that economics students are more successful when they have chosen the course, rather than when it is an obligatory part of the curriculum. This is particularly relevant for this research given that two cohorts of students are considered, one of which has chosen to study economics as part of their University degree and the other which has not.

2. Institutional context

The analysis in this article is based on students in a first year Introduction to Economic Policy course offered at Trinity College Dublin, Ireland. Trinity College Dublin is the top university in Ireland and is ranked in the top 50 universities in the world and 9th in Europe (Leiden, 2013). Competition for places on degree programs at Trinity is intense[1] and thus the students taking this course are, for the most part, able and motivated, although perhaps not necessarily in the field of economics.

In Ireland, university places are allocated on the basis of CAO (Central Application Office) points. Students earn CAO points through their performance at their final exam in secondary level education. In Ireland this final exam is the Leaving Certificate where students study a minimum of six subjects – either at a higher or an ordinary level to reflect difficulty. The grades from the top six subjects in a single sitting of this Leaving Certificate exam are used to calculate the student's CAO points according to the conversions displayed in Table 1 (CAO, 2013).

From Table 1 it can be seen that the maximum a student can receive is 600 CAO points (made up of six A1 grades on higher level papers). Places on degree programs at Irish Universities are allocated to students with the highest CAO points until all the places on the program have been filled.

In Trinity College Dublin, students decide upon their chosen degree upon application to University, in other words before taking any introductory economics modules at University. This differs from many Universities in the US for example, where students do not officially choose their major until their third year at university and so would take an introductory economics class before declaring a major.

[1] An average of 18 applications for every 1 place on undergraduate programmes at TCD in 2012 (CAO, 2012).

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Table 1
CAO points conversion table.

Grade	Grade band	CAO points	
		Higher level	Ordinary level
90–100%	A1	100	60
85–89%	A2	90	50
80–84%	B1	85	45
75–79%	B2	80	40
70–74%	B3	75	35
65–69%	C1	70	30
60–64%	C2	65	25
55–59%	C3	60	20
50–54%	D1	55	15
45–49%	D2	50	10
40–44%	D3	45	5
<39%	E	0	0

Table 2
Breakdown of students by degree program for the academic year 2011/2012.

Degree program	Number of students
Economics and another subject	41
Political science and geography	21
Social studies	46
Sociology and social policy	21
Sociology and a language (French/Spanish/German/Italian/Irish)	12
Sociology and geography	20
History of art/history and sociology	7
Jewish and Islamic civilizations and sociology	2
Philosophy and sociology	6
Sociology and world religions and theology	3
History and political science	26
Law and business	24
Law and political science	20
Computer science and business	21
Business studies and French	12
Business studies and German	8
Business studies and another language (Polish/Russian)	9
Business studies and Spanish	10
Total number of students	309
Percentage of students who have chosen economics as part of their degree program in 2011/2012	13%

This is particularly relevant for this research as just 11.5% of the introductory economics class being examined have chosen to study economics as part of their degree program. The remaining 88.5% do not have the option of continuing with economics beyond this introductory module, a decision which they made before commencing at University through their choice of degree program. It should be noted that the module under investigation is a compulsory module for both cohorts of students, the economics majors and non-economics majors.

Students from outside Ireland, but within the EU, also apply to Irish Universities through the CAO system and have their final second-level examination results converted to CAO points, again with a maximum of 600 CAO points. The data set for this study includes students from both Ireland and other EU countries and this CAO scale allows for consistent measurement across all students regardless of where they conducted their secondary level education.[2]

[2] The small number of non-EU students taking this course have been omitted from the analysis as there is no CAO information available for them.

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The course under investigation here is EC1040, Introduction to Economics Policy. This is a two semester first-year compulsory course for 27 different degree programs across the University. The breakdown of students in this course in the 2011/2012 year is shown in Table 2.

It can be seen from Table 2 that 13% of students in 2011/2012 were enrolled in degree programs consisting of 'Economics and another subject'. It is this group of students which is referred to throughout this paper as economics majors. It should be noted that strictly speaking these students are enrolled in a dual-major, one subject of which is economics.[3] However, for ease of terminology, these students are referred to throughout this paper as economics majors to distinguish them from the remainder of students in this course, who are majoring/dual-majoring in subjects other than economics.

3. Methodology

The methodology involves estimating the relationship between grades on the course EC1040, Introduction to Economic Policy and a number of explanatory variables for the two cohorts of students (economics majors and non-economics majors). The estimation models take four general forms: the first is an OLS model which estimates final grade based on a range of explanatory variables including CAO points, achievement at mathematics, previous economics study, other subjects taken at secondary level, gender and year; the second estimation is an Oaxaca decomposition of explained and unexplained differences in the two student cohorts; the third estimation looks at differences in results across micro and macroeconomics; and the final model examines the performance of students on chosen majors other than economics. A number of different specifications of these models are considered in the analysis and are described in further detail in the remainder of this section. Table 3 explains the variables used in the empirical models presented throughout this section.

The general OLS model is illustrated in Eq. (1) and is estimated for both student cohorts (economics majors and non-economics majors). All variables are explained in Table 3.

$$FinalGrade_i = \beta_0 + \beta_1 CAO\,points_i + \beta_2 Math75_i + \beta_3 PriorEcon_i + \beta_4 BusOrg_i \beta_5 Accounting_i + \beta_6 Male_i + \beta_7 Year_i + e_i \quad (1)$$

It should be noted that since *FinalGrade* is a limited dependent variable which is bounded by the extremes of 0% and 100%, strictly speaking a Tobit model would be more appropriate than an OLS model. However, the grades in this module are not clustered around either of these extremes and, in fact, examination of the data reveals that there were no incidents of any student achieving a 100% grade. There were a number of instances of 0%, however, these were due to absence at examination rather than a graded script being awarded 0% and thus these data points have been removed from the analysis.

A further OLS model is estimated (Eq. (2)) which uses the full data set rather than separating out the two student cohorts and includes a dummy variable (*EconDegree)* for students who have chosen to study 'Economics and another subject' as their degree program.

$$FinalGrade_i = \beta_0 + \beta_1 CAO\,points_i + \beta_2 Math75_i + \beta_3 PriorEcon_i + \beta_4 BusOrg_i \beta_5 Accounting_i + \beta_6 Male_i + \beta_7 Year_i + \beta_7 EconDegree_i + e_i \quad (2)$$

An expansion of the model is then tested, Eq. (3), to further investigate the role of mathematics ability in determining final grades by introducing mathematics dummy variables representing specific grades in mathematics at secondary level.

$$FinalGrade_i = \beta_0 + \beta_1 CAO\,points_i + \beta_2 PriorEcon_i + \beta_3 MathA_i + \beta_4 MathB_i + \beta_5 MathC_i + \beta_7 Year_i + e_i \quad (3)$$

[3] These students can opt to specialize in one or both subjects in their fourth year, however, both subjects are studied in equal measure in first year which is when students take the module under investigation in this paper.

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Table 3
Explanation of variables used in empirical models.

Variable	Definition
Dependent variables	
Final grade	Total points (in percentage) earned in the course
Micro grade	Total points (in percentage) earned in the microeconomics component of the course
Macro grade	Total points (in percentage) earned in the macroeconomics component of the course
Independent variables	
CAOpoints	Total CAO points earned by the student (as a proxy for performance at secondary school)
Math75	=1 if student earned 75 CAO points or above in second level mathematics (this represents a B grade or above); =0 otherwise
MathA	=1 if student earned A grade in second-level mathematics; =0 otherwise
MathB	=1 if student earned B grade in second-level mathematics; =0 otherwise
MathC	=1 if student earned C grade in second-level mathematics; =0 otherwise
PriorEcon	=1 if student studied Economics at second-level; =0 otherwise
BusOrg	=1 if student studied Business Organization at second-level; =0 otherwise
Accounting	=1 if student studied Accounting at second-level; =0 otherwise
Male	=1 if student is male; =0 if female
Year	Dummy variables representing the years of the study: 2008, 2009, 2010 and 2011.
EconDegree	=1 if student has chosen Economics and another subject as their degree program; =0 otherwise
HistPol	=1 if student has chosen History and Politics as their degree program; =0 otherwise
SocStd	=1 if student has chosen Social Studies as their degree program; =0 otherwise
BusLang	=1 if student has chosen Business Studies and a Language as their degree program; =0 otherwise
SocSocPol	=1 if student has chosen Sociology and Social Policy as their degree program; =0 otherwise
LawBus	=1 if student has chosen Law and Business as their degree program; =0 otherwise
LawPol	=1 if student has chosen Law and Political Science as their degree program; =0 otherwise
PolGeog	=1 if student has chosen Politics and Geography as their degree program; =0 otherwise
CompBus	=1 if student has chosen Business and Computer Science as their degree program; =0 otherwise

The second general estimation model consists of an Oaxaca decomposition (Oaxaca, 1973; Blinder, 1973) of the explained and unexplained differences in the two student cohorts. The framework considers the following separate regressions for samples of n_{Econ} economics majors and $n_{NonEcon}$ non-economics majors.

$$FinalGrade_{Econ,i} = \mathbf{x}'_{Econ,i}\beta_{Econ} + \varepsilon_{Econ,i}, \quad i = 1, \ldots, n_{Econ}$$

$$FinalGrade_{NonEcon,j} = \mathbf{x}'_{NonEcon,j}\beta_{NonEcon} + \varepsilon_{NonEcon,j}, \quad j = 1, \ldots, n_{NonEcon}$$

The regressor vectors **x** include the explanatory variables in Eq. (1), namely, *CAOpoints, Math75, PriorEcon, BusOrg, Accounting, Male* and *Year*. The Oaxaca decomposition compares these two regressions to see if they suggest that the differences in final grades across the two student cohorts is due to differences in prior characteristics (the explanatory variables) or by unexplained differences,

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which may be due to ways in which the courses acts upon these prior characteristics. For any two vectors of characteristics, we have

$$\begin{aligned} E[FinalGrade_{Econ,i}] - E[FinalGrade_{NonEcon,j}] &= \mathbf{x}'_{Econ,i}\beta_{Econ} - \mathbf{x}'_{NonEcon,j}\beta_{NonEcon} \\ &= \mathbf{x}'_{Econ,i}\beta_{Econ} - \mathbf{x}'_{Econ,i}\beta_{NonEcon} + \mathbf{x}'_{Econ,i}\beta_{NonEcon} \\ &\quad - \mathbf{x}'_{NonEcon,j}\beta_{NonEcon} \\ &= \mathbf{x}'_{Econ,i}(\beta_{Econ} - \beta_{NonEcon}) + (\mathbf{x}_{Econ,i} - \mathbf{x}_{NonEcon,j})'\beta_{NonEcon} \end{aligned} \tag{4}$$

The second term on the right hand side of (4) is identified with differences in prior characteristics between economics and non-economics majors (such as differences in CAO points, maths scores etc.) which would explain differences in final grades. The first term on the right hand side of Eq. (4) shows the differential in final grades which is unexplained by the independent variables previously listed and may capture other factors such as how the course operates upon prior characteristics or other exogenous factors such as differences in motivation across the two groups.

The third component of the analysis, Eqs. (5) and (6), examines differences in micro and macro grades and investigates whether the explanatory variables have a different impact depending on the component of the course being considered.

$$\begin{aligned} MicroGrade_i = \beta_0 &+ \beta_1 CAO\,points_i + \beta_2 PriorEcon_i + \beta_3 MathA_i + \beta_4 MathB_i + \beta_5 MathC_i \\ &+ \beta_6 Male_i + \beta_7 Year_i + e_i \end{aligned} \tag{5}$$

$$\begin{aligned} MacroGrade_i = \beta_0 &+ \beta_1 CAO\,points_i + \beta_2 PriorEcon_i + \beta_3 MathA_i + \beta_4 MathB_i + \beta_5 MathC_i \\ &+ \beta_6 Male_i + \beta_7 Year_i + e_i \end{aligned} \tag{6}$$

Finally, Eq. (1) is expanded to include dummy variables representing the eight main degree programs that the non-economics majors are enrolled in and Eqs. (7)–(9) are estimated to determine the impact these have on final grades.

$$\begin{aligned} FinalGrade_i = \alpha_0 &+ \alpha_1(HistPol_i) + \alpha_2(SocStd_i) + \alpha_2(SocStd_i) + \alpha_3(BusLang_i) \\ &+ \alpha_4(SocSocPol_i) + \alpha_5(LawBus_i) + \alpha_6(LawPol_i) + \alpha_7(PolGeog_i) \\ &+ \alpha_8(Com\,pBus_i) + \beta\mathbf{x}'_i + e_i \end{aligned} \tag{7}$$

$$\begin{aligned} MicroGrade_i = \alpha_0 &+ \alpha_1(HistPol_i) + \alpha_2(SocStd_i) + \alpha_2(SocStd_i) + \alpha_3(BusLang_i) \\ &+ \alpha_4(SocSocPol_i) + \alpha_5(LawBus_i) + \alpha_6(LawPol_i) + \alpha_7(PolGeog_i) \\ &+ \alpha_8(Com\,pBus_i)Com\,pBus_i + \beta\mathbf{x}'_i + e_i \end{aligned} \tag{8}$$

$$\begin{aligned} MacroGrade_i = \alpha_0 &+ \alpha_1(HistPol_i) + \alpha_2(SocStd_i) + \alpha_2(SocStd_i) + \alpha_3(BusLang_i) \\ &+ \alpha_4(SocSocPol_i) + \alpha_5(LawBus_i) + \alpha_6(LawPol_i) + \alpha_7(PolGeog_i) \\ &+ \alpha_8(Com\,pBus_i) + \beta\mathbf{x}'_i + e_i \end{aligned} \tag{9}$$

In Eqs. (7)–(9) the vector of regressors $\mathbf{x}'$ includes all of the explanatory variables in Eq. (1).

4. Data summary

This analysis considers a course called EC1040 Introduction to Economic Policy over the four year period from 2008 to 2012. Overall exam results, including a breakdown by individual continuous assessment components and final exam questions, are available through the Department of Economics internal records for each of these four years. Fig. 1 illustrates the distribution of the overall grade (incorporating both the final exam and continuous assessment marks) for students in the 2009/2010 cohort.

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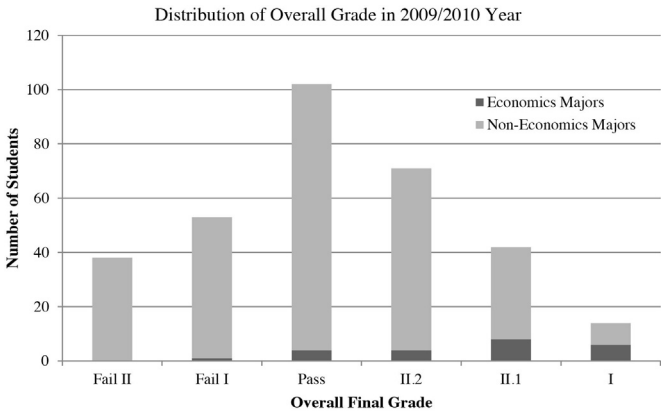

Fig. 1. Distribution of overall grade in 2009/2010 year.

Table 4
Explanation of examination grade bands.

Grade	Explanation
Fail II	0–29% (this represents a non-compensatable fail and the student must repeat the examination)
Fail I	30–39% (this result can be compensated providing the student has sufficiently high grades in their other subjects)
Pass	40–49%
II.2	50–59%
II.1	60–69%
I (first class honours)	Above 70%

In Trinity College Dublin (TCD), the final grades shown in Fig. 1 translate to the percentage ranges shown in Table 4.

Data on admissions (CAO points, mathematics grades, etc.) are available through the TCD centralized student information system. Table 5 illustrates the descriptive statistics on the data over the four year period for the two student cohorts (non-economics majors and economics majors).

Comparing the data across the two student cohorts, it can be seen that the economics majors generally perform better on this course (with an average final grade of almost 58% compared to the rest of the class with a 49% average). Those who have chosen to major in economics also tend to have higher CAO points on average (503 compared to 469) and stronger Maths skills (with 49% achieving a B grade or above compared to 22% for the rest of the class).

Another difference between the two cohorts is the gender split. For the non-economics majors, just 43% of the class are male, whereas for the economics majors, 72% of the class are male. It can also be seen that there is a higher level of prior economics study amongst the economics majors (55%) compared to the rest of the class (21%).

The author tested and did not find multicollinearity between the explanatory variables in any of the models run.

5. Results and discussion

The first, most basic model, examines the relationship between performance on this course and the student's performance at secondary school level (as measured by $CAOpoints_i$, which indicates how well they did in their Leaving Certificate or equivalent exam). This is run for the two student cohorts, denoted by 'Econ Majors' and 'Non-Econ Majors'.

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Table 5
Descriptive statistics.

Variable	*N*	Mean	Std. dev.	Min	Max
Non-economics majors					
Final grade	998	48.71	12.05	6	83.55
Micro grade	998	55.47	15.33	0	91.25
Macro grade	998	40.82	18.59	0	90.5
CAOpoints	998	468.51	81.21	0	600
Variable	*N*	%	Std. dev.	Min	Max
Dummy variables					
Math75	224	22%	–	–	–
MathA	76	8%	–	–	–
MathB	148	15%	–	–	–
MathC	229	23%	–	–	–
PriorEcon	211	21%	–	–	–
BusOrg	362	36%	–	–	–
Accounting	151	15%	–	–	–
Male	429	43%	–	–	–
Year 2008	143	14%	–	–	–
Year 2009	297	30%	–	–	–
Year 2010	290	30%	–	–	–
Year 2011	268	26%	–	–	–
Variable	*N*	Mean	Std. dev.	Min	Max
Economics majors					
Final grade	130	57.92	10.76	10	89.5
Micro grade	130	61.46	14.32	0	95
Macro grade	130	51.40	16.27	0	96.5
CAOpoints	130	502.58	70.60	155	600
Variable	*N*	%	Std. dev.	Min	Max
Dummy variables:					
Math75	64	49%	–	–	–
MathA	42	32%	–	–	–
MathB	22	17%	–	–	–
MathC	18	14%	–	–	–
PriorEcon	71	55%	–	–	–
BusOrg	40	30%	–	–	–
Accounting	21	16%	–	–	–
Male	94	72%	–	–	–
Year 2008	39	29%	–	–	–
Year 2009	23	18%	–	–	–
Year 2010	27	21%	–	–	–
Year 2011	41	32%	–	–	–
Variable	*N*	%	Std. dev.	Min	Max
Degree program dummies					
EconDegree	130	12%	–	–	–
HistPol	80	7%	–	–	–
SocStd	136	12%	–	–	–
BusLang	79	7%	–	–	–
SocSocPol	71	6%	–	–	–
LawBus	70	6%	–	–	–
LawPol	60	5%	–	–	–
PolGeog	56	5%	–	–	–
CompBus	86	8%	–	–	–

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In this OLS(1) model (see Table 6), we see that there is a positive and significant relationship between performance at secondary level and performance in Introduction to Economics, however, this relationship differs between economics majors and non-economics majors. For the non-economics majors, a 100 points increase in *CAOpoints* corresponds to a 5.2% increase in final grade. Interestingly, *CAOpoints* performance is less significant for the economics majors who show only a 3.6% increase in final grade corresponding to a similar increase in CAO points. However, given that the economics majors have higher CAO points on average with a lower standard deviation (see Table 5) there is less variation in the *CAOpoints* variable for the economics majors and thus it is perhaps unsurprising to see it have a smaller impact on final grades as a result.

The second iteration of the OLS model, OLS(2), shown in Table 6 examines further the relationship between performance on this course and secondary level achievement by looking at how well the student did in mathematics (using a dummy variable for a grade of B or above) and whether the student chose to study economics at secondary level. Similar to findings in previous literature, we see that mathematics ability is an important predictor of performance in this course. Also, interestingly, we see that its importance is greater for students having chosen to major in economics rather than for those who have not.

The results show that there is a positive and significant relationship between prior economics study and performance on this course which is in line with the findings of Durden and Ellis (1995) and Brasfield et al. (1993) but counter to results found by Faulk et al. (2012) and Ballard and Johnson (2010). Given this inconsistency in the existing literature it is possible that results are being driven by the specific economics curricula at second level versus third level and program structures in the chosen case studies. This is supported by commentary in Ballard and Johnson (2010) who cite program structure (where there is duplication of material across the macro and micro components of the introductory economics course in the case study University) as being a possible reason for a negative relationship between prior study of economics and later performance. Other explanations could include differences in admission policies and incentives at different Universities. In the case of Ireland, the economics curriculum at second-level is very similar to what is offered in this introductory economics module which may explain why students who have seen the material previously at secondary level would perform better. Prior study of economics is seen as being more important for the non-economics majors than the economics majors. In fact, having studied economics previously is the single largest determinant of success in this course for the non-economics majors.

The third model, OLS(3), includes variables *BusOrg* and *Accounting* to capture if the student studied Business Organization or Accounting at secondary level. It is hypothesized that if the student had chosen either of these subjects at secondary level then perhaps this would indicate an interest in the financial sector which may make them more motivated about studying economics in this course. It is seen however, that although there is a negative coefficient for *Business Organization* for both cohorts of students and a positive coefficient for *Accountancy*, neither of these results are statistically significant.

Also, despite the fact that there are considerably more males in the EconMajor cohort, it is seen that gender is statistically insignificant in terms of explaining final grades across both student groups.

The final set of results presented in Table 6, OLS(4), uses data for the full class and includes a dummy variable representing whether the student is an economics major or not. It can be seen that being an economics major increases final grade by almost 5%, compared to students majoring in other disciplines. This variable captures the fact that these students have *chosen* economics and are thus likely to be more engaged and motivated in the material and achieve greater success in economics modules as a result. This supports the results of Clauretie and Johnson (1975) who find that economics students are more successful when they have chosen the course, rather than when it is a compulsory component.

Given the large body of research into the link between economics success and mathematics ability, and the interesting results from Table 6 that show that mathematics ability is more important for the economics majors than for the non-economics majors, Table 7 explores this relationship further through the use of expanded mathematics dummy variables (see Eq. (3) for model specification).

As seen from Table 7, of the variables modeled, achieving an A grade in mathematics at secondary level is the single largest determinant for success in this course for economics majors and is

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Table 6
OLS model regression results.

Variables	OLS (1)		OLS (2)		OLS (3)		OLS (4)
	Non-econ majors	Econ majors	Non-econ majors	Econ majors	Non-econ majors	Econ majors	All students
CAOpoints	0.0519*** (0.00487)	0.0368*** (0.0117)	0.0443*** (0.00504)	0.0268** (0.0112)	0.0443*** (0.00511)	0.0265** (0.0112)	0.0420*** (0.00473)
Math75			3.711*** (0.845)	7.009*** (1.689)	3.443*** (0.856)	6.948*** (1.812)	4.286*** (0.783)
PriorEcon			5.722*** (0.688)	3.162* (1.672)	5.507*** (0.730)	3.649** (1.788)	5.171*** (0.682)
BusOrg					−0.529 (0.651)	−1.870 (1.836)	−0.724 (0.610)
Accounting					1.177 (0.889)	1.523 (2.380)	1.207 (0.837)
Male					0.564 (0.691)	−1.533 (1.931)	0.301 (0.655)
EconDegree							4.814*** (1.018)
Constant	23.43*** (2.439)	34.56*** (5.909)	25.00*** (2.475)	36.07*** (5.350)	24.94*** (2.531)	37.55*** (5.230)	25.42*** (2.339)
Observations	998	130	998	130	998	130	1128
R-squared	0.242	0.156	0.296	0.257	0.298	0.268	0.321

Robust standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

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Table 7
OLS Regression results with expanded mathematics dummy variables.

Variables	OLS (5)		OLS (6)
	Non-econ majors	Econ majors	All students
CAOpoints	0.0429*** (0.00506)	0.0261** (0.0117)	0.0411*** (0.00467)
PriorEcon	5.720*** (0.692)	3.269* (1.658)	5.355*** (0.647)
MathA	5.479*** (1.276)	9.074*** (2.116)	7.082*** (1.085)
MathB	3.708*** (1.035)	2.611 (2.466)	3.803*** (0.950)
MathC	1.718** (0.770)	−0.911 (2.396)	1.611** (0.737)
EconDegree			4.374*** (1.000)
Constant	25.13*** (2.476)	36.73*** (5.779)	25.38*** (2.292)
Observations	998	130	1128
R-squared	0.300	0.298	0.326

Robust standard errors in parentheses.
*** $p<0.01$.
** $p<0.05$.
* $p<0.1$.

Table 8
Oaxaca decomposition analysis results.

Variables	(1)	(2)	(3)
	Overall	Explained	Unexplained
CAOpoints		−1.478*** (0.333)	10.78* (6.508)
Math75Dum		−1.142*** (0.293)	−2.165** (0.931)
PriorEcon		−1.875*** (0.350)	0.788 (0.961)
BusOrg		−0.0279 (0.0423)	0.451 (0.591)
Accounting		−0.0116 (0.0401)	−0.113 (0.400)
Male		−0.122 (0.203)	1.805 (1.401)
NonEcon Majors	48.71*** (0.381)		
Econ Majors	57.92*** (0.941)		
difference	−9.203*** (1.015)		
explained	−4.656*** (0.567)		
unexplained	−4.547*** (0.985)		
Constant			−16.10*** (6.086)
Observations	1128	1128	1128

Robust standard errors in parentheses.
*** $p<0.01$.
** $p<0.05$.
* $p<0.1$.

considerably more important than prior study of economics. Economics majors with an A grade in mathematics, achieve on average over 9% higher grades than those with lower mathematical ability. Mathematics ability is also significant for the non-economics majors but to a lesser extent.

The second model consists of an Oaxaca decomposition to investigate the difference in results across the two cohorts of student. Table 8 illustrates the results of the Oaxaca analysis.

It can be seen that students who opted to study economics as part of their degree (Econ Majors) show a 9.2% higher grade than those who have chosen other degree programs (NonEcon Majors). The Oaxaca decomposition investigates how much of this difference in grades is due to differences in prior characteristics (as shown in the explanatory variables), versus how much is due to unexplained characteristics. It can be seen that differences in prior endowments account for 4.66%, just over half, of the final grade gap. Looking at the individual explanatory variables, we can see that performance at secondary level (*CAOpoints*), mathematics ability (*Maths75)*, and prior study of economics (*PriorEcon*) are the key drivers of the explained differences in final grades between economics majors and non-economics majors. The results also indicate that almost half of the overall difference in grades (4.55%)

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Table 9
OLS regression results across the micro and macro components of the course.

Variables	Micro grades			Macro grades		
	Non-econ majors	Econ majors	All students	Non-econ majors	Econ majors	All students
CAOpoints	0.0365*** (0.00624)	0.0144 (0.0175)	0.0350*** (0.00582)	0.0505*** (0.00808)	0.0413*** (0.0146)	0.0496*** (0.00741)
PriorEcon	4.390*** (1.032)	1.935 (2.486)	3.910*** (0.953)	5.019*** (1.301)	5.619** (2.807)	5.005*** (1.184)
MathA	6.031*** (1.471)	6.787** (2.978)	6.165*** (1.259)	8.913*** (2.320)	13.85*** (3.100)	11.04*** (1.886)
MathB	3.465*** (1.261)	2.365 (3.921)	3.406*** (1.209)	7.161*** (1.716)	5.959* (3.594)	7.245*** (1.563)
MathC	2.139** (1.004)	−0.536 (4.170)	1.968** (0.985)	0.814 (1.256)	−5.760 (4.050)	0.405 (1.207)
Male	−0.925 (0.856)	−1.571 (2.901)	−0.952 (0.831)	−0.679 (1.111)	0.0758 (2.858)	−0.697 (1.053)
EconDegree			1.876 (1.394)			3.696** (1.592)
Constant	30.59*** (2.988)	47.49*** (8.866)	31.87*** (2.810)	19.54*** (3.875)	24.40*** (7.020)	19.23*** (3.602)
Observations	998	130	1128	998	130	1128
R-squared	0.310	0.184	0.302	0.204	0.324	0.222

Robust standard errors in parentheses.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

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Table 10
Impact of degree program chosen by non-economics majors.

Variables	Non-economics majors		
	Overall final grade	Micro grades	Macro grades
CAOpoints	0.0350*** (0.00540)	0.0348*** (0.00649)	0.0348*** (0.00823)
Math75Dum	2.729*** (0.870)	3.200*** (1.088)	6.170*** (1.481)
PriorEcon	5.670*** (0.715)	4.535*** (1.028)	5.203*** (1.316)
BusOrg	−0.0150 (0.675)	−0.611 (0.896)	−0.483 (1.084)
Accounting	1.652* (0.914)	1.063 (1.136)	2.313 (1.454)
Male	0.161 (0.704)	−0.339 (0.874)	−0.782 (1.125)
HistPol	4.988*** (1.262)	4.351*** (1.665)	10.40*** (2.095)
SocStd	−0.906 (1.122)	3.804*** (1.194)	−0.704 (1.848)
BusLang	−1.860 (1.414)	1.748 (1.647)	1.260 (2.090)
SocSocPol	−2.363* (1.240)	−1.185 (1.560)	−0.230 (2.167)
LawBus	4.340*** (1.410)	2.695 (1.797)	7.292*** (2.290)
LawPol	1.817 (1.384)	−0.763 (1.988)	3.471 (2.542)
PolGeog	−0.992 (1.475)	−1.999 (2.181)	1.197 (2.036)
CompBus	−3.246*** (1.188)	−1.347 (1.715)	−6.063*** (1.984)
PhilPol	1.458 (2.774)	2.372 (3.375)	2.673 (3.665)
Constant	29.75*** (2.711)	30.50*** (3.172)	26.02*** (4.046)
Observations	998	998	998
R-squared	0.328	0.323	0.243

Robust standard errors in parentheses.
* $p<0.1$.
** $p<0.05$.
*** $p<0.01$.

is unexplained by the prior characteristics included which may point to issues such as motivation, the study of complementary modules and how the course uses these prior characteristics as explanation for the difference in final grades across the two cohorts.

The third component of the analysis examines differences in grades across the micro and macro components of the course and the results are illustrated in Table 9.

Table 9 indicates that performance at secondary school (*CAOpoints*) is more important for the macro components of the course than the micro, particularly for the economics majors. Also, it is interesting to see that prior economics study is more important for the macro component than the micro across both cohorts of students. Mathematics ability is seen as being the most important determinant of success in both micro and macroeconomics.

Also, by looking at the dummy variable *EconDegree* it can be seen that choosing to major in economics is a significant determinant of grades in macroeconomics but is not a statistically significant determinant of microeconomics grades.

Table 10 investigates whether the chosen specialty of the non-economics majors has an impact on their performance in the course as a whole and broken down into the micro and macro components. Eight dummy variables are introduced to capture the eight main degree programs for the non-economics majors, and results are relative to the non-economics majors in the other degree programs (see Table 2).

Table 10 illustrates the interesting results that of the disciplines chosen by the non-economics majors, those studying in the 'History and Politics' and 'Law and Business' programs do significantly better in this course than any other speciality. Also in both these programs, students are considerably better at macro than micro economics which perhaps reflects their interests in government policy and politics. This is supported by positive coefficients (although not significant) in macroeconomics for 'Politics and Geography' and 'Philosophy and Politics' students.

Conversely, we see that students of 'Computer Science and Business' and 'Sociology and Social Policy' do worse overall than their peers in other non-economics disciplines with the former doing significantly worse in macro than micro and the latter preferring macro to micro, although not significantly. This perhaps reflects more of an interest in firm level issues for 'Computer Science and Business' students while 'Sociology and Social Policy' may have slightly more of an interest in

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economic policy. However, overall the grades for these two groups, are significantly lower than their peers and anecdotal evidence suggests that these two groups of students tend to be the most disengaged with the course compared to their peers, perhaps as they feel it has little application to their chosen degree programs.

6. Conclusions

Teaching economics to non-economics majors has been recognized as a challenge in Economics Departments around the world. The difficulties arise because the course is often compulsory with students not having chosen to study economics and therefore there is a high-level of non-engagement with the subject. This leads to high failure and drop-out rates and a negative first-year experience for both students and instructor. Despite these challenges, however, there remain a large number of students who excel in these courses. This research investigates the factors which influence success in an introductory economics course for non-economic majors and compares these results to economics major students.

The results show that while previous performance at secondary school is a significant predictor of success, it is more important for the non-economics majors compared to the economics majors. Also, having studied economics previously is positively related to success on this course and is more important for the non-economics majors. Gender is insignificant in terms of explaining success on this course.

Having an A in honours mathematics at secondary school level is a large determinant of success across both cohorts of students, but is more important for the economics major students. Mathematics ability is the single largest determinant of success in both the micro and macro components of the course, however, is more important for the macro component.

Choosing to major in economics is seen to be a significant determinant of grades in macroeconomics but is not a statistically significant determinant of microeconomics grades.

For the non-economics majors, 'History and Politics' and 'Law and Business' majors fared significantly better overall than their peers in other degree programs, and both groups had a clear aptitude for macroeconomics compared to micro economics. 'Computer Science and Business' and 'Sociology and Social Policy' students did worse overall with 'Computer Science and Business' students doing particularly badly in macro compared to micro economics.

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