

GENDER DISPARITY IN HUMAN CAPITAL AND UTILISATION RATES OF INTRODUCTORY ECONOMICS STUDENTS

A NWU, Potchefstroom Campus, Study

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Abstract

As many students struggle with introductory economics it is important to understand factors that influence their performance. This paper looks at the effects of human capital and utilisation rates of the 2011 introductory economics (ECON 111) cohort at the Potchefstroom campus of the North West University (NWU) and how these factors relate to the performance of these students. It also investigates the possibility of a gender gap in terms of human capital and utilisation rates. Prior knowledge and education are used as proxies for human capital, while various indicators of student effort are used to establish utilisation rates. Primary data was collected by means of the University's administrative database as well as a multiple choice questionnaire that was distributed to the students, covering demographic and previous academic level information. Cross tabulations were used to analyse the data and to determine whether or not a gender disparity exists amongst ECON 111 students. A Heckman two-step estimation model determines which factors contribute to a student's ability to pass or fail and which factors relate to a higher score for ECON 111. It was established that despite female students exerting more effort on their economics studies, there was no significant gender gap when considering final module marks, though females are more likely to obtain distinctions. The probability of passing introductory economics is improved if a student scores well in his/her high school mathematics and language proficiency test, enrolled for full mathematics and economics at high school and is a English second language speaker (at the Potchefstroom campus). For a student to improve his/her introductory economics mark, it is essential to attend lectures, including participation in class assessments, and make good use of E-fundi.

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1. INTRODUCTION

Economics, despite its abstract nature that mirrors mathematics, is inherent to any B.Com degree and in some cases B.Sc and B.A degrees as well (van der Merwe, 2006:150-151). Economics forms part of the foundation of a commercial degree together with modules such as accounting, business management and human resources (van der Merwe, 2006:150). The primary function of introductory economics is to teach students problem solving and creative skills in order to bridge the gap between existing knowledge and theory (Siegfried, Bartlett, a Hansen, Kelley, McCloskey and Tietenberg, 1991:199-200).

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It is unfortunate that introductory economics is associated with high failure rates and is stereotyped as a problematic and difficult subject. Several studies worldwide conclude that the problem with student performance in economics is due to the influence of underlying factors such as education, prior knowledge, student attendance, lecture effectiveness, tutorial systems and class sizes (Edwards, 2000:457). This paper examines the impact of these underlying factors and establishes whether a gender gap is evident. It also establishes which factors have a significant impact on student success rates.

When grouping these underlying factors into issues that are either inherent (such as previous education) to create a combined factor, human capital, or grouping factors that are more current, such as effort expended in current studies, to form a combined factor to represent utilisation rates, one can start to picture the input-output production function explained by Edwards (2000:458). On the input side, for the purposes of this paper, *human capital* consists out of prior knowledge as captured by previous education results and *utilisation rate* consists out of current student effort. Final module marks, indicating pass or fail in the subject, are deemed to be the output of the production function.

The following section provides a summary of the international and South African literature existing on the subject of first year economics modules and success rates. This is followed by *Section 3* that presents the data which is then analysed in *Section 4* before concluding.

2. LITERATURE BACKGROUND

2.1 The Gender gap

Literature supports the notion of a gender disparity and suggests that female students are less integrated in their economic disciplines than male students (Colander and Holmes, 2007:93). Colander and Holmes (2007) found that when comparing stress levels of economics students in the United States, certain stressors contributed more to the poor performance of females. They found that female stress levels are the highest for coursework, due to the mathematics and graphs that are involved, and are twice as high as the stress levels experienced by males. Female students are three times more stressed than males by their relationship with faculty. Womble (2002: 2) explains that an absence of social support from mentors and faculty contribute to increased stress levels. Stress related to the mathematical requirements of economics indicate that females are more than three times as stressed as males with the possibility that their lack of spatial skills contribute to this stressor.

Higher stress levels result in animosity and lack of confidence and undermine student performance (O'Malley and Stranahan, 2002:589). Stress can influence a student's ability to perform academically because it takes more than just studying to achieve a successful university career (Womble, 2002:1). Stressors such as financial standing, coursework¹, social activities, time management and the relationship with faculty can contribute to a student's ability to perform well (Womble, 2002:1).

Colander and Holmes's (2007) argument is however not the only argument. Some analysts have looked to psychological literature for the reason behind the gender differential (Lumsden and Scott, 1987:365). These studies indicate that females develop higher verbal skills than males yet have less developed spatial skills (O'Malley and Stranahan, 2002:590). Spatial skills involve an individual's perception of a situation, the mental rotation of objects and the location of figures (Linn and Petersen, 1985:1479). These are important skills for understanding and interpreting graphs.

In keeping with their better developed verbal skills, females perform better in essay type questions where they can demonstrate this advantage. Males on the other hand have a comparative advantage in quantitative skills². Multiple choice questions involve compound applications and research suggests that males are better equipped to use their knowledge to analyse questions (Lumsden and Scott, 1987:370). Essay type questions involve a wide range of knowledge and the memorisation of facts; female students perform better due to their writing and synthesising skills (Lumsden and Scott, 1987:370). Lumsden and Scott (1987) report that females score between three and four per cent lower than males in multiple choice tests and seven per cent higher in essay type questions (Lumsden and Scott, 1987:370).

In order to understand the gender differences in economic or mathematical achievement and ability, researchers contend it is critical to identify the specific areas and cognitive skills where males and females differ in order to maximise their ability to perform academically (Gierl, Bisanz and Boughton, 2002:27-28).

These factors are relevant to the way that knowledge is assessed in tertiary institutions in South Africa today: larger student numbers necessitate that essay questions are removed and that assessments rely on shorter questions as well as multiple choice options to facilitate the marking. If

¹ Coursework is defined by the English dictionary as: "...work carried out by students at university/high school/middle school, but which is assessed separately from their final exams, i.e. assignments, book reports, experimental work or research.

² Scientists found that a region in the brain called the inferior-parietal lobule (IPL) is significantly larger in males than in females, and the size of the IPL correlates with mathematical abilities (Sabbatini, 2001:2).

the literature holds, the current tertiary undergraduate assessment system is biased in favour of male students.

2.2 Economic education

International literature regarding economic education involves studies from the United States, United Kingdom and Canada and the main contributors are Palmer, J, Carliner, G and Romer, T (1979), Reid *et al* (1983), Brasfield, Harrison and McCoy (1993), Cohn, Hult, Balch and Bradley (1998), as well as Kirby and McElroy (2003). These studies analyse the main factors of human capital that may have an impact on a student's ability to perform in economics. Factors include a student's previous knowledge of economics and mathematics and whether or not lecture attendance matters. This study expands on these factors by including the utilisation of additional resources.

Results from exposure to economics in high school are not consistent in the international literature. Palmer *et al* (1978) conclude that students who had economics as subject in school do not have a substantially higher level of knowledge than students who did not have economics. Brasfield (1993) on the other hand finds that the basic understanding of economics that students gain at high school level assists in a better understanding of tertiary economics. Reid (1983) contradicts Palmer *et al* (1978) and Brasfield (1993) by finding that high school economics has a detrimental effect on tertiary performance in economics. A possible reason for this is that students gain a misperception of economics and their ability to grasp economics at high school and this translates negatively to their performance in economics at tertiary level.

With regards to mathematics, Cohn *et al* (1998) find that it can elucidate relationships and improve student understanding of economics. Kirby and McElroy (2003) found that lecture attendance contributes to an economics grade rather than contributing to a pass.

The main contributors in the South African literature for economic education are Edwards (2000), Smith and Edwards (2002), Howie (2002), van Walbeek (2004), and van der Merwe (2006). These studies focus on individual factors of human capital and utilisation rates that may have an impact on a student's ability to perform in economics.

Here too previous exposure to economics at high school shows mixed results. Edwards (2000) indicates that having economics in high school will have a positive impact on economic performance since this previous exposure leads to a better understanding of economics, concurring with Brasfield *et al* (1993). Smith and Edwards (2002) on the other hand conclude that students who had

economics as subject in school do not have a substantially higher level of knowledge, agreeing with Palmer *et al* (1978).

South African literature also examines the impact of mother tongue versus second (or third) language instruction. This is because only 8.2 per cent of South Africans use English as a first language (StatsSA, 2001), yet textbooks and instruction at tertiary level are primarily in English. With regards to language proficiency it was found that students grasp new or difficult concepts better in their home language but this does not translate to an ability to express their learning in English (Howie, 2002). A student with an A-symbol or B-symbol in English will score 3.9 percentage points higher in multiple choice questions than students with a C-symbol and less (Smith and Edwards, 2002).

Van Walbeek (2004) finds that if a student performed better in high school mathematics, the likelihood of the student performing better in economics is significantly greater than a student who obtained a C-symbol in mathematics. A student who attends his/her lectures will on average score 7.3 percentage points higher in multiple choice questions and 8.7 percentage points higher in essay type questions (Van Walbeek, 2004).

A previous study at the North West University (Fourie, 2010) finds that factors that impact positively on economic performance are performance at high school, especially in mathematics and English, yet mixed results are obtained for high school economics. The existence of a gender gap is confirmed with females stressing more than males and also putting more effort into their studies despite enjoying it less.

Despite conflicting results, a combination of these factors can have a cumulative impact on student performance. The remainder of this paper focuses on how individual and grouped factors affect males and females respectively and whether the theory regarding better male performance in economics is true for the students currently enrolled in a first year economics module at the North West University, Potchefstroom campus. It also indicates the impact of these factors on the output of all students in this cohort.

3. DATA

This section discusses the data used in the empirical analysis. The data were obtained from the university's student administration database for the 1410 registered ECON 111 students and is supplemented by a questionnaire distributed to the first year students. A basic structure questionnaire was designed to gather primary data to facilitate a comparison of the 2011 first semester cohort of Introductory Economics (ECON 111) at the North West University, Potchefstroom

campus with the findings from literature studies presented in *Section 2* and to determine whether these factors are significantly related to their performance in ECON 111.

The questionnaire was administered at each of the six class groups of the follow-up course in economics, Basic Micro- and Macro Economics (ECON 121), where 831 students completed the questionnaire regarding their previous semester economics - ECON 111. The difference between the 1410 enrolled students and the 831 respondents can be due to various factors: firstly many students are repeating the follow-up module and therefore do not qualify to complete the questionnaire, secondly not all students were present in the classes that administered the questionnaire, thirdly some questionnaires were incomplete or spoiled and could not be used.

Of the 831 students who completed the questionnaire 53.2 per cent were female and 45.7 per cent were male. The majority of the ECON 111 students' home language is Afrikaans (89.2 per cent) and are 18 to 20 years of age (88 per cent). Only 8.2 per cent of students are enrolled in the School of Economics, implying that economics is an auxiliary subject.

4. ECONOMETRIC ANALYSIS AND RESULTS

The purpose of this study is to establish whether gender differences exist as suggested in the literature and whether this supports the assertion that female students are less integrated in economic disciplines (Colander and Holmes, 2007:93).

Firstly a cross tabulation was run on the data and the results are shown in *Tables 1* through *4*. The first three tables look at the input factors: Human capital and utilisation rate. *Table 1* displays the human capital factors that are related to previous academic performance and summarises the academic ability of students. *Table 2* groups the factors that refer to the individual effort expended on the module, the utilisation rate. *Table 3* reports on inherent factors such as stress and experienced difficulties as reported by the students. *Table 4* summarises the output achieved by reporting the final module mark for students participating in the first exam opportunity.

The analyses up to this point only establishes whether significant gender differences exist, not whether these factors contribute to their success rate in economics. *Table 5* presents the results of a Heckman two-step analyses which considers the impact of these factors on the success rate, regardless of gender, but also considers whether gender has an impact on the final mark.

4.1 GENDER DIFFERENCES

Table 1 displays the factors related to human capital and uses a Chi-square measure to indicate the 95 per cent probability of a significant gender difference. Both genders indicate similar results for each factor and there are no significant gender differences except for the high school English final result. The English results indicate that females generally obtain higher scores and support the findings that females have better developed verbal skills. In contrast to the literature there seems to be hardly any difference between genders when looking at high school mathematics or economics.

Table 1: Human capital results

	Male	Female	Total	Chi Sq
TAG				0.536
< 50 %	53.07%	53.87%	53.50%	
50 % - 59 %	21.66%	21.49%	21.50%	
60 % - 69 %	15.16%	16.33%	15.76%	
> 70 %	10.11%	8.31%	9.24%	
GR12 mathematics				0.421
0-39 %	2.22%	1.03%	1.42%	
40-69 %	35.56%	36.60%	4.54%	
> 70 %	62.22%	62.37%	62.27%	
GR12 English				0.017
0-39 %	1.55%	0.68%	1.08%	
40-69 %	35.49%	30.32%	32.61%	
> 70 %	62.95%	68.78%	66.19%	
Economics in high school				0.933
Yes	22.04%	21.71%	21.91%	
No	77.96%	78.29%	78.09%	
Type of mathematics				0.378
Mathematics	85.08%	84.06%	84.42%	
Mathematics literacy	14.92%	15.94%	15.58%	

Table 2: Utilization rates results

	Male	Female	Total	Chi Sq
Lecture attendance				0.010
Hardly ever	6.58%	5.60%	5.35%	
Sometimes	11.05%	7.08%	8.02%	
Mostly	36.32%	42.18%	34.14%	
Always	46.05%	73.45%	51.88%	
Class preparation				0.000
Hardly ever	46.60%	36.43%	41.28%	
Sometimes	39.01%	43.21%	41.16%	
Mostly	11.52%	16.06%	13.92%	
Always	2.88%	3.17%	3.03%	
Making use of study groups				0.563
Hardly Ever	45.34%	47.51%	46.45%	
Just before tests	18.91%	16.97%	17.93%	
Just before tests and exams	25.13%	25.11%	25.15%	
Just before exams	8.81%	7.01%	7.82%	
Always	0.78%	3.17%	2.05%	
Making use of the study guide				0.221
Hardly Ever	48.16%	45.18%	46.40%	
Sometimes	37.37%	36.70%	37.00%	
Regularly	10.26%	14.45%	12.70%	
Always	4.74%	4.36%	4.52%	
Making use of facilitation				0.044
Hardly ever	49.48%	40.27%	44.40%	
Just before tests	13.21%	13.12%	13.24%	
Just before tests and exams	23.06%	28.51%	25.99%	
Just before exams	10.10%	13.80%	12.03%	
Always	3.89%	4.30%	4.21%	
Spending extra hours on ECON 111				0.114
Less than an hour per week	18.39%	16.52%	17.57%	
More than an hour per week	79.27%	82.35%	80.75%	
Making use of notes				0.000
No	55.11%	36.99%	45.52%	
Yes, my own	38.44%	52.27%	45.78%	
Yes, someone else	5.91%	10.50%	8.32%	
Use of E-fundi				0.000
Hardly ever	29.02%	14.03%	21.06%	
Once a week	45.85%	51.58%	48.98%	
Every second day	15.80%	20.81%	18.41%	
Every day	8.81%	13.57%	11.31%	

The gender gap becomes evident in *Table 2*. The raw data indicates that females better utilize academic and social structures as well as spend more time to master the module. Of note is class attendance where almost three quarters of females attend almost all classes and less than half of males do and the use of notes, where more than half the males do not use any form of notes opposed to only a third of female students. Both these factors also indicate a statistically significant gender difference. Other factors that show statistically significant differences between genders are class preparation, facilitation and use of E-fundi³. Factors that are not statistically significant in gender difference include the use of study groups, use of study guides and the extra hours spend studying. This is not to say that these factors do not impact on successful output, but rather that there are not significant differences between the genders.

Females attend more lectures, prepare for class, attend facilitation, made use of notes and made more use of E-fundi than males. It seems that although the relationship between males and females are similar regarding human capital factors, a significant difference exists between males and females regarding utilization rates. In short, females put more effort into their economic module than males.

Table 3: Other factors

	Males	Females	Total	Chi Sq
<i>Difficulties</i>				0.011
Calculations	7.55%	10.45%	9.19%	
Theory	53.39%	39.77%	46.19%	
Graphs	17.45%	17.05%	17.17%	
Calculations and Theory	2.60%	1.82%	2.18%	
Theory and Graphs	8.33%	12.73%	10.64%	
Calculations and Graphs	5.73%	12.73%	9.43%	
All	4.95%	5.45%	5.20%	
<i>Stressful</i>				0.000
Not at all	12.70%	5.80%	8.78%	
Sometimes	51.32%	75.87%	63.06%	
Mostly	35.98%	18.33%	25.87%	

When considering other factors, as presented in *Table 3*, the gender gap is again significant. A third more females find the calculations difficult, and almost twice as many find calculations, together with graphs, difficult, yet females struggle less with theory. Less than six per cent of females find

³ Lecture attendance refers to formal, weekly lectures, whereas facilitation attendance refers to tutorials presented by senior students which are optional to attend. Study groups refer to informal support structures initiated amongst students, and E-fundi refers to the intranet based academic platform that distributes information and access the presentations used by the lecturers.

economics not at all stressful against almost thirteen per cent of male students. Three quarters of female students are sometimes stressed by economics against only half of males.

Table 4 considers whether the final results for the economic module indicates any significant gender differences and shows that despite the higher utilization rates amongst females, there does not seem to be any positive impact on their final results. Although more females obtain distinctions, marginally fewer females pass their economic module. This would suggest that males are more efficient at economics and concurs with international literature findings (see Colander and Holmes, 2007). However, the results are not statistically significant.

Table 4: Final module marks for ECON 111

	Male	Female	Total	Chi Sq
Final ECON 111 mark				0.154
Participation not achieved	5.79%	3.66%	4.63%	
Failed	8.16%	12.36%	10.49%	
Pass: 50-59 %	24.47%	25.17%	24.76%	
Pass: 60-74 %	36.32%	28.38%	31.95%	
Distinction: 75-100 %	25.26%	30.43%	28.17%	

Table 1 indicated no statistically significant gender differences in human capital while *Table 2* indicated statistically significant gender differences in utilization rates as did *Table 3* for factors related to stress and difficulties experienced with the work. *Table 4* negates any statistically significant gender differences in final marks obtained, despite the significant difference in utilisation rates.

4.2 FACTORS THAT IMPACT ON FINAL MODULE MARKS

Table 5 presents the results of a Heckman two-step model to establish which factors impact significantly on the final module mark as well as on a pass or fail result for the module after the first exam. One cannot use an ordinary least squares regression as only students who obtained a minimum participation mark are allowed to write the exam and also some students are only able to write the second exam. The Heckman two-step model avoids possible sample selection bias that may be evident in an ordinary least squares regression when factors could possibly be co-linear.

Table 5: Heckman selection model - Two step estimates

	Coef.	P
Final Mark (Utilisation rate factors)		
⁴ * Gender (females as reference group)	-0.7653	0.358
E-fundi Use Index (based on user rates)	14.2060	0.000
Mark attained in class assessment ⁵		
First	0.7933	0.000
Second	0.1195	0.000
Third	0.1012	0.000
*Lecture attendance		
Hardly ever vs. always	-4.5427	0.012
Sometimes vs. always	-4.5051	0.044
Mostly vs. always	-3.0082	0.001
*Lecture preparation		
Hardly ever vs. always	-0.1968	0.992
Sometimes vs. always	-0.6572	0.730
Mostly vs. always	0.21873	0.916
* Use of study group		
Hardly ever vs. always	0.84085	0.747
Before tests vs. always	0.24581	0.927
Before tests & exams vs. always	0.89423	0.733
Just exams vs. always	0.89423	0.848
* Use of study guide		
Study guide hardly ever vs. always	-2.3486	0.257
Study guide sometimes vs. always	-3.3704	0.103
Study guide regularly vs. always	-4.1263	0.084
Extra hours 0-1 vs. more than 1 hour	0.10130	0.933
* Use of notes		
No Notes vs. own notes	-0.9734	0.265
Someone else's notes vs. own notes	2.1738	0.152
* Facilitation attendance		
Hardly ever vs. Always	-0.7248	0.385
Pass / Fail (Human capital factors)		
TAG ⁶ (score)	0.0287	0.000
Mathematics (score)	0.0466	0.000
*Mathematic Literacy vs. Mathematics	-1.8967	0.000
* English 2 nd language vs. English 1 st language	1.6341	0.000
* High school economics vs. no high school economics	1.1692	0.000

⁴ * Dummy variables

⁵ This refers to unprepared multiple choice tests that test the student's comprehension of the work explained in that specific lecture.

⁶ TAG refers to a language proficiency test completed by all first year students upon entry to the university.

With the Heckman selection model categorical factors are compared to a reference group. The coefficient is therefore relative to the performance of the reference group with a negative coefficient indicating that the reference group scored higher and a positive coefficient indicating a lesser score for the reference group.

Human capital factors indicate a statistically significant contribution to a student passing or failing the introductory economics module. Language proficiency and a good mathematics grade at high school contribute marginally to a student passing ECON 111, but mathematics and high school economics contribute more. The significance of English second language as a predictor of passing ECON 111 could be explained by the nature of the Potchefstroom campus that is primarily Afrikaans speaking and also provides the first years with an Afrikaans text book.

With regards to utilisation rates, only E-fundi use, lecture attendance and performance in unscheduled class tests are statistically significant. Students who attend all the lectures score higher than students who only attend some of the lectures. Those who score higher in the unscheduled class tests outperform those with lesser scores. Students who make more frequent use of E-fundi score better than those who use it less often.

The probability of passing introductory economics is improved if a student scores well in his/her high school mathematics and language proficiency test, enrolled for full mathematics and economics at high school, and is a English second language speaker (at the Potchefstroom campus). For a student to improve his/her introductory economics mark, it is essential to attend lectures, including participation in class assessments, and make good use of E-fundi.

5. Conclusion

This paper investigated the possibility of a gender gap amongst first year economics students at the North West University, Potchefstroom campus. It specifically identified human capital, or inherent, factors as well as factors that contribute to utilisation rates. A gender gap was evident under utilisation rates, but only the high school English score was significantly different under human capital factors. Despite female students exerting more effort on their economics studies, there was no significant gender gap when considering final module marks, though females are more likely to obtain distinctions. This study contributes to the existing South African literature on economics education by including the gender gap analysis.

Using a Heckman two-step estimation model, it is found that human capital factors, based on high school subjects and scores, contribute significantly to students passing ECON 111. This concurs with

the findings of Palmer *et al* (1979), Brasfield (1993) and Edwards (2000) who found that high school economics contributes to success at tertiary level economics. However, it contradicts Reid (1983) and Smith and Edwards (2002) who found that high school economics is either detrimental or insignificant in contributing to success in introductory tertiary level economics. This is also in keeping with the findings of Cohn *et al* (1998) and van Walbeek (2004) regarding the contribution of mathematics to student understanding of economics.

With regards to improving the mark attained in ECON111, it is found that lecture attendance, test scores and E-fundi use improve marks. In terms of lecture attendance this matches the findings of van Walbeek (2004) and Kirby and McElroy (2003).

What is evident from this study is that female students put more effort into their economics studies and few are rewarded with distinctions. It also indicates that despite experiencing some difficulty with the more abstract concepts in economics, female students are capable of coping and performing well in economics and might do better with alternative assessment methods.

Future studies should ideally investigate gender disparities using alternative assessment methods together with methods in popular use at tertiary institutions.

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