

# WHO PROVES TO BE APT IN FINANCE?

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## ABSTRACT

*Since finance relies on mathematical procedures and considerable quantitative skills, this study aims to investigate whether the level of math preparation prior to university has an impact on students' performance in a financial management course. Moreover, it aims to determine if the mathematical ability of the Lebanese business students is gender dependent. The sample consisted of 2,243 students who joined different majors offered by the Faculty of Business Administration and Economics at one Lebanese university adopting the American system of education. Data are accessed from the university's SIS and SPSS was used for analysis.*

*Results show that students whose mathematical abilities are lower and were required to take a remedial math course, performed lower in finance and the difference is statistically significant. Moreover, students' performance in finance is found to be positively and significantly correlated with their performance in statistics, unless they barely pass this statistics course. However, gender seems to have no significant impact on this performance. Furthermore, students majoring in Banking & Finance, Financial Engineering, Accounting or Economics are found to score a statistically significant higher grade in finance, when compared to other business students.*

*No previous studies are found on the factors affecting Lebanese students' performance in finance, and here lies this research's value. The findings have important implications for finance curriculum setters, finance instructors and decision makers in the university admissions office.*

## INTRODUCTION

Effective learning is dependent on a series of building blocks. Students regularly start with a prerequisite course that prepares the ground, to an introductory course that overviews the general concepts of a subject, then to advanced courses that gradually nurture the students' proficiency in that discipline (Hoag & Benedict, 2010). As with many other masteries, finance students sequence from accounting courses to principles level courses in finance, which typically require algebra level mathematical skills, to intermediate courses that focus on advanced technical skill development, and finally to higher level courses that develop increasingly complex applications of financial theories.

In addition, a number of studies find that there are links between mathematical ability and performance in college. Mathematical ability is highly associated with achievement in the sciences, engineering, business, and technology fields, where mathematical language and visual-spatial intelligence is essential and critical (Stavridou & Kakana, 2008). Applying mathematics to problems in physics can improve both the mathematical abilities and the understanding of the physics (Giannetto & Vincent, 2002). The level of mathematical aptitude is also used to explain gender differences in attainment in the sciences and in gender choices of science professions (Bolli, et. al, 1985). Researchers also find that numeracy ability is important for introduction to

statistics courses in psychology (Gnaldi, 2006) and in making health and medical related decisions (Reyna & Brainerd, 2007). Thus, mathematical comprehension, even when it is as simple as understanding fractions, provides fruitful paybacks for individuals.

Given that students from different high-school strands of the Lebanese Baccalaureate Part II (General Sciences, Literature and Humanities, Social Sciences and Economics, Life Sciences) can join the finance major at university, the finance educator's end up facing, in a single classroom, a variety of students' mathematical preparation. Since finance relies on mathematical procedures and considerable quantitative skills, and because finance courses are typically difficult for the average student, this study aims to investigate whether the level of math preparation prior to college has an impact on the final grade in introductory and principles level finance courses. This level of math preparation is measured through the university math entrance examination, according to which the university can issue a conditional acceptance letter asking relatively weak students to take a remedial math course before registering any major course. Moreover, this study aims to find out if gender plays a significant role in determining Lebanese students' achievement in an introductory financial management course, which basically requires good mathematical abilities. In other words, this paper aims to determine if the mathematical ability of the Lebanese business students is gender dependent. Its importance lies in the originality of researching such a topic in the Lebanese market. To the researcher's knowledge, there is no previous study conducted studying the factors affecting the performance of the Lebanese business students in a principles of financial management course.

## LITERATURE REVIEW

Most business students consider quantitative courses the most difficult and challenging courses in the business curricula. The majority dislikes quantitative classes such as calculus, statistics, quantitative analysis, accounting and finance for a number of reasons (Blaylock & Hollandsworth, 2008; Brookshire & Palocsay, 2005; Mukherjee, 2000). Few studies have investigated the performance of undergraduate business students in a quantitative course such as finance and factors influencing their performance in such a course in developing countries in general and in Lebanon in particular. The following review of literature section tackles the relationship between business students' mathematical abilities and their performance at the university, specifically in quantitative courses such as finance, accounting and others; and whether these mathematical abilities and university performance are gender dependent.

### **Mathematical Abilities and Students Performance At The University**

Many scholars have studied the relationship between business students' mathematical abilities and their performance at university. Clauretje and Johnson (1975) find that the male economic major student approaching graduation, with a higher GPA outperforms his peers in an introductory economic class. These findings are replicated in introductory finance courses. Anderson et al. (1994) added that to the above findings, the importance of the student's quantitative background, and the "basic understanding in algebra" (Ballard & Johnson, 2004) in particular, in shaping success in these economic classes. Schuhmann et al. (2005) supported this finding too. Furthermore, Almunais et al. (2014) found that students' background, whether scientific or humanities, affects significantly the students' academic performance. They argued that students' performance with a scientific background is better than students' performance with

a humanities background. This finding could be partially explained by the fact that students with a scientific background tend to take more and higher-level mathematics classes in high school, which likely helps them perform better in quantitative courses such as accounting and finance.

Evans and Farley (1998) showed that grades in high school mathematics are positively and significantly related to student performance and determinants of success. This finding is replicated by Gupta and Maksy (2014) who found that the overall GPA and the grade in a pre-requisite financial management course have significant relationship with student performance in an undergraduate Investments course. Out of the four self-perceived ability factors used in the study (writing, math, reading, and listening) only the math ability has positive relationship with student performance. Hoag and Benedict (2010) indicated that the level of math skills one brings to college has a statistically and economically significant effect on the performance in the economics course. Furthermore, Alfian and Othman (2005) studied the performance of business and accounting students in Malaysia and found that mathematical knowledge obtained in high school is crucial in promoting their performance at college. In identifying the potential factors that might affect accounting students' performance in Saudi Arabia, Al-Twaijry (2010) found that mathematical skills have a significant impact on students' performance. Moreover, findings revealed that the weekly registered hours' load has no negative impact on the students' performance. In Turkey, Uyar et al. (2011) established a regression model proving that perceived "difficulty in accounting course", "lack of numerical abilities", and "earnings opportunities in other fields" have a significant negative association with performance in the accounting course. Within the same context, Eskew and Faley (1988) and Gul and Fong (1993) suggest that students with strong mathematical backgrounds outperform students with weaker mathematical backgrounds in accounting courses. By contrast, Gist et al. (1996) do not report the same results. This is also reported by Kirk and Spector (2006) who argued that cost accounting performance is insignificantly related to math achievement. Additionally, Guney (2009) suggests that grades in secondary education mathematics are a very strong determinant of performance in accounting but only for non-accounting majors. Moreover, Maksy (2014) found that math ability and GPA had strong associations with student performance in intermediate accounting course at the commuter school only. Rochelle and Dotterweich (2007) showed that class attendance, previous performance in algebra and differential calculus, and overall GPA affect students' success in business statistics. In contrast to Al-Twaijry (2010), Al-Tamimi and Al-Shayeb (2002) concluded that the semester load of a student has a significant influence on his/her performance whereas mathematical skills did not affect this performance.

### **Mathematical Abilities and Gender**

Previously, there has been a significant gender gap in science, technology, engineering, and mathematics (STEM) occupations (Beede et al., 2011), which has been traced to females' lack of interest and motive to undertake professions in these areas (Singletary et al., 2009). The scarcity of female presence in these careers was justified by a difference in natural abilities in these areas, especially in mathematics (Benbow & Stanley, 1983). Khishfe and Bou Jaoude (2016) revealed that Lebanese female students prefer human and caring-type activities while males prefer purely scientific activities and jobs that involve mechanical and technical features. This result endorses previous conclusions (Awan et al., 2011) about girls having a strong inclination toward biology (Uitto, 2014) and professions that have a humanistic aspect while boys had a preference to physics and engineering related jobs where math takes the big share.

Smith and Naylor (1993) examined determinants of degree performance of students leaving UK universities and found that this performance is shaped significantly by personal characteristics. They also revealed that female students' performance is better than the males' one in Biological Science and Humanities and worse in Mathematics and Computing. Thus, granting extra credits to male when it comes to mathematical ability.

On the other hand, research has shown that females are capable of performing just as well as males in the same age group in math (Smith & White, 2002). Devine et al. (2012) found no gender differences for mathematics performance but levels of mathematics anxiety (MA) and test anxiety (TA) were higher for girls than for boys. MA. These results might suggest that girls may have had the potential to perform better than boys in mathematics however their performance may have been attenuated by their higher levels of MA, which is a state of discomfort associated with performing mathematical tasks. Moreover, Aoude (2013) argued that the comparison of the mean grades of Lebanese males and females revealed a mean difference of 2.8987 in favor of males but this difference was not significant. This suggested that Lebanese males cannot be considered better achievers than females in the remedial mathematics courses.

### **Gender and Students Performance at the University**

Burrus and Graham (2013) argued that grades in introductory finance courses are found to be higher for students who are taking more credit hours, a likely practice for the motivated ones; as well as for female students. Moreover, Al-Mutairi (2011) and Almunais et al. (2014) revealed that, in Kuwait, a significant gender difference exists, where female students outperform their male counterparts and married students perform better than non-married ones. The possible explanation for the females' better performance might be traced to the fact that females spend more time in the house studying and they are not involved in social relationship as male students who spend more time in gathering (Dewaniaya). Moreover, Dayioglu and Turut-Asik (2007) and Cheeseman et al. (2006) found that Caribbean female students outperformed their male counterparts. Gender was thus considered as a variable affecting students' performance and success at university. However, Nyikahadzoi et al. (2013) found that male students have a better chance of achieving higher grades in Zimbabwe. This is also shown in the United Arab Emirates, where Al-Tamimi and Al-Shayeb (2002) used a sample of 256 students to investigate the factors behind students' performance in the fundamentals of financial management and found that attendance, gender, and semester load are the most significant variables. They also found that significant gender differences exist, with males outperforming females. In Saudi Arabia, the findings came diverse. Abdullah (2005) used a sample of 126 male and 111 female students to examine the main determinants of student performance in the Principles of Financial Management course. He found that gender has a significant impact and that the performance of the male student depends upon the accounting courses while the female student depends upon economic courses.

Yousef (2013) results with respect to the effects of gender on business students' performance in quantitative courses confirmed the findings of Yousef (2009) who found differences between males and females performance in the operations research course, those of Kaighobadi and Allen (2008) who found that both older and female students tend to earn higher GPAs than younger and male students, the findings of Alfani and Othman (2005) who revealed differences between female and male business students, and the findings of Castagnetti and Rosti (2009) who reported that female students outperformed male students in academia. However,

Brookshire and Palocsay (2005) found no significant difference between male and female students performance in the management science course. Rochelle and Dotterweich (2007) also found that gender has no significant impact on student success in business statistics. Similarly, Byrne and Flood (2008) concluded that gender is not significantly associated with the first year academic performance of accounting students.

## RESEARCH METHODOLOGY

The purpose of this study is to find out if the Lebanese business students' mathematical abilities affect their performance in an introductory financial management course and to find out the factors behind this performance such as gender, subspecialty selected and others. Thus the research questions are formulated as follows:

1. *Does the business student's mathematical ability predict his/her performance in a "Principles of Financial Management" course?*
2. *Is the business student's performance in a "Principles of Financial Management" course dependent on his/her gender and subspecialty?*

The sample consisted of 2,243 students who joined different majors offered by the Faculty of Business Administration and Economics (FBAE) at one Lebanese university adopting the American system of education. These majors are: Accounting, Banking and Finance, Financial Engineering, Economics, Management, International Business Management, Marketing, Human Resources, Health Care Management, Hospitality Management and others. Data are accessed from the student's information system (SIS) of the university, after taking the permission of the key persons. For referencing purposes and ethical reasons and to protect the identities of the participants, codes are created to identify each student's ID, as names are not originally present in the data requested. Thus, anonymity is secured. Moreover, grades are converted from letter grades to numerical ones, going from 60 for a "D" to 97 for an "A<sup>+</sup>".

In order to understand the data collected and analyzed using SPSS, it is important to shed light on the way high school students are admitted to the university. Applicants must pass the Lebanese Baccalaureate Part II (any strand) or its equivalent as identified by the Lebanese Ministry of Education and Higher Education. The selection depends on the following assessment model:

1. *TOEFL, or Writing Section of SAT I, or IELTS or EET (for the university English proficiency requirements)*
2. *SAT I or the university Entrance Test (Aptitude Test)*
3. *High school grades.*

Applicants must accumulate a certain composite score CS required by the FBAE in order to be admitted in its respective majors. This score is calculated by allocating 55% weight to the last 2 years school final averages and 45% to the university Math Aptitude Test or Math for SAT I. When this CS is not as appealing, students are asked to take and pass a remedial math course.

Moreover, the course that the researcher is interested in in this paper is the Principles of Financial Management I. Its description came as follows in the university's catalog: an introduction to the role of the financial manager and to the techniques for obtaining and using funds to maximize the value of the firm. Topics covered include: discounted cash-flow analysis;

valuation methods; risk and rates of return; financial analysis and forecasting; financial planning and control; working-capital policy; cash and marketable securities management. The passing grade for this course is “C”, (i.e. 70/100). And in order to be able to register in this course, business students have to take and pass the following prerequisite courses: “Principles of Financial Accounting II” and “Applied Statistics for Business and Economics I”.

### DATA PRESENTATION AND ANALYSIS

Table 1 presents and defines the variables used in the analysis while it indicates the source for each of them. With a dummy variable, a sample observation without the value of 1 has a value of 0. In this section data are analyzed, using SPSS in order to answer the research questions set earlier.

<b>Table 1 VARIABLES DEFINITION</b>		
Variable type/name	Description	Data source
All	Refers to the entire sample analyzed in this paper	The university's students information system (SIS)
<b>Variable type: continuous</b>		
BAF	Refers to the grade students achieved in the Principles of Financial Management I course	The university's SIS
STA	Refers to the grade students achieved in the Applied Statistics for Business and Economics I course	The university's SIS
ACO	Refers to the grade students achieved in the Principles of Financial Accounting II course	The university's SIS
GPA	Refers to the cumulative grade point average business students achieved upon graduation	The university's SIS
LAG	Refers to the time difference, in terms of semesters, between the ACO and BAF courses.	The university's SIS
<b>Variable type: Dummy</b>		
Gender	Dummy = 1 for male participants and = 0 for female students	The university's SIS
Remedial	Dummy = 1 when the Math remedial course is required and = 0 when students do not have a Math remedial course	The university's SIS
Major	Dummy= 1 when the student's major is Banking & Finance, Financial Engineering, Accounting or Economics, and =0 when his/her major is Management, Marketing, Human Resources, International Business Mgt, Health care Management.	The university's SIS

### Descriptive Statistics

Before the proper investigation starts, it is necessary to highlight some percentages describing the data. Table 2 shows that the gender distribution of the students in this research is as follows: 55.7% out of the 2243 students are male and 44.3% are female.

<b>Gender</b>	<b>Male</b>	<b>Female</b>
	55.7% (1249 students)	44.3% (994 students)
<b>Major</b>	<b>Banking &amp; Finance, Financial Engineering, Accounting or Economics</b>	<b>Management, Marketing, Human Resources, and others.</b>
	46.7% (1045 students)	53.3% (1198 students)
<b>Remedial</b>	<b>Acceptance with a math remedial course</b>	<b>Acceptance without remedial</b>
	44.4% (997 students)	55.6% (1246 students)

Moreover, 44.4% of these business students are asked to take a remedial math course, and the other 55.6% had an unconditional acceptance into the university's business school. Around 46.7% of these students are majoring in a more quantitative program such as Banking & Finance, Financial Engineering, Accounting or Economics; and the other 53.3% have chosen the more qualitative aspects of the business specialty such as Management, Marketing, Human Resources, International Business Management or Health care Management, (Table 2).

### **Factors Affecting Students' Performance in The Principles Of Financial Management Course**

Regression is run in order to predict the students' grades in the finance course, where gender is the independent variable. The reported evidence in Table 3 suggests that female students tend to have 78.96 on average, as their final grade in BAF, whereas the male students' grade in the same finance course is 77.23 on average. Although the difference between these two averages is relatively low, it is highly significant with a coefficient of 0.00, significant at  $p < 0.05$  (Table 3). This result supports Burrus and Graham (2013) findings with respect to female students achieving higher grades in introductory finance courses. Indeed, these were the univariate results, not controlling for other factors. However, in a multivariate context, the gender effect becomes statistically insignificant, as discussed below.

<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>Prob.</b>
Intercept	78.96	0.249	0
Gender	-1.729	0.334	0

The Censored Normal (TOBIT) in Table 4 shows that students' grade in STA and their grade in ACO are significantly and positively related to their grade in BAF. For instance, on average, a 1-point increase in ACO grade is associated with future 0.30-point increase in BAF grade. No wonder, as the concepts in Finance are built, to a great extent, on knowledge acquired in the Accounting courses. In turn, a 1-point increase in STA grade is, on average, associated with future 0.18-point increase in BAF grade. Moreover, students who are required to take a remedial math course performed lower in the BAF course and the difference is statistically significant ( $p\text{-value}=0$ ).

<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>Prob.</b>
Intercept	40.09917	1.738079	0
Gender	-0.551979	0.293295	0.0598
ACO	0.299736	0.020648	0
STA	0.181225	0.016797	0
LAG	0.347603	0.072524	0
Remedial	-1.048151	0.304561	0.0006
Major	1.829326	0.307008	0
<b>Akaike info criterion:</b> 6.667677			
<b>Schwarz criterion:</b> 6.688115			

This supports D'Souza and Maheshwari (2010) who reported that the completion of pre-calculus prerequisite influenced the performance of students in the introductory management science course. However, gender seems to have no significant impact on the students' performance in the Principles of Financial Management I course (BAF). In other words, being a female, did not affect the BAF grade up in a significant way (p-value= 0.0598), when a multivariate analysis is conducted and other variables are highlighted.

Furthermore, to examine whether the students' gender moderates the effect of previous academic performance on BAF grade, Table 5 reports a model whereby the interactions of predetermined variables with the Gender specific dichotomous are added to the variables. The reported evidence suggests that gender seems not to affect the influence of the previous variables (STA, ACO, Remedial, Major, LAG) on students' performance in BAF.

<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>Prob.</b>
Intercept	37.52877	2.49106	0
Gender	4.86294	3.438686	0.1573
ACO	0.323935	0.03043	0
STA	0.189629	0.025628	0
LAG	0.359937	0.113451	0.0015
Remedial	-1.532035	0.476124	0.0013
Major	2.206607	0.457991	0
ACO*Gender	-0.048747	0.041455	0.2396
STA*Gender	-0.021857	0.034033	0.5207
LAG*Gender	-0.01992	0.147354	0.8925
Major*Gender	-0.63178	0.616769	0.3057
Remedial*Gender	0.868775	0.61943	0.1608

STA, ACO, LAG have a non-linear effect on students' performance in BAF, significant at  $p < 0.05$  (Table 6: ML - Censored Normal (TOBIT)). A deeper analysis of the impact of

students' performance in STA on their achievement in BAF, showed that students' performance in BAF decreases when students' grades in STA increase up to 64/100, to go again and increase after this threshold. ( $0.007105x^2 - 0.90899x$ , so  $0.01421x - 0.90899 = 0$ , so  $x = 0.90899/0.01421 = 63.97$ ). However, it is worth noting here that 60 is the passing grade for this statistics course. Thus, the researcher argues that the relation between students' performance in this statistics course and their achievement in the finance one is positive, unless if they are extremely weak and barely pass the statistics course.

Indeed, instructors of statistics are generally educated as mathematicians and consider statistics as a subfield of mathematics rather than as a mathematical science. Students view this too (Hannigan et al., 2013). However, there is a growing acknowledgment that statistics, while thoroughly related to mathematics, is not a subfield of mathematics but a distinct discipline (Moore, 2004) that has been developed to tackle practical problems in real-life situations and to deal with data in a context. However, what is common is the quantitative and numerical literacy required by the one dealing with both. Results showed that students who are required to take a remedial math course performed lower in the finance course, and their performance there is positively linked to their performance in the statistics course, although beyond 64, which is a very low threshold anyway. These findings support previous researches conducted in different quantitative business disciplines such as finance, accounting and economics, and in different countries such as Malaysia, Saudi Arabia; and which concluded that students' mathematical skills and knowledge is crucial in promoting their performance at college (Alfan & Othman, 2005; Al-Twaijry, 2010; Hoag & Benedict, 2010).

<b>Variable</b>	<b>Coefficient</b>	<b>Std. Error</b>	<b>Prob.</b>
Intercept	150.5857	16.38184	0
Gender	-0.429637	0.289644	0.138
ACO	-1.42964	0.388061	0.0002
STA	-0.908993	0.212397	0
LAG	0.775676	0.157788	0
Remedial	-1.044931	0.3009	0.0005
Major	1.889999	0.302914	0
ACO*ACO	0.010577	0.002395	0
STA*STA	0.007105	0.001385	0
LAG*LAG	-0.060052	0.018551	0.0012
<b>Akaike info criterion</b>		6.641606	
<b>Schwarz criterion</b>		6.669708	

Moreover, results in Table 6 reveal that the BAF grade increases when the time lag between the ACO course (a prerequisite course for BAF) and the BAF increases till reaching a maximum point of 6.45 semesters, before it starts to decrease again. Thus, students should be advised not to postpone taking the finance course more than 6 semesters after taking the ACO course, as their performance will be affected negatively afterward. This finding has an implication on the way students' maturity at the college is shaping their performance in the

finance course, as one can simply expect that the higher is the time lag, the lower is the performance in a course counting on an accounting course as a prerequisite. However, what has been found denied the expectation, at least when the time lag is less than 6.45 semesters on average. Kirk and Spector (2006) revealed that cost accounting students perform better in the first finance course if they postpone finance until after taking cost accounting. Although both courses are quantitative in nature, their contents do not match or at least the students' financial skills will not be enhanced after the cost accounting course. A plausible explanation of the better performance may be traced to the students' maturity, thus supporting the results obtained in this research. Maturity here does not solely refer to the advanced state of wisdom and looking into one's self interest by investing more time in studying and adopting other beneficial educational habits; but also refers to the knowledge gained in the area of specialization during this time lag, through the students' exposure to different topics taught in the different courses making up the business curriculum. Economic courses and other business Math courses, for instance, might be Finance-relevant, and help boost students' financial skills and consequently lead to better performance. It is worth noting here that the lag discussed above is substantially large, cause the sample analyzed in this study includes all business majors, where 53.3% of the business students are majoring in a qualitative subspecialty such as management and human resources management for instance, where the BAF course can be postponed until near graduation somehow, as they are not asked to take further finance courses that do require this BAF as a prerequisite. Thus, such students are to benefit from the recommendation advanced earlier; as in the other finance related business majors, students are somehow obliged to take the BAF course earlier since it opens their chances to take other numerous advanced finance courses. When the researcher decided to check the optimal LAG point taking into account the data of the finance and other quantitative majors only; she was surprised to pinpoint in the sample, observations with large figures for this LAG as well, which could be due to students who have quit the university for some time, then came back again to pursue their studies. The researcher does not want to exclude these outliers from the analysis, as the optimal LAG figure found earlier could be considered a motivating tool for those who are obliged to quit the university for some time in order to work and save some money for tuition fees, or to give a child birth, or due to any other circumstances. The findings here implicitly encourage business students to join again the program they already quit for a short period.

The researcher wanted to check if the optimal points found out earlier depend on gender. Thus, TOBIT with a nonlinear specification is employed in order to examine if the gender moderates the nonlinear effects of STA, ACO and LAG.

Variable	Coefficient	Std. Error	Prob.
Intercept	146.4908	16.59456	0
ACO	-1.569015	0.436079	0.0003
STA	-0.660189	0.300598	0.0281
LAG	0.659113	0.257956	0.0106
Remedial	-1.518606	0.470116	0.0012
Major	2.210869	0.452317	0

ACO*ACO	0.011531	0.002691	0
LAG*LAG	-0.043464	0.031648	0.1696
STA*STA	0.00546	0.001938	0.0048
ACO*Gender	0.411324	0.387428	0.2884
STA*Gender	-0.432792	0.403605	0.2836
LAG*Gender	0.173931	0.326463	0.5942
Major*Gender	-0.571109	0.609011	0.3484
Remedial*Gender	0.834349	0.612019	0.1728
ACO*ACO*Gender	-0.00272	0.00245	0.2669
STA*STA*Gender	0.002866	0.002633	0.2765
LAG*LAG*Gender	-0.024206	0.039078	0.5356
<b>Akaike info criterion:</b> 6.645232			
<b>Schwarz criterion:</b> 6.691218			

Results in Table 7 reveal the non-significance of the nonlinear interactions individually. Moreover, the Wald Test, with the joint restriction that all the nonlinear effects related to gender are jointly equal to zero, is implemented. The statistical output shows that the null hypothesis should not be rejected. Consequently, the researcher concludes that the optimal points discussed earlier (STA grade: 64/100; ACO grade: 68/100 and LAG: 6.45 semesters) do not depend on gender.

### The Null Hypothesis

$$\begin{aligned}
 Coeff_{ACO \times Gender} &= Coeff_{STA \times Gender} = Coeff_{LAG \times Gender} = Coeff_{Major \times Gender} \\
 &= Coeff_{Remedial \times Gender} = Coeff_{ACO \times ACO \times Gender} = Coeff_{STA \times STA \times Gender} \\
 &= Coeff_{LAG \times LAG \times Gender} = 0
 \end{aligned}$$

Thus, the Wald Test results further indicate that gender has no significant role in moderating the effects of previous students' performance on BAF grades. More specifically, the restriction that the moderating effects of gender are jointly equal to zero, is not rejected as reported in Table 8 with an F-statistics value of 1.013158 and a probability of 0.42361. Results confirm one more time that gender has no impact on the students' performance in this introductory finance course.

<b>Table 8</b>			
<b>THE WALD TEST CHECKING THE MODERATING EFFECT OF GENDER</b>			
<b>Test Statistic</b>	<b>Value</b>	<b>df</b>	<b>Prob.</b>
F-statistic	1.013158	(8, 2218)	0.4236
Chi-square	8.105263	8	0.4233

The findings here contradict some results in other Arab countries. In the United Arab Emirates, for instance, Al-Tamimi and Al-Shayeb (2002) found that significant gender differences exist, with males outperforming females in the fundamentals of financial

management course. In Saudi Arabia, Abdullah (2005) found that gender has a significant impact and that the performance of the male student in the principles of financial management course depends upon the accounting courses while the female student depends upon economic courses. However, when it comes to Lebanon, the results confirm what Aoude (2013) argued with respect to the absence of a significant gender impact on the Lebanese students' performance in remedial mathematical courses. Thus, this finding helps explain to a great extent, the absence of a significant Lebanese gender effect in the BAF performance if one assumes that this finance course benefits from the students' mathematical abilities.

Model	Unstandardized Coefficients		Stand. Coefficient	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta		Lower Bound	Upper Bound
1 (Constant)	76.122	.222		.000	75.687	76.557
Major	4.019	.324	.254	.000	3.383	4.655

Grade in *BAF* =  $76.122 + 4.019 * Major$ . Thus, a student majoring in Banking & Finance, Financial Engineering, Accounting or Economics achieves, on average, 4.019 extra points over 100, in the finance course when compared to any other business student (Table 9). The predicted value has a mean of 78 with a standard deviation of 2.006. This difference in the final grade attained is statistically significant, with p-value= 0. Durbin-Watson value is equal to 1.917. Moreover, Adjusted R Square is equal to 0.064, thus Major explains 6.4% of the variation in the business students expected grade in the finance course. Results confirm the findings of Yousef (2011) who reported that the performance of Emirati business students in quantitative courses differed across business majors, high school major and gender, among others. Brookshire and Palocsay (2005) also highlighted the impact of the students' business major on their performance in quantitative courses. More specifically, Yousef (2013) assumed that students majoring in accounting, finance, and MIS might perform better in quantitative courses than those majoring in management and marketing.

Model	Unstandardized Coefficients		Stand. Coefficient	Sig.
	B	Std. Error	Beta	
1 (Constant)	2.995	.016		.000
Gender	-.320	.016	-.366	.000
Major	.119	.016	.137	.000
Remedial	-.221	.016	-.252	.000

Parsons et al. (2009) found, through the regression model he developed, a 5% increase in mathematical marks for each increase in the students' confidence level. Thus, better qualifications were shown to be associated with better university marks and students' confidence also produced a remarkable connection with the marks achieved. This might explain the results just reported that students majoring in banking and finance for instance, have a higher

confidence level in their ability to perform better than their colleagues in the finance courses; consequently achieving higher grades.

### Factors Affecting Students' Cumulative GPA upon Graduation

The researcher checked the factors affecting business students' GPAs and tested if this non-significant gender effect is still dominating on GPA. A regression analysis is run to predict the students' GPA when the independent variables are Gender, Major and Remedial math course required. It is found that  $Expected\ GPA = 2.995 - 0.320 * Gender + 0.119 * Major - 0.221 * Remedial$  (Table 10). The Adjusted R Square is found to be 0.246, thus these independent variables explain 24.6% of the variation in the business students' GPAs, with male performing lower than female. Thus, a female business student achieves 0.341 extra points on GPA upon graduation when compared to any other male business student. This difference in the GPA attained is statistically significant at a confidence level of 95%, with  $p\text{-value} = 0$ . The Durbin-Watson statistics is equal to 1.904, value found to be very close to 2, indicating that the assumption of independent errors is tenable. These results match previous findings in other Arab countries, such as Kuwait (Al-Mutairi, 2011 and Almunais et al., 2014) where female are found to outperform male students; and in Caribbean islands as well (Cheeseman et al., 2006 and Dayioglu & Turut-Asik, 2007), but contradict what had been found by Nyikahadzoi et al. (2013) with respect to male students having a better chance of achieving higher grades in Zimbabwe.

Being accepted into the business program without a remedial math course indicates, in one way or another, the good students' performance in high school, and more specifically, the likelihood that these students have a scientific high school background. Yousef (2013) found that Emirati students who are majoring in sciences in high school might perform better than those majoring in arts. This confirms the results here that show the negative and significant impact of the "remedial" on the Lebanese business students' overall performance, as students with a scientific high school background are less likely to be asked to take a remedial math course at university. Moreover, findings support Richter (2006) who found that, among the factors taken into account, high school grades were the most important predictors of the academic grade performance of students enrolled in a Business Administration program at a German university.

When results pertaining to "Major" are analyzed, the regression revealed that the expected GPA increases by 0.119 when the student business major is quantitative in nature. Thus, finance, financial engineering, accounting, or economics business students achieve 0.119 extra points on GPA upon graduation when compared to students in other majors under the business umbrella. This difference in the GPA attained is statistically significant at a confidence level of 95%, with  $p\text{-value} = 0$ . When it comes to the third variable, "Remedial", it is found that students who had a conditional acceptance into the Faculty, with respect to math, achieved 0.221 less points in their cumulative GPA upon graduation. This difference is statistically significant at a confidence level of 95%, with  $p\text{-value} = 0$ . To conclude, results show that, for instance, a female finance major student who had been accepted without any math remedial into the Faculty, will graduate with 0.66 extra points on GPA, thus with an average GPA of 3.655 over 4.0.

### CONCLUSION

To conclude, this research reveals that Lebanese business students whose mathematical abilities are lower and were required to take a remedial math course, performed lower in an introductory financial management course. And students' performance in this finance course is

positively correlated to their performance in a prerequisite statistics course, a course assumed to require good mathematical abilities. Thus, a strong math preparation, probably from the scientific major that students were enrolled in at high school, is associated with the strongest positive impact on students' performance in finance. This finding may suggest that mathematics skills are essential in promoting the performance of finance students. Consequently, this finding suggests that providing some mathematics courses to high schools humanities majors prior to taking finance classes may improve their performance in finance. This finding has important implications for finance curriculum setters, suggesting that incorporating mathematics course prerequisites for high school students majoring in humanities might bridge the mathematical deficiency observed among such students who later major in finance. For instructors, this study indicates which students might perform poorly in such a quantitative course, and in turn, lead to taking the necessary actions such as arranging extra tutorial sessions to enhance the students' quantitative skills. It may also lead to offering continuous mentoring of these students in order to enhance their performance in these courses. For instance, key administrators in the Faculty of Business can tailor extra problem-solving sessions administered by the Teaching Assistants who are usually pursuing their Masters degree. The admissions office can benefit from these findings too, where the acceptance decisions should shed light on the student's strength and guide him/her to the right major where his/her abilities will flourish. In other words, a student applying for a Finance or a Financial Engineering major, and whose Math Aptitude Test or Math for SAT I's score is not really motivating, should be asked to choose another major under the Business umbrella, such as Management, Marketing or others.

Although the univariate results indicate that female students tend to have a statistically significant higher grade in the introductory financial management course, gender seems to have no significant impact on students' performance in this course in a multivariate context. This finding is not conclusive with respect to judging the gender equality in the mathematical ability of the Lebanese students, as this paper focuses on students majoring in business only. In order to generalize, researchers need to shed light on gender differences in other majors where math really counts, such as engineering and where the number of male students exceeds by far the female ones. Moreover, this paper did not take into account other variables that might affect students' performance such as the part-time jobs that students are undertaking in order to finance their studies, which might leave them with less studying time, and consequently mediocre performance. Another variable neglected in this study is the place where the students live, if it is rural or urban. A city always gives college students a higher chance for leisure activities, whereas, students living in villages are inclined to spend more time at home, and consequently devote more time for studying, which might affect grades positively. Future research should tackle these issues before judging if the mathematical ability of the Lebanese students is dependent on gender or not, although results revealed that a female business student achieves 0.32 extra points on GPA upon graduation when compared to any other male business student. Within the same context, results revealed that a student majoring in Banking & Finance, Financial Engineering, Accounting or Economics achieves 4.019 extra points over 100, in the finance course, when compared to any other business student. The same student, if female, and possessing good mathematical abilities achieves 0.66 extra points on GPA upon graduation.

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