

The Impact of Attitudes of Students in Economics Department towards Mathematics and Statistic Courses on the Success of Econometrics Course

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Abstract

In this study, the impact of attitudes of students attending mathematics, statistics and econometrics courses towards mathematics on attitudes towards statistics and econometrics course successes and the impact of attitudes towards statistics on econometrics course successes were analyzed by using Structural Equation Model, with data collected from a sample of 147 students studying Economics in Gaziantep University. Analyses provided findings that mathematics anxiety and interest in mathematics significantly and positively affect statistics anxiety and interest in statistics. It is also founded that statistics anxiety and mathematics anxiety significantly and negatively affected the econometrics score of students.

Keywords: Attitudes towards Mathematics, Attitudes towards Statistics, Structural Equation Modeling

Introduction

Today, we need to know statistic and its applications to understand and solve the problems we are facing. In order to solve problems and make accurate analyzes, it is necessary to collect and analyze many numeric data related to economy, production and businesses. The knowledge of assessments and rules of the collecting, organizing, presenting and evaluating these data is crucial. The students are taught basic statistics and the meaning of the basic terms, and they also practice evaluation and presentation methods of the data obtained. Learning and understanding the basic statistical terms very well by the students will be very helpful in solving the problems that they encounter in the business life after graduation regardless of the sector they work in. Investigating the factors, that affect success and enjoyment of students in these lessons, is necessary to get better and more productive results.

Data collection and analysis stages in statistics are linked to mathematics. The fear and anxiety of the students towards mathematics is very high (Yenilmez and all Uzun, 2004). The first math anxiety in students primarily causes lack of self-confidence in students (Bursal and Paznokas, 2006) and low motivation (Zakaria and Nordin, 2008). Lack of self-confidence and low motivation starting from primary education also cause students to avoid mathematics and fail at higher education levels (Harper and Daane, 1998; Zakaria and Nordin, 2008). In short, mathematics anxiety and therefore failure are carried to the upper class levels. Most of the research on mathematics anxiety has been done in the United States (Yüksel-Şahin, 2008). In our country, some studies about mathematics anxiety have been done in recent years (Aydın et al., 2009; Bekdemir, 2007). Despite these studies, more scientific research is needed on the mathematical anxiety of the students at every level of teaching in Turkey (Yüksel-Şahin, 2008). Although mathematics and statistics are not directly related, the relationship between them is important. The relationship between mathematics and statistics is a natural result of cognitive processes related to mathematics and statistics. Statistics involve different mental processes and need to be used more with mathematical symbols (Cruise, Cash, & Bolton, 1985). We need to use logic skills as well as mathematical skills to solve statistical problems (DeMaria Mitton, 1987; Zerbolio Jr, 1989). The success in statistics course cannot just be explained with the success or anxiety of mathematics course, but since these two anxieties are widely seen among students, the correlation between them needs to be examined. More research is needed to study empirically mathematics anxiety and statistics anxiety and the relationship between them (Baloglu, 2004).

Moreover, in the Programme for International Student Assessment (PISA), which is a world-wide study first done in 2003 to measure 15-year-old school pupils' scholastic performance and their preparedness to cope with the problems they faced in the information society, Turkish students were in the last rank in mathematics and failed compared to other countries (OECD, 2003, 2004). There are many factors that influence students' school success. Success is known to include cognitive behaviors such as knowledge and skills, non-cognitive behaviors such as personality traits and attitudes. To be an individual who is happy, successful in family and business life and has a good carrier in future, one must learn and succeed in how to rightly assess the data.

As econometrics is a combination of economics, mathematics and statistics, it is thought that students who have interest in statistics and mathematics may have interest in econometrics, and students who have anxiety towards statistics and mathematics may have anxiety towards econometrics.

Therefore, in this study, the impact of attitudes of students attending mathematics, statistics and econometrics courses towards mathematics on attitudes towards statistics and econometrics course successes and the impact of attitudes towards statistics on econometrics course successes were analyzed by using Structural Equation Model, We believe that the results of this study will guide other students and supervisors.

Research Method

In this study which investigates the impacts of attitudes of students of economics to mathematics and statistics courses on the success of econometrics courses, firstly exploratory and confirmatory factor analyzes of variables were done using SPSS.21 and AMOS statistical package programs, and then reliability and correlation analyzes were done and finally, the established model has been tested by using structural equation modeling.

The hypotheses of the research are as follows

H1: Interest in mathematics affects interest in statistics significantly and positively

H2: Mathematics anxiety affects interest in statistics significantly and negatively

H3: Interest in mathematics affects statistics anxiety significantly and negatively

H4: Mathematics anxiety affects statistics anxiety significantly and positively

H5: Interest in mathematics affects econometrics score significantly and positively

H6: Mathematics anxiety affects econometrics score significantly and negatively

H7: Interest in statistics affects econometrics score significantly and positively

H8: Statistics anxiety affects econometrics score significantly and negatively

Sample of the Study and Some Demographic Characteristics

The universe of the research is composed of 400 students from Gaziantep University Department of Economics who have taken Mathematics, Statistics and Econometrics courses. The sample of the research consists of 147 students selected by simple random sampling from these students. The data of the study were collected in 2016.

Of the participants 89 (60.5%) are female and 58 (39.5%) are male. 86 of the students (58.5%) (n: 86) are in the third grade and 61 of them (41.5%) are in the fourth grade.

Scales

The scale measuring the attitudes towards the mathematics course used in the research was taken from the study of Duatepe and Çilesiz (1999) and the scale measuring the attitudes towards the statistics course was taken from the study of (Yaşar, 2014). The questions that measure the attitude of mathematics involve interest in mathematics and mathematics anxiety while the questions that measure the statistics attitude consist of questions on interest in statistics and statistics anxiety. For econometrics success the scores of econometrics course is asked to participants.

Findings of the Research

In this section, information on the exploratory and confirmatory factor analysis of scales, correlation and reliability analyzes, normality test and regression weights of the structural equation model are given.

Factor Analysis of Variables

Exploratory factor analyzes of variables were followed by confirmatory factor analyzes. The exploratory factor analysis results for the mathematics attitude are given in Table 1.

Table 1

Exploratory Factor Analysis of Mathematics Attitude Scale

Items	Interest in Mathematics	Mathematics Anxiety
I want to study mathematics.	.570	
I feel comfortable when dealing with a new mathematics problem.	.781	
It is hard to give up studying mathematics when started to study.	.676	
I don't feel anxious while studying mathematics.	.650	
To deal with mathematics questions that are unfinished in the class gives me pleasure.	.522	
I enjoy mathematics course.	.586	
I do not think I can understand mathematics.		.730
I don't have self-confidence when I need to study mathematics.		.577
Mathematics confuses my mind.		.834
Mathematics is one of the lessons I'm most afraid of.		.755
I feel very desperate when I study mathematics.		.734

KMO test conducted within the scope of this study and the KMO value was determined as .916, thus the sample size is sufficient for factor analysis. As a result of the Bartlett's Sphericity Test, the Chi Square value is 781.417, the degree of freedom value (df) is 55 and Sig. value was found to be ,000 and the data showed the multivariate normal distribution and is suitable for factor analysis.

In this study, to test construct validity of the scale, confirmatory factor analysis was performed and the results are shown in Figure 1. Goodness of fit values for both scales are presented in Table 3.

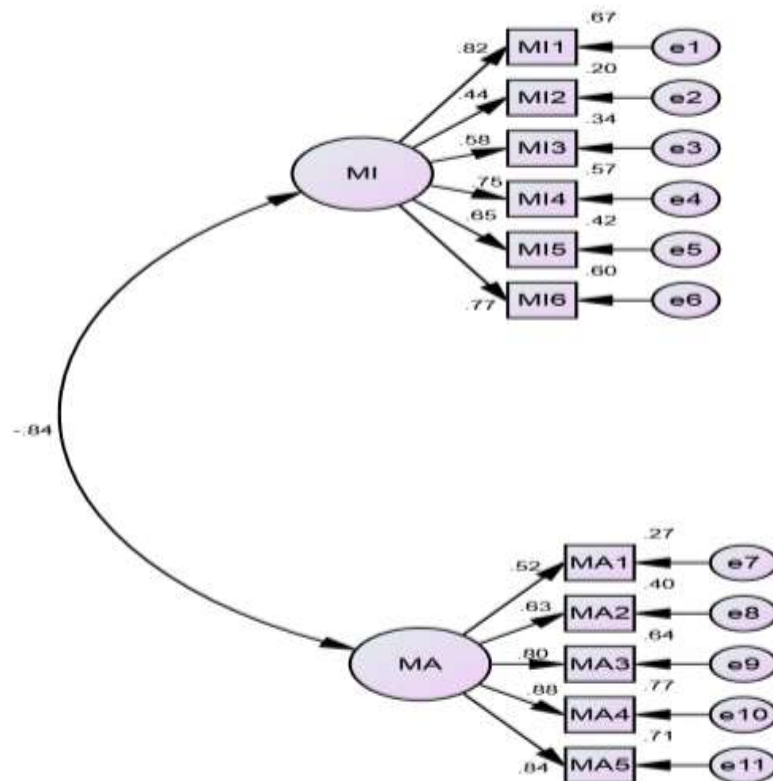


Figure 1. Confirmatory Factor Analysis of Mathematics Attitude Scale

In the study the exploratory factor analysis is done for statistics attitude and the results are given in Table 2.

Table 2
Exploratory Factor Analysis Statistics Attitude Scale

Items	Interest in Statistics	Statistics Anxiety
I think that statistics is useful in reaching very new information	.801	
I think statistics, as an scientific field, is enjoyable	.709	
I love reading researches on statistics	.816	
I have difficulty in understanding statistical concepts.		.757
Nobody can tell me that statistics is easy		.794
Since statistics is difficult I am very bored in classes		.803
I think that very complicated formulas make statistics difficult.		.785

One of the questions, as a result of exploratory factor analysis, regarding interest in statistics; “I deal with topics regarding statistics in my spare time” was removed from the analysis since the Cronbach alpha reliability coefficient was calculated as .626 by reliability analysis and the same value was .709 after the removal of mentioned item from the analysis.

KMO test conducted within the scope of this study and the KMO value was determined as .810, thus the sample size is sufficient for factor analysis. As a result of the Bartlett's Sphericity Test, the Chi Square value is 327.545, the degree of freedom value (df) is 21 and Sig. value was found to be ,000 and the data showed the multivariate normal distribution and is suitable for factor analysis.

In this study, to test construct validity of the scale, confirmatory factor analysis was performed and the results are shown in Figure 2. Goodness of fit values for both scales are presented in Table 3.

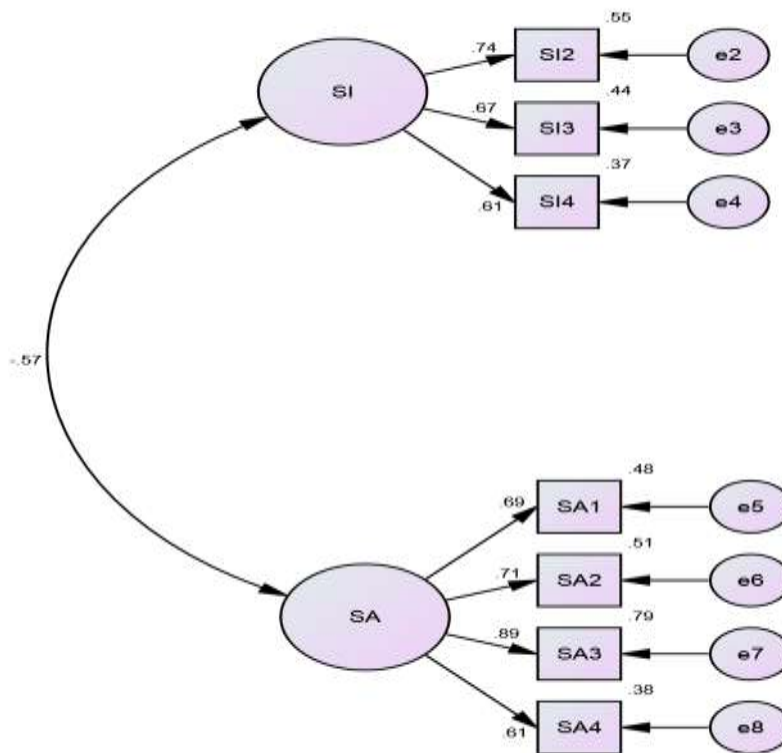


Figure 2. Confirmatory Factor Analysis of Statistics Attitude Scale
 Goodness of fit values obtained through confirmatory factor analysis for both scales are presented in Table 3.

Table 3

Goodness of fit for Confirmatory Factor Analysis

Variable	CMIN	Df	CMIN/ DF≤5	GFI ≥.85	AGFI ≥.80	CFI ≥.90	TLI ≥.90	RMSEA ≤.08
Mathematics Attitude	60.585	43	1.409	0.929	0.891	0.977	0.97	0.053
Statistics Attitude	17.692	9	0.931	0.97	0.943	1.00	1.00	0.00

As can be seen from Table 3 variables provide goodness of fit values.

Correlation and Reliability Analysis

The results of performed correlation and reliability analysis are shown in Table 4.

Table 4

Correlation and Reliability Analysis Results

	Interes t in Math.	Math. Anxiet y	Interest in Statistic s	Statistic s Anxiety	Econometric s Score	Averag e	Std.Dev.
Interest in Math.	(.832)					3.1421	1.00760
Math. Anxiety	-,719**	(.851)				2.5096	1.07923
Interest in Statistics	,378**	-,299**	(.709)			2.9689	.90418
Statistics Anxiety	-,390**	,528**	-,403**	(.818)		2.6795	1.00669
Econometric s Score	,232**	-,298**	.108	-,298**	1	60.673 5	21.5886 7

** Significant at 0,01 level

As can be seen in the Table 4, the Cronbach alpha reliability coefficients, calculated through reliability analysis, are found as .832 for interest in mathematics variable, .851 for mathematical anxiety variable, .709 for interest in statistics variable, and .818 for statistics anxiety variance, and the results show that the variables are reliable. Correlation analysis results show that; mathematics anxiety and interest in mathematics, interest in statistics and mathematics anxiety, statistics anxiety and interest in mathematics and statistics, econometrics score and mathematics and statistics anxieties have negative significant relationship at 0,01 significance level. Interest in statistics and interest in mathematics, statistics anxiety and mathematics anxiety, econometrics score and interest in mathematics have a positive significant relationship at the 0,01 significance level. A significant relationship between the econometrics score and interest in statistics could not be found.

Normality Test

In order to test whether the data show normal distribution, kurtosis and skewness of the variables are examined and the results of the analysis are given in Table 5.

Table 5
Normality Test

Variables	Skewness	Kurtosis
Interest in Mathematics	-.005	-.749
Mathematics Anxiety	.530	-.456
Interest in Statistics	.091	-.137
Statistics anxiety	.295	-.414
Econometrics Score	-.177	-.629

As can be seen from Table 5, since the values of kurtosis and skewness are between -1 and +1, the data shows a normal distribution.

Analysis of Hypotheses with Structural Equation Modeling

In order to test the research hypotheses, the structural equation modeling is formed and shown in Figure 3 and the goodness of fit values are given in Table 6.

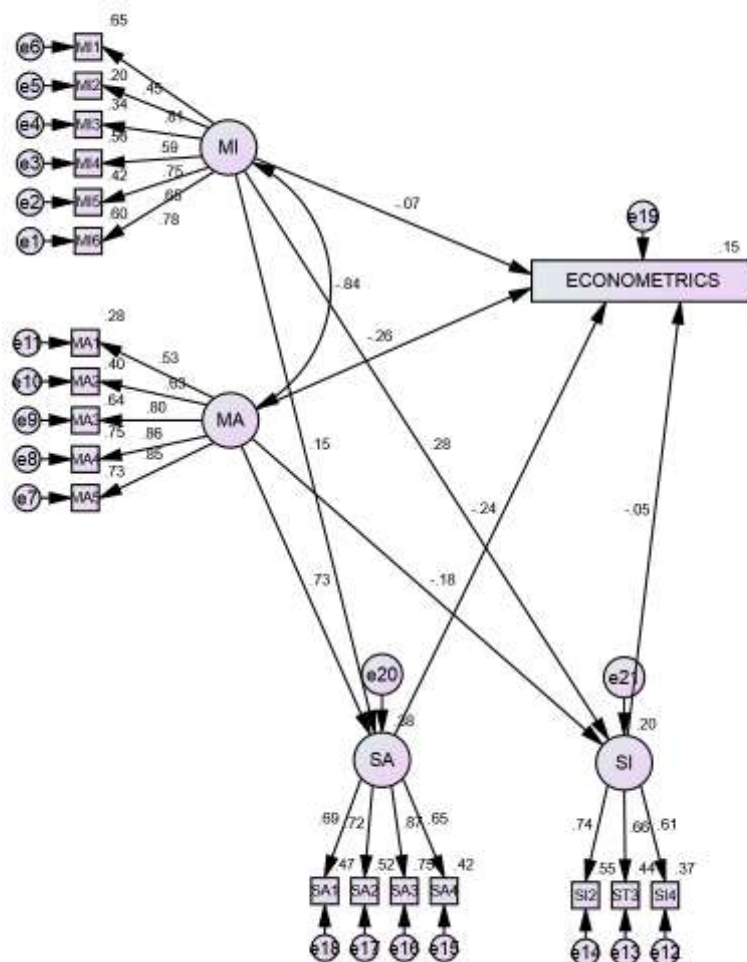


Figure 3. Structural Equation Model

Table 6

Goodness of Fit Values for Structural Equation Model

	CMIN	df	CMIN/ DF≤5	GFI ≥.85	AGFI ≥.80	CFI ≥.90	TLI ≥.90	RMSEA ≤.08
Structural Model	192.283	143	1.345	0.882	0.843	0.958	0.949	0.049

As can be seen in Table 6, which is arranged according to acceptable limits, the structural model satisfies the goodness of fit values.

The regression weights obtained from the analysis of the structural equation model are presented in Table 7.

Table 7

Structural Model Regression Weights

Test Path			Prediction	Std.Error	Critical Ratio	Significance
Statistics Anxiety	<---	Mathematics Anxiety	0.52	0.151	3.448	***
Interest in Statistics	<---	Mathematics Anxiety	0.014	0.141	0.102	0.919
Statistics Anxiety	<---	Interest in Mathematics	0.134	0.148	0.908	0.364
Interest in Statistics	<---	Interest in Mathematics	0.299	0.156	1.923	0.050
Econometrics Score	<---	Interest in Mathematics	-0.04	0.214	-0.185	0.854
Econometrics Score	<---	Mathematics Anxiety	-0.199	0.216	-0.92	0.032
Econometrics Score	<---	Statistics Anxiety	-0.338	0.195	-1.736	0.045
Econometrics Score	<---	Interest in Statistics	-0.129	0.212	-0.609	0.542

As it can be seen in Table 7, findings show that mathematics anxiety affects statistics anxiety and interest in mathematics affects interest in statistics significantly and positively whereas mathematics and statistics anxieties affect econometrics score significantly and negatively. Therefore the hypotheses H1, H4, 6 and H8 are supported.

Conclusion

This study, which investigated the attitudes of economics students towards mathematics and statistics courses and the impacts of these attitudes on econometric course grades by using data obtained from 147 students studying at economics department in Gaziantep University, concluded following findings; interest in mathematics affects interest in statistics significantly and positively, mathematics anxiety affects statistics anxiety significantly and positively, and

this anxiety affects econometrics score significantly and negatively, statistics anxiety affects econometrics score significantly and negatively.

Since econometrics contains information form mathematics and statistics, it is taught at the 3rd Grade in the economics departments. This study is conducted on the idea that students who are interested in mathematics and statistics or have mathematics and statistics anxieties also show the same anxiety and interest in econometrics courses. The findings of this study show that for students to succeed in econometrics course, which is very important for researching in the field of economics, they should overcome their anxieties. For this reason, it is crucial that academicians who teach mathematics and statistics in economics departments should create awareness that whatever students learn in these courses will be used in econometrics courses which a very important course for economics department.

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