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The Impact of Music Instrument Grades on Cumulative Grade Point Averages at Graduation: A Times Series Empirical Approach

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ABSTRACT This study breaks new ground focusing on assessment of individual music instrument courses on Cumulative Grade Point Averages at Graduation by employing the Johansen test for co-integration to investigate a possible long-run equilibrium relationship between CGPA and MUSK instruments courses at Eastern Mediterranean University of North Cyprus. Vector error correction models have also been carried out to investigate any possible short-run dynamic models in sequel of co-integration tests. The study follows Granger's causality analysis among the assessment of individual music instrument courses, Grade Point Averages and Cumulative Point Averages at Graduation. The results for Vector Error Correction Estimations (ECM) also reveal that MUSK2 and MUSK8 coefficients are found to be significant and elastic for the equation of CGPA and the music instruments courses as well as per semester Grade Point Averages and CGPA's respectively.

INTRODUCTION

This study breaks new ground focusing on assessment of individual music instrument courses on Cumulative Grade Point Averages at Graduation by employing the Johansen test (Johansen and Juselius 1990; Johansen 1991) for co-integration to investigate a possible long-run equilibrium relationship between CGPA and MUSK instruments courses at Eastern Mediterranean University of North Cyprus. Vector error correction models have also been carried out to investigate any possible short-run dynamic models in sequel of co-integration tests. The study follows Granger's (Granger 1969) causality analysis among the assessment of individual music instrument courses, Grade Point Averages and Cumulative Point Averages at Graduation. By contrast and in most recent previous study (Tekin 2014) a different methodology has been implemented to predict the Grade Point Averages at Graduation through applying a data mining approach. Methodologically, the study employs the Johansen's (1991) test for co-integration to investigate a possible long-run equilibrium relationships.

The paper is organized in four Parts. Part I is introduction and survey of related literature. In Part II methodology and data sources used in the present study are examined. Part III summarizes the major empirical results and findings, and Part IV highlights the wider conclusions and policy implications for the impact of music instrument assessment on Cumulative grade Point Averages at Graduation at EMU of North Cyprus.

Individual instruments are offered as an applied course in the department of music education and in music teaching programs of the fine arts education departments of universities. With a program determined according to the students' instrument, applied individual instruments course starts in the first semester and continues for 8 semesters all through students' music education. Music teaching program comprises major area courses and education courses. Applied individual instruments course is considered as a core course, which has a significant effect on determining the direction of students' careers upon graduation (Konakci 2010). Major area courses in the music teaching programs can be classified in four categories as subject area courses, education courses, courses of the teaching profession, and the general knowledge courses (Kucukoncu 2003). Furthermore, since the major area courses in the music teaching programs are interrelated with each other, they also have great importance on the way the other courses are run. Studies showing the correlation between music teaching students' success in playing the instru-

ments and their academic success are also found in the literature. These studies have been carried out to compare the types of secondary schools which the students of music teaching program graduated from, genders, and determine the relationships between their success in applied individual instruments and the other courses (Ergün 2006; Tebis 2006; Ece and Kaplan 2008; Ece and Bilgin 2007). In their study aiming to determine significant correlations between the guitar students' success in their applied individual instrument course versus their success in major area courses and general academic success, Ozdemir and Yöndem (2011) found out that there is no significant difference in the age students started playing the guitar and their general academic success. On the other hand, their study also revealed that there is a significant correlation between the age they started playing the guitar and their academic success in applied individual instrument course as well as in their major area courses (academic success grade and university entrance exam).

It is a common view that the research on the effects of general music education on different student groups and different subjects is always kept up-to-date. At present, computers are being used in every aspect of music such as sound analysis and synthesis, composition, musical analysis, music education, and note writing with their features of digital sound and algorithms. Furthermore, statistics have played an important role in drawing meaningful conclusions from complex musical knowledge. In addition, it has been possible to formulate and analyze qualitative data with the help of mathematical and statistical methods used in musicology (Beran 2004). Whereas algorithmic compositions and estimation studies are performed in musicology, studies such as estimating students' success and research investigating causation between courses are carried out in the field of music education.

It is also possible to use statistical data in order to analyze students' academic grades. Tekin (2014) has pointed out that he has been using data mining in order to reveal implicit data by analyzing the present data, processing it, and drawing meaningful conclusions from it. He has also indicated that artificial neural networks (ANNs), support vector machines (SVMs) and similar classification and regression techniques can be used in order to make estimations on the education data. Moreover, in Dagli et al.'s (2009) study, it is stated that implicit data comprises many aspects such as various talents, intuitions, perceptions and values. It is also possible to find various studies in the literature citing that individuals' explicit and implicit knowledge produce new organizational data as a result of interaction within an organization.

The results of the data in the dissertation named 'Attitudes of first and third year students in The Department of Music Education in The Faculty of Education' presented by Karabulut (2009) indicate that as the students get into higher years in their education, their attitude towards their lessons shows a significant change towards the negative. This study can set an example for other studies which will be carried out in the field of music education, and it will be directive in analyzing the causation between students' various successes and their success in applied individual instruments course. On the basis of the information above, this study concentrates on the student grades and averages of the applied individual instrument course. The purpose of this study is to find out whether there is a causative relationship between the graduation degree of the students and the general grade average they received in the term the applied individual instruments course is taken. In addition, the study will investigate whether there is a causative relationship between the grades received from the applied individual instruments course and the averages obtained in the term when this course is taken.

Additionally, this study is important in the sense that it searches the link between CGPA's and the main determinants of individual music instrument courses and Grade Point Averages at each academic term by employing the most commonly used empirical time series methodology developed by Johansen (1991).

For example, the time series analysis methodology developed by Dean and Bailes (2010) can support ongoing work to understand the perception of music in terms of dynamically changing information centre with vector autoregression (VAR) and Granger causality analysis. The study undertaken by Dean and Bailes (*ibid*) also illustrated an alternative approach to that of an assessment of the importance of musical features defined by composer musicologist, particularly in the investigation of the impact of animate and human voice sounds on listeners, perceptions and on their variance.

Another time series empirical study in education by Erdem and Tugcu (2012) implementing Peseran et al.'s (2001) bounds test ARDL modelling approach has investigated the possibility of long-run equilibrium relationship between higher education and unemployment in the case of Turkey. Moreira et al. (2013) have also recently noted that music education is pragmatic and showed promising positive effects on reading skills and academic achievement considering Comlier Avarage Causal Effect (CACE) music-based invention. Janssen et al. (2012) have also implemented a bio-signal approach in their original empirical study to measure listener's personal emotional reactions to their own music as impulse for affective user models.

As a result, the time series empirical approach used in this study (Johansen 1991) is important in the sense that it searches the link between CGPA's at graduation and the main determinants such as individual music instrument courses and Grade Point Averages at each academic term.

METHODOLOGY

This study applies two econometric models, originally developed for this study. The Models are as follows:

Model 1:

$$\ln (CGPA)_{(t-1)} = b_1 + b_2 \ln (MUZK1)_{(t-1)} + b_3 \ln (MUZK2_{(t-1)}) + b_3 \ln (MUZK3_{(t-1)}) + b_3 \ln (MUZK4_{(t-1)}) + b_3 \ln (MUZK5_{(t-1)}) + b_3 \ln (MUZK6_{(t-1)}) + b_3 \ln (MUZK7_{(t-1)}) + b_3 \ln (MUZK8_{(t-1)}) + \varepsilon_t$$

Model 2:

$$\ln (CGPA)_{(t-1)} = b_1 + b_2 \ln (MUZK1GPA)_{(t-1)} + b_3 \ln (MUZK2GPA_{(t-1)}) + b_3 \ln (MUZK3GPA_{(t-1)}) + b_3 \ln (MUZK4GPA_{(t-1)}) + b_3 \ln (MUZK5GPA_{(t-1)}) + b_3 \ln (MUZK6GPA_{(t-1)}) + b_3 \ln (MUZK7GPA_{(t-1)}) + b_3 \ln (MUZK8GPA_{(t-1)}) + \varepsilon_t$$

In Model 1, the *CGPA* is the Cumulative Grade Point Average at Graduation for each student studying in music education department of EMU in academic term *t;* MUZK1 to MUZK8 stand for the course grades earned by the Students for each individual music instrument courses such as violin, guitar, flute, viola, violincello etc. In academic term *T* and E_t is the random disturbance Term. In Model 2, MUZK1GPA to MUZK8GPA stand for the per term grade point averages earned by the students during which they registered for their music instrument courses correspondingly in each academic term *t.* All figures are in natural logarithms.

Data used in this study covers the period 1996 - 2013 and variables of the study are Cumulative Grade Point Average (CGPA) as dependent variable and MUZK1 to MUZK8 and MUZK1GPA to MUZK8GPA as independent variables. Data for each Music instrument courses, Academic Grade Point Averages (GPA) and the Cumulative Grade Point Averages (CGPA) are collected from the EMU Registrars Office (http://newportal.emu.edu.tr) for each individual student.

Unit Root Process

Some data in econometric time series studies can be stationary and some are not. Thus the important differences between the stationary and non-stationary time series should definitely be realized before examining the unit root process. In order to proceed co-integration tests we need to use non-stationary data series. Yet, for short-run dynamic regression estimations, non-stationary data has to be transformed into stationary form and then an error correction estimations can be carried out. If non-stationary data are used for estimations then the results will be spurious. The purpose here is therefore to check the stationarity.

The Augmented Dickey-Fuller (ADF) test was employed over here to test the integration level and the possible co-integration among the variables (Dickey and Fuller 1979,1981) . The results for the ADF unit root test are available in Table 1.

Johansen's Maximum Likelihood Cointegration Approach

Johansen's (1991) Maximum Likelihood Co-integration techniques has been implemented to this study with the help of Eviews-8 Econometrics Software. Evidence of the same order of integration is required for the test of co-integration. The lag selection test have been implemented throughout this study in order to choose the best lag selection before preceding the Johansen co-integration and Vector Error Correction estimations. The results for best lag selections are available in Table 2.

The researcher allows for a deterministic trend because the null hypothesis of an intercept in the co-integrating vectors against the al-

Table 1: ADF Unit Root Test

Endogenous variables[lnCGPAlnMUZK1CR lnMUZK2CR lnMUZK3CR lnMUZK4CR lnMUZK5CR lnMUZK6CR lnMUZK7CR lnMUZK8CR]
Exogenous variables: C
Sample: 1 60
Included observations: 56

Lag	*LogL*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	-79.2919	NA*	1.89-10*	3.1532	3.4787	3.2794*
1	-31.5113	78.4965	6.42e-10	4.3396	7.5947	5.6016
2	30.4655	81.8980	1.57e-09	5.0190*	11.2036*	7.4168
3	116.2688	85.8033	2.50e-09	4.8475	13.9616	8.3810
4	244.7635	87.1928	2.08e-09	3.1513	15.1949	7.8205

Endogenous variables [lnGPA lnGPA1 lnGPA2 lnGPA3 lnGPA4 lnGPA5 lnGPA6 lnGPA7 lnGPA8]
Exogenous variables: C
Sample: 1 60
Included observations: 56

Lag	*LogL*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0	240.2669	NA*	2.09e-15*	-8.259531	-7.934028*	-8.133334*
1	300.9768	99.73781	4.47e-15	-7.534887	-4.279857	-6.272919
2	357.8466	75.14932	1.32e-14	-6.673093	-0.488537	-4.275353
3	430.7922	72.94557	3.31e-14	-6.385434	2.728648	-2.851924
4	573.5660	96.88226	1.66e-14	-8.591643*	3.451966	-3.922361

Table 2: Vector error correction estimations and variables

Variables	*t–stat*
Overall CGPA	-8.000183
MUZK 1CR	-6.205504
MUZK 1GPA	-8.323775
MUZK1CGPA	-8.215849
MUZK 2CR	-8.185966
MUZK 2GPA	-7.564021
MUZK 2CGPA	-8.200577
MUZK 3CR	-6.150547
MUZK 3GPA	-7.641012
MUZK 3CGPA	-7.446813
MUZK 4CR	-7.247081
MUZK 4GPA	-6.653966
MUZK 4CGPA	-7.764006
MUZK 5CR	-7.330990
MUZK 5GPA	-6.612925
MUZK 5CGPA	-7.733644
MUZK 6CR	-7.507766
MUZK 6GPA	-8.796721
MUZK 6CGPA	-9.039765
MUZK 7CR	-8.252588
MUZK 7GPA	-8.205595
MUZK 7CGPA	-8.065299
MUZK 8CR	-8.516045
MUZK 8GPA	-7.144986
MUZK 8CGPA	-8.021072
MacKinnon (1991) Critical Values	
1%	-3.5461
5%	-2.9117
10%	-2.5935

ternative of a linear trend in the variables was rejected. The Johansen co-integration test approach for possible co-integration relationship between the CGPA at graduation and the factors which influence the CGPA's such as the grades earned from music instrument courses (MUZK1 to MUZK8) and the Grade Points Averages in corresponding academic term where music instrument courses have been taken are represented with the following equations:

$$\ln(CGPA_{t-1}) = 1.172 - \underset{(-2.160)}{0.338}\ln(MUZK1_{t-1}) - \underset{(-3.559)}{0.570}\ln(MUZK2_{t-1}) + \underset{(3.485)}{0.567}\ln(MUZK3_{t-1}) - \underset{(-2.319)}{0.485}\ln(MUZK4_{t-1}) + \underset{(5.020)}{1.063}\ln(MUZK5_{t-1}) - \underset{(-2.244)}{0.616}\ln(MUZK6_{t-1}) + \underset{(4.105)}{0.993}\ln(MUZK7_{t-1}) - \underset{(-1.946)}{0.506}\ln(MUZK8_{t-1}) \quad \text{(eq1)}$$

$$\ln(CGPA_{t-2}) = -0.133 + \underset{(5.435)}{1.787}\ln(GPA1_{t-2}) + \underset{(2.825)}{0.426}\ln(GPA2_{t-2}) - \underset{(-2.586)}{0.356}\ln(GPA3_{t-2}) - \underset{(-1.788)}{0.223}\ln(GPA4_{t-2}) + \underset{(3.683)}{0.712}\ln(GPA5_{t-2}) + \underset{(7.694)}{1.131}\ln(GPA6_{t-2}) - \underset{(-2.073)}{0.423}\ln(GPA7_{t-2}) - \underset{(-5.454)}{0.735}\ln(GPA_{t-2}) \quad \text{(eq2)}$$

The Johansen's eigen value trace t-statistics can be used to determine the number of statistically significant long-run relationship between the CGPA and the music courses (MUZK1 to MUZK8) as well as the GPA's in corresponding

academic terms (GPA1 to GPA8). The critical values of Johansen's Maximum Likelihood estimations with eigen values, likelihood ratio statistics and probability values are tabulated in Table 3.

The results in long run equilibrium relationship equations (equ(1) and equ(2)) demonstrates that all coefficient results are found to be significant at 5 percent confidence interval. The elasticity coefficients for individual music instrument course credits in equ(1) reveal that all variables are found to be significant but inealstic at 5 percent significance interval except MUZK5 and MUZK7. The elasticity coefficient for MUZK5 course is found to be elastic (1.063) and the one for MUZK7 is found to be unit elastic. Unit elasticity simply means that when MUZK7 course credits changes by one percent, it causes exactly the equal percentage proportional change in overall CGPA at graduation. The elastic MUZK5 course, however it represents a higher percentage change on overall CGPA at graduation. When there is one percent change in MUZK7 course credits, it causes more than one percent (1.063 percent) change in overall CGPA at graduation.

The results indicated in equ (2) on the other hand represents a similar figure which was expected and all the results are also consistent with theory. The long run equilibrium relationships are validated among the academic Grade Point Averages at the corresponding periods where instrumental music courses (MUZK1GPA to MUZK8GPA) have been taken with overall CGPA at graduation. The results demonstrate that all variables are found to be inelastic but significant at 5 percent confidence interval except MUZK1GPA and MUZK6CPA, which are found to be elastic with 1.787 and 1.131 elasticity coefficients respectively. It is very important to found co-integration relationships before preceding the short-run dynamic model estimations. Dynamic models are all tested with vector error correction approach, that is explained in more detail below:

Vector Error Correction Models (VEC)

As it is discussed in the previous section, if the series are co-integrated, there is a long-run equilibrium relationship between the dependent variable and all independent variables. If there is a co-integration, then vector error correction

Table 3 : Johansen Co-integration Test

Equations	*NH*	*AH*	*Eigenvalue*	*LR test statistics*	*0.05*	*prob*
Lag selection=1						
Model 1 ln(CGPA)=	R=0	r=1	0.6656	287.3712*	197.3705	0.0000
f(lnMCR1,lnMCR2,lnMCR3,	R≤1	r=2	0.5694	223.8275*	159.5297	0.0000
lnMCR4, lnMCR5, lnMCR6,	R≤2	r=3	0.5441	174.9451*	125.6154	0.0000
lnMCR7, lnMCR8)	R≤3	r=4	0.4516	129.3801*	95.75366	0.0000
	R≤4	r=5	0.3658	94.53433*	69.81889	0.0002
	R≤5	r=6	0.3540	68.11312*	47.85613	0.0002
	R≤6	r=7	0.2751	42.76678*	29.79707	0.0010
	R≤7	r=8	0.2242	24.10147*	15.49471	0.0020
	R≤8	r=9	0.1492	3.372847	3.841466	0.0022
Lag selection=2						
Model 2 ln(CGPA)=	R=0	r=1	0.7373	257.4939*	197.3705	0.0000
f(lnGPA1,lnGPA2,	R≤1	r=2	0.5373	181.2868*	159.5297	0.0019
lnGPA3, lnGPA4,	R≤2	r=3	0.4887	137.3549*	125.6154	0.0079
lnGPA5, lnGPA6,	R≤3	r=4	0.4521	99.10987*	95.75366	0.0288
lnGPA7, lnGPA8)	R≤4	r=5	0.3653	64.80627	69.81889	0.1177
	R≤5	r=6	0.2410	38.89212	47.85613	0.2646
	R≤6	r=7	0.1952	23.17031	29.79707	0.2378
	R≤7	r=8	0.1191	10.78955	15.49471	0.2248
	R≤8	r=9	0.0605	3.559191	3.841466	0.0592

Trace test indicates 9 co-integration equations in model 1 and 4 co-integrating equations in model 2 at the 0.05 level .
*denotes rejection of the hypothesis at the 0.05 level.
**MacKinnon (1991) p-values

model (VEC) of CGPA must be constructed and estimated by taking the first differences of the series and taking the first lag of the residuals from an auxiliary regression. An error correction mechanism (ECM) will overcome the problem of spurious regression associated with traditional econometric modelling approaches to estimating CGPA functions with equations 3 and 4.

The Granger's representation theorem proves that, if a co-integration relationship exists among set of integrated series, then a dynamic error correction representation of the data also exists. It is there, a vector error correction estimation (VEC) procedures developed by Charemza and Deadman (1997) were then preceded. The VEC model can be represented as follows:

$$\Delta X_t = \sum_{i=1}^{k-1} \Gamma_1 \Delta X_{t-1} + \prod X_{t-x} + \mu + \varepsilon_{1-4}$$

Where

$$\prod = \alpha\beta'$$

where X_1 is a *px1* vector of stochastic variables, which are integrated order one I(1), Γ represents the intercept term, and the error term ε_t is the white noise. Since X_t is I(1), if a linear combination of these I(1) variables exists that is stationary then these variables are said to be co-integrated. If there is a co-integration relationship between the variables then there is an error correction representation for these variables. Engle and Granger (1987) showed that the impact matrix where < is the vector of adjustments coefficients and ® is the vector of co-integrating relations and both are *pxr* matrices.

Hendry and Ericsson (1990) 'general-to-specific' methodology is used here to find a dynamic error-correction representation. Appropriate lags of the first difference of each variable, a constant term and an error correction term (Σ_{t-1}) are used for short-run dynamic models estimation, which are generated from the Johansen co-integration procedure for each sole equation. The VEC estimation results for short-run dynamic models are available in Table 4.

Table 4: Vector error correction estimates
Standard errors in ( ) and t-statistics in [ ]

ln(CGPA)t-1		*ln(CGPA)T-2*	
C	-0.0018	C	-0.0041
	(0.0240)		(0.0233)
	[-0.078]		[-0.0176]
ln(MUZK1CR)t-1	0.1008	ln(MUZK1GPA)t-1	-0.059
	(0.068)		(0.220)
	[1.475]		[-0.271]
In(MUZK2CR)t-1	-0.1863	ln(MUZK2GPA)t-1	0.204
	(0.0683)		(0.158)
	[1.476]		[1.289]
ln(MUZK3CR)t-1	0.0791	ln(MUZK3GPA)t-1	0.092
	(0.0725)		(0.147)
	[1.0914]		[0.627]
ln(MUZK4CR)t-1	-0.0244	ln(MUZK4GPA)t-1	0.352
	(0.0752)		(0.197)
	[-0.3244]		[1.783]
ln(MUZK5CR)t-1	-0.04484	ln(MUZK5GPA)t-1	-0.330
	(0.0764)		[-0.5864]
	(0.244)		[-1.349]
ln(MUZK6CR)t-1	-0.0252	ln(MUZK6GPA)t-1	-0.257
	(0.0728)		(0.240)
	[-0.3458]		[-1.071]
ln(MUZK7CR)t-1	-0.1474	ln(MUZK7GPA)t-2	0.449
	(0.1027)		(0.237)
	[-1.4358]		[1.886]
ln(MUZK8CR)t-1	0.1729	ln(MUZK8GPA)t-1	0.303
	(0.0889)		(0.183)
	[1.9448]		[1.649]
ε_t-1	-0.026	ε_t-1	-0.163
	(-0.073)		(0.2214)
	[-0.365]		[-0.736]

Estimated short-run dynamic equation models (VEC Models) are constructed below which shows that overall estimations are significant. Some of the coefficient signs are found to be insignificant as not expected. Therefore, the insignificant elasticit coefficients were omitted from the interpretations. Some of the t-statistics have also not been found significant either at 5 or 10 percent significance level.

Granger Causality Analysis

Considering the equation shown below as in the Figure 1, the empirical findings of Granger causality analysis with two lags included in the model reveal that there are unidirectional causalties running from MUZK2, MUZK8 credits points toward CGPA at graduation. Besides that, there are unidirectional causalities running from MUZK1, and MUZK2 towards MUZK5 and MUZK6, as well as from MUZK2 towards MUZK5, MUZK7 and MUZK8. Lastly, the results also indicate that there is a bidirectional causality running from MUZK6 towards MUZK7.

Bearing in mind the second equation as can be followed in Figure 2, the empirical findings of Granger causality analysis with two lags included in the model reveal that there are unidirectional causalties running from the GPA earned at the academic semester where MUZK2GPA and MUZK4GPA credit points have been earned toward the CGPA at graduation. Besides that, there are unidirectional causalities running from MUZK1GPA, MUZK2GPA, MUZK3GPA and MUZK5GPA towards MUZK6GPA. Also, there are bidirectional causalities running from and MUZK6GPA towards MUZK3GPA, MUZK5GPA and MUZK7GPA towards MUZK4GPA. Lastly, the results also indicate that there is a bidirectional causality running from MUZK7GPA towards MUZK8GPA.

RESULTS AND DISCUSSION

$$\Delta\ln(CGPA_{t-1}) = 0.0018 - 0.101\ \Delta\ln(MUZK1_{t-1}) + 0.186\ \Delta\ln(MUZK2_{t-1}) - 0.079\ \Delta\ln(MUZK3_{t-1})$$
$$(-1.475) \qquad (2.830) \qquad (-1.091)$$
$$+0.024\ \Delta\ln(MUZK4_{t-1}) + 0.044\ \Delta\ln(MUZK5_{t-1}) + 0.025\ \Delta\ln(MUZK6_{t-1})$$
$$(-0.324) \qquad (0.586) \qquad (0.345)$$
$$+0.147\ \Delta\ln(MUZK7_{t-1}) + 0.172\ \Delta\ln(MUZK8_{t-1}) - 0.026\ \varepsilon_{t-1} \qquad \text{(eq3)}$$
$$(1.435) \qquad (-1.944) \qquad (-0.365)$$

$$\Delta\ln(CGPA_{t-2}) = 0.0004 + 0.059\ \Delta\ln(GPA1_{t-1}) - 0.204\ \Delta\ln(GPA2_{t-1}) - 0.092\ \Delta\ln(GPA3_{t-1})$$
$$(0.271) \qquad (-1.289) \qquad (-0.627)$$
$$+0.352\ \Delta\ln(GPA4_{t-1}) + 0.330\ \Delta\ln(GPA5_{t-1}) + 0.257\ \Delta 1n(GPA6_{t-1})$$
$$(1.783) \qquad (1.349) \qquad (1.071)$$
$$+0.449\ \Delta\ln(GPA7_{t-2}) + 0.303\ \Delta\ln(GPA8_{t-1}) - 0.163\ \varepsilon_{t-1} \qquad \text{(eq4)}$$
$$(1.886) \qquad (1.649) \qquad (-0.736)$$

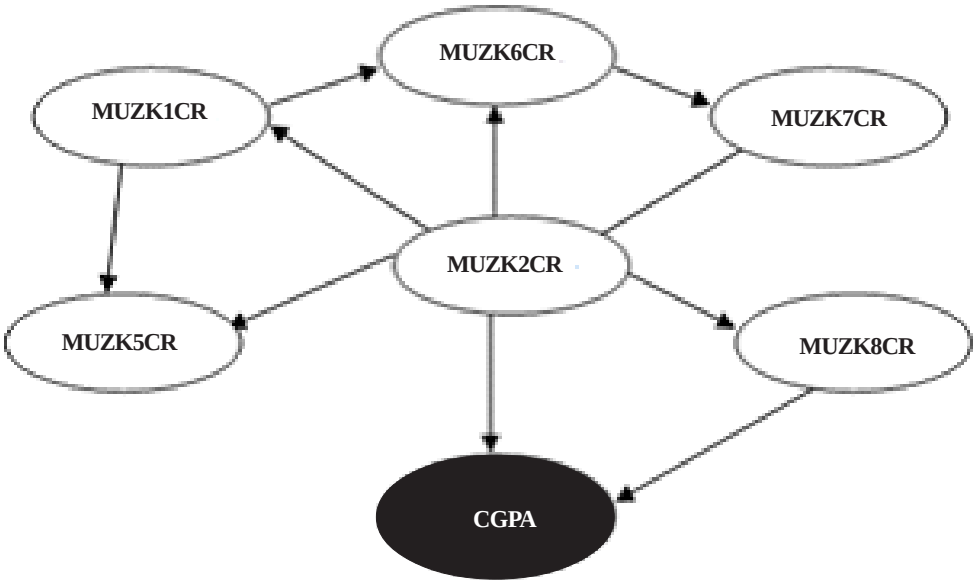

Fig. 1. Granger Causalties among individual music instrument credits and CGPA at graduation

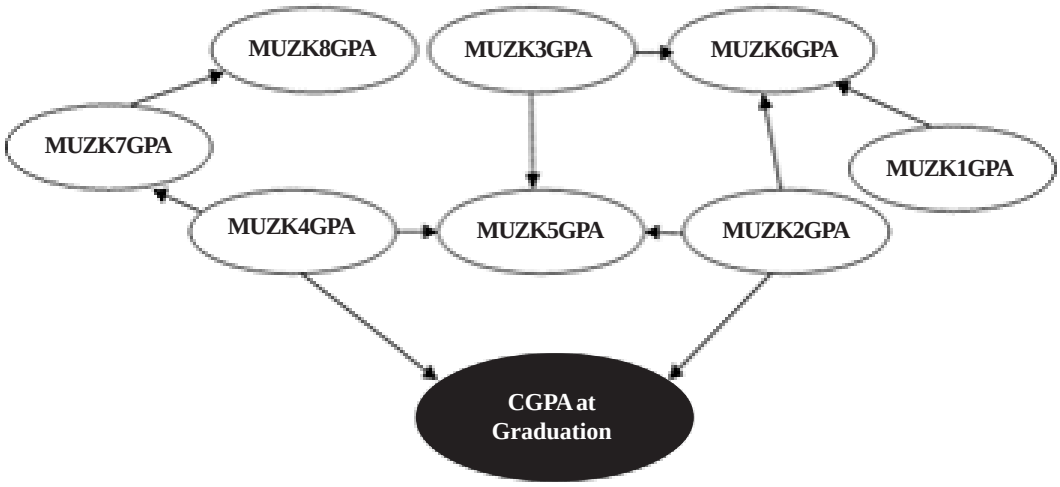

Fig. 2. Granger Causalties between periodical GPA's and CGPA at graduation

When the researcher considers the individual music instrument courses in equation 3, the coefficient results reveal that the music instrument courses taken in the second and eight semester have significant impact on overall CGPA at 5 percent confidence interval. The coefficient signs for these two variables have been found both significant and consistent with the theory. The elasticity coefficient for MUSK2 courses reveal that for every 1 percent increase in the MUSK2 instrument grades will cause 0.186 percent increase in overall CGPA of music education students in the short-run. The elasticity coefficient for the MUSK8 instrument courses has also been found significant, which indicates that for every 1 percent increase in MUSK8 instrument course grades will increase the overall CGPA by 0.172 percent. The results for error correction elasticity coefficient in equation 3 also reveal that about 0.02 percent of the discrepancy between the actual and the long-run, or equilibrium, value of CGPA is eliminated or corrected, however the t-value for the residual is found to be insignificant which is not expected.

In the fourth equation, the elasticity coefficients for the grade point averages (GPA) for the fourth, seventh and eight academic academic terms have been found significant and meaningful at 5 or 10 percent confidence interval. A 1 percent increase in the fourth semester's GPA results at least 0.352 percent increase on the overall CGPA of each student. The results also show more significant impact towards coming to graduation especially during the last two sequel academic semesters before graduation. This is what is expected and may be the causes of minimum requirement for graduation with at least 2:00 CGPA or students who intends to proceed for postgraduate studies are pushing to upgrade their overall CGPA before proceeding the postgraduate applications. According to the reputation of universities, minimum CGPA for postgraduate studies starts from 3.50 out of 4:00. Considering the short-run dynamic model estimations, results for the seventh academic semester the GPA7 have been found significant at 5 percent confidence interval with significant t-statistics (1.886) and shows that for every 1 percent increase in GPA during the seventh academic semester, causes 0.449 percent increase in overall CGPA just before the graduation. The results for the GPA8's corresponding the eight academic semester (last semester) have been found significant at 5 percent confidence interval with significant t-statistics (1.649) and reveals that for every 1 percent increase in GPA's during the seventh academic semester will cause 0.303 percent increase in overall CGPA at the graduation.

Short-term dynamic relationships accounting for departures from equilibrium are also estimated by using an error correction model. The results for short run dynamics of GCPA estimations are given in Table 4. Both of the models have one error correction term. The coefficient

of the error term ε_{t-1} captures the adjustment toward the long-run equilibrium. The error term ε_{t-1} is constructed from the long-run elasticities of CGPA and the credits of individual music instrument courses (MUZK1 to MUZK8) as well as from the CGPA and academic grade point averages (GPA1 to GPA8) in short run dynamic models. The result for error correction elasticity coefficient in equation 3 reveals that about 0.02 percent of the discrepancy between the actual and the long-run, or equilibrium, value of CGPA is eliminated or corrected. The residuals for equation 8 also demonstrates that about 16 percent of the discrepancy between the actual and the long-run has been eliminated.

There is a debate in the literature that general music education has an impact on different group of students as well as on different courses. Regarding this debate Duke et al. (1997) accentuated that piano performance ability plays a significant role in students's academic achievements. Laycock (1992) also reported that there is a low correlation between musical characteristics of students' original compositions with their GPA's. Haynes (1982) emphasized that participation in musical instrument courses have significant impact on GPA's and course grades such as, in mathematics and natural sciences. According to Monico et al. (2015) There is a positive relationship between learning music and academic achievement, although doubts remain regarding the mechanisms underlying this association. After controlling for intelligence, socioeconomic status and motivation, music training is positively associated with academic achievement .Uygun (2013) analyzed the correlations between piano practicing music department candidate students' levels of study and piece versus certain variables and found out that there is a significant correlation between the students' academic success level in applied individual instruments course and the level of the study/piece practiced on the piano. In other words, this study concludes that as the students get to a higher year in their studies, the level of the pieces practiced on piano also increase.

The diagnostic test results for each ECM tests show that all of the ECMs are best fitted with good F-statistics. The diagnostic test results are summarized in Table 5.

The models do not have any autocorrelated terms so there are no autocorrelation problems identified and are simultaneously equal to zero, which the error variance is hemoscedastic. Breusch-Godfrey serial correlation LM test results show that there is not any serial correlation available in any error terms. Low R-square or adjusted R-square values are obtained because of the first differences of the actual series with appropriate lagged values. Considering each R-

Table 5: Summarized Granger causality results

Lags: 2 *Null Hypothesis:*	*Obs*	*F-Statistic*	*Prob.*
Model 1.			
LNMUZK2CR does not Granger Cause LNSONCGPA	58	5.25579	0.0083
LNMUZK8CR does not Granger Cause LNSONCGPA	58	2.45820	0.0953
LNMUZK2CR does not Granger Cause LNMUZK1CR	58	3.82490	0.0281
LNMUZK1CR does not Granger Cause LNMUZK5CR	58	2.93406	0.0619
LNMUZK1CR does not Granger Cause LNMUZK6CR	58	2.36814	0.1035
LNMUZK2CR does not Granger Cause LNMUZK5CR	58	6.51938	0.0029
LNMUZK2CR does not Granger Cause LNMUZK7CR	58	3.30495	0.0444
LNMUZK2CR does not Granger Cause LNMUZK8CR	58	3.71260	0.0310
LNMUZK6CR does not Granger Cause LNMUZK7CR	58	2.56740	0.0862
Model 2.			
LNSONCGPA does not Granger Cause LNMUZK2GPA	58	2.44127	0.0968
LNMUZK4GPA does not Granger Cause LNSONCGPA	58	2.35332	0.1049
LNMUZK6GPA does not Granger Cause LNMUZK1GPA	58	3.86367	0.0271
LNMUZK5GPA does not Granger Cause LNMUZK2GPA	58	2.55871	0.0869
LNMUZK6GPA does not Granger Cause LNMUZK2GPA	58	2.48963	0.0926
LNMUZK3GPA does not Granger Cause LNMUZK5GPA	58	4.00593	0.0240
LNMUZK6GPA does not Granger Cause LNMUZK3GPA	58	2.40211	0.1003
LNMUZK4GPA does not Granger Cause LNMUZK5GPA	58	5.64352	0.0060
LNMUZK4GPA does not Granger Cause LNMUZK7GPA	58	4.05571	0.0230
LNMUZK8GPA does not Granger Cause LNMUZK7GPA	58	4.29688	0.0186

square value, the empirical results suggest that, the statistical fit of each model to the data is satisfactory. JB-Normality results with low probability values indicate that residuals in all equations are normally and independently distributed with zero mean and constant variance. Overall diagnostic results prove that estimations are all satisfactory.

CONCLUSION

This study examines the factors that influence the overall CGPA of the music education students studying at Eastern Mediterranean University of North Cyprus. It is aimed in this study to investigate any possible impact of the success in individual music instrument courses to overall cumulative grade point averages (CGPA) at graduation. The Johansen Maximum Likelihood co-integration estimations revealed positive and significant long run equilibrium relationships between CGPA and individual music instrument courses as well as academic term averages (GPA). For these equations an error correction estimations (ECM) were also implemented where some of the significant elasticity coefficients were indicated for the short run dynamic model estimations with one lag differences. In the literature, such a time series empirical methodology is very rare, especially for measuring the impact of success in individual music instrument courses in music education studies. It is researchers' interest to contribute with this study something original and novel in its entire network, in which it may attract many academics researchers, practitioners and policy makers to benefit from the empirical results of the actual data provided by the Eastern Mediterranean University. Results in summary suggest that, there is a positive impact on the success of individual music instrument courses on the academic cumulative grade point averages of students at graduation. Success in different academic terms has also positive and significant impact on overall CGPA of the music education department students at EMU.

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