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Research Article

Assessing the impact of Class Sizes on the Educational Performance by Business, Management and Commerce students: A Vocational Education and Training Case Study

A. Zarb
Institute of Business, Management and Commerce, MCAST, Malta

Abstract. This empirical paper follows the ongoing economic literature investigating the impact of larger class sizes on the academic performance by students. This study uses secondary data involving 874 business, management, and commerce students who followed an educational course between 2018/2019 and/or 2019/2020 at the Malta College of Arts, Science and Technology (MCAST). Several variations of the proposed Ordinary Least Squares (OLS) regression model have been tested to produce the best possible model intended to test for a scientific relationship between the two variables, whilst controlling for a set of academic and socio-economic characteristics affecting students' academic performance. Results suggest that larger class sizes lead to lower end-of-course scores obtained by students. Furthermore, a statistically significant positive relationship is also evident between the end-of-course score and the students' age, level of studies, and attendance rate. Also, students' family background and the distance from college are proved to be significant indicators to explain changes in the dependent variable. Such findings encourage management teams in schools to design smaller classes to enhance students' academic wellbeing and advance the economic and social development of society.

Keywords: Class sizes, Regression, Wellbeing

1 Introduction

The importance of investing in human capital to improve the quality of the labour force to attain economic development has been acknowledged by several economists and researchers, including the acclaimed Robert Solow (1957). Such relationship is reciprocal since social and economic development within the country is also linked to better educational performances as the government affords to invest more to improve the quality of educational institutions (Maganga, 2016).

1.1 Background to the Subject

The most common technique adopted by employers when hiring workers, especially amongst fresh graduates, is to assess the academic scores obtained by students at the end of the course followed. To this extent, as from the late years of the 19th century, policymakers, teachers and parents have been pushing for Class Size Reduction (CSR) proposals as an attempt to improve the academic performance by students (Rice, 1902). Intuitively, smaller classes should result in better learning outcomes compared to those in larger classes since the educator can provide more individualised attention and classroom discipline is more easily implemented with fewer students. The adoption of this suggestion leads to a substantial increase in the amount of financial resources from the national budget to be spent in education as it requires more classrooms, teachers and potentially schools (Shin et al., 2009). In fact, Mitchell (2001, p.5) argues that,

> "class size reduction is provided to be one of the costliest, if not the costliest, of state-level education policies ever implemented."

Between 2012 - 2018, the Maltese government allocated 14% of the national budget on the education sector, although this cost is increasing every year (Figure 1).

Despite these efforts, latest publications by the OECD compared the performance of Maltese students to that of international learners as part of their Programme for International Student Assessment (PISA) and concluded that

> "students in Malta scored lower than the

Correspondence to: A. Zarb (ayrton.zarb@mcast.edu.mt)

> OECD average in reading, mathematics and science." (OECD, 2021, p.1)

Moreover, although there has been a drastic decrease in the number of youths between 16 - 18 years as being Not in Employment, Education and Training (NEETs), Malta is still classified as one of the least performing countries in terms of early school leavers from formal education. In fact, in 2019, 16.7% of youths between 18 – 24 years left formal education.

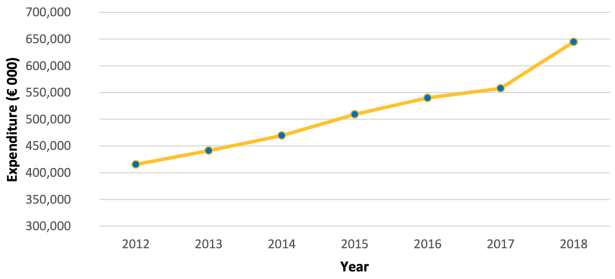

Figure 1: Government expenditure on education

Source: NSO (2020)

1.2 Scope of the Study

The educational debate revolves around the concept of maximising the amount of student learning given finite resources such as class time, number and availability of teachers, and the percentage of financial resources dedicated to education.

The rationale behind this study is to examine whether students perform better academically when assigned in small classes compared to when they are assigned in a larger class. Using data from students who have followed a course at the Institute of Business, Management and Commerce (IBMC) at MCAST between scholastic years 2018/2019 and/or 2019/2020, this paper will showcase a Vocational Education and Training (VET) perspective by forming regression models to compare the end-of-course scores obtained by students assigned in different class sizes, whilst controlling for other determinants that have an impact on academic scores.

2 Materials and Methods

Over the past years, numerous researchers and academics from the fields of education, psychology, and economics (amongst others), have investigated the impact of class sizes (or the teacher-pupil ratio) on the average scores attained by students in their assessments (Ehrenberg et al., 2001; Kukreja et al., 2013; Olufemi et al., 2018; Talib et al., 2012).

2.1 The Impact of Class Size Reductions

Studies about class sizes and student achievements have been performed since the late 1890s (Rice, 1902). Over the years, separate nationwide class reduction programmes have been implemented, namely Project STAR (Student-Teacher Achievement Ratio) in Indiana and Project SAGE (Student Achievement Guarantee in Education) in Wisconsin. Apart from exploring the intended benefits associated with class size reductions (referring to the actual number of students taught by a teacher at a particular time), being an improvement in students' academic performance (referring to the outcome of the teaching and learning process in terms of knowledge and skills); researchers have also examined the external benefits and costs of such reduction programmes.

Each student gets a proportion $\frac{1}{n}$ of the teacher's time and attention. Hence, smaller classes allow for instructional improvements through frequent assessments, more discussions, more writing and more help to individual students. This translates into

> "more individual tailored questions, instructions, examples, referents, etc. (better scaffolding) when responding to individual students." (Zahorik, 1999, p.211)

Furthermore, student socialisation is enhanced by making it easier for teachers to intervene when anti-social and inappropriate behaviour is exhibited (R. Mitchell, 2001). This conclusion supports Krueger's (1999) and Blatchford's (2000) findings that lower achieving and marginalised students benefit more than higher achievers from reduced-sized classes. Such advancements occur since learners,

> "may pay better attention when there are fewer students in the room" (Ehrenberg et al., 2001, p.21)

whilst "managing student misbehaviour is easier" (Molnar et al., 2000, p.165), being fundamental problems faced by educators to maintain order in their classrooms (Goodlad, 2004).

However, contrasting arguments to the above believe that the returns of smaller classes are subtle and unlikely to result in significant differences in students' academic performance (Slavin, 1989). In fact, Pollard and Yap (1995), and Sturm (1997) believe that large classes are correlated with higher academic achievements. R. Mitchell (2001) extends these thoughts and hypothesizes that although better democratic citizens can be created in return, as well as a more productive workforce, there are

no returns in the form of increased test scores. Furthermore, the researcher argues that possible pair and collective interactions decrease as the class size is reduced, an argument that contrasts Epstein et al.'s (1984) earlier conclusions. Also, unlike Ehrenberg et al. (2001), Shapson et al. (1980) firmly believes that there are no statistical differences in student engagement in small vis-à-vis large classes. Such results concur with Jepsen's (2015) view that

> "other education policies, such as tutoring, early childhood programs, or improving teacher quality would be better investments".

2.2 A Review of Past Methodologies

Lab and field experiments were mostly adopted by past researchers to examining the impact of manipulating one independent variable (class size) on the dependent variable (students' test scores). The acclaimed Tennessee experiment in the 1980s involved the random assignment of 11,000 students between small classes (15 students) and regular classes (23 students) (Jepsen, 2015). Results from this field experiment proves that students in smaller classes improve their test scores by 0.048 standard deviations. Opposing results were acclaimed by **Fredriksson2013** whilst adopting the same methodology when finding "little, if any, improvement in achievement". Consistent results were revealed by Shapson et al. (1980) whilst performing a quasi-experiment in Toronto. In this experimental design, students were randomly assigned in classes consisting of 16, 23, 30 or 37 students. Results prove that there are no consistent differences between smaller and larger classes.

In Sweden, results by Chingos (2012) show that on average, a reduction of one student is associated with an increase in test scores of 0.023. Such benefits were also claimed in Gary-Bobo and Mahjoubs (2013) publication on students in France as well as Urquiola (2006) among learners in Bolivia. However, most of the literature using regression models in Europe prove substantial cross-country variations with most countries finding small or no benefits from smaller class sizes (Woessmann et al., 2006). Still, when Urquiola (2006) repeated the study among pupils in Kenya, he uncovers contrasting findings to the above, proving that a class reduction programme from 82 to 44 students per class is not associated with improved academic achievements.

2.3 Determinants Behind Academic Scores

The cross-country research surveyed performed by academicians in various fields of study have identified numerous internal and external classroom determinants that significantly affect the academic score obtained by students in their studies (Maganga, 2016). These group of independent variables can be classified in three:

Category 1. Demograpihic characteristics
Category 2. Academic characteristics
Category 3. Socio-economic characteristics

Dependent variable: Academic score

Most empirical research measure students' academic performances using their end-of-course test scores, being a weighted average value of the accumulated final grades earned during the course (Kukreja et al., 2013; Yigermal, 2017). Using such a holistic approach enables this research to quantify the impact of class sizes on the academic scores attained by learners throughout the course, rather than its individual impact in every subject. This variable will be obtained from administrative records based on the average unweighted mark obtained by each student in his/her studies.

Demographic characteristics

- Student's gender:
  This parameter has been quoted in the literature and proved to be a statistically significant determinant that explains variations in academic performances among students (Alhassan et al., 2019; Hansen, 2000; Weldegiorgis et al., 2011; Yigermal, 2017). Using primary data, analysed under an econometric model, Yigermal (2017) found that males perform better than females ($\beta = 0.1727$). Card and Krueger 1996, Koh and Koh 1999, and Matamande et al. (2013) support this conclusion by proving that males outpace females in their studies. Opposing views to these were presented by several authors, including Tyson et al. (n.d.), Mutchler (n.d.), and Dayioğlu et al. (2007). This gender-gap has been acknowledged in Cheesman et al.'s 2006 study performed among upper division accounting students, when finding that males underperform when compared to the opposite sex, potentially due to females' biology which makes them more mature during teenage years (Pekkarinen, 2012). The last interpretation of this variable was presented in Kukreja and Aali's (2013) publication where gender was not a statistically significant variable to explain changes in students' academic performance.
- Student's age:
  In their studies, Koh and Koh Koh et al. (1999), Hansen (2000), and Aripin et al. (2008) have all acknowledged that the student's age influences the average grade obtained during the course. Furthermore, in their study, Reilly and Woodfield (2009)

found that mature students tend to attain marginally higher grades vis-à-vis their peers, potentially due to being equipped with more life-experience. However, Nyikahadzoi et al. (2013) produced a contradictory argument when finding that younger students outperform their older counterparts with a beta coefficient equivalent to -0.3301. The econometric model produced by Yigermal (2017) produced a non-significant coefficient for this variable, meaning that age was not scientifically important to explain changes in students' scores.

- Minnority students:
  Minority students (foreign students) are taught in an environment different than the one to which they are accustomed in their home country. In fact, Mwinsheikhe (2003) pointed out that students perform better when they are taught using their country's official language, an argument which is supported in Finn et al.'s (2001) earlier publication. Such positive attributes are also acknowledged in Robinson and Wittebols (1986), and R. Mitchell (2001) who proved that class reduction programmes are promising for disadvantaged students. In a similar study involving a regression model, Hruz (2000) noted that African American students in North Carolina (minority students) benefited much more from this reduction programme whilst white students (major cohort) did not benefit. Hence, the author concludes that race is an important determinant that needs to be controlled for in econometric models.

Academic characteristics

- Student's grade of studies:
  Several researchers identified the grade/level of study of the assessed students to influence the programme effectiveness. In fact, according to Ehrenberg et al. (2001, p.13), the positive returns associated with designing smaller classes are most effective in elementary grades as they help pupils to

  > "develop working habits and learning strategies that would enable them to better take advantage of learning opportunities in later grades".

  Such results corroborate with Jepsen's publication (2015) who finds that the class reduction programme in Japan was effective among students in grades four and six, whilst being ineffective when implemented among higher grade students. In fact, a common finding by researchers is that the returns of class reduction programmes diminish as grade levels increases, whilst positive effects are mostly found at early stages (Glass et al., 1978; R. Mitchell, 2001; Robinson et al., 1986).
- Enrolment status:
  The type of admission followed by students was proved in the literature to have an impact on the academic performance by students. Part-time employees typically have work-related or family commitments which require such individuals to exert extra effort, compared to full-time employees, to attain the same marks (**BournerRace1990**; Nyikahadzoi et al., 2013; Zeidler et al., 2005).

Socio-economic characteristics

- Family background:
  The positive influence of family on students' academic scores has been acknowledged by several authors (Farooq et al., 2001; Florence, 2012; Sakho, 2004). In fact, Noble et al. (2006) and Aldin et al. (2011) identified the positive impacts of household attributes such as family income, education, and support on the composite scores attained by students. Similar conclusions were reached by Considine and Zappalà (2002, p.20) in their study among students in Australia, finding that

  > "families where parents are advantaged socially, economically and educationally foster a higher and higher level of achievement in their children".

  Conversely, students coming from deprived socio-economic backgrounds, including financial, social, and interpersonal problems at home experience negative impacts on test scores (Hansen, 2000). In fact, students coming from low-income households must strive harder to succeed since they incur higher living expenses whilst richer families are able to provide their children important and necessary facilities to produce better learners (Ermisch et al., 2001). However, opposite to these views, Karemera et al. (2003) found no statistical evidence between family income and the final scores by students.
- Distance:
  The distance between the student's hometown and the school attended contributes to differences in academic scores. In fact, Raychauduri et al.'s (2010) study presented a negative link between the distance to school and the end-of-course scores obtained by students due to higher effort being exerted by students who live far.

2.4 Research Rationale

This paper utilises a linear regression model intended to answer the research question, *"Does class size matter for business, management and commerce students' academic achievements?"* Based on the publications surveyed, this study will contribute to the growing library and developments on the subject by applying the regression model among business, management and commerce students in Malta following vocational courses at MCAST. To this extent, the following hypothesis was formed which can be expressed algebraically:

H_0: The class size has no or a positive impact on the academic score of students.

H_A: The class size has a negative impact on the academic score of students.

2.5 Data Collection

In total, a dataset involving 874 full-time students was received involving the population of students who have followed a course within IBMC between the scholastic years 2018/2019 and/or 2019/2020 (Table 2). These administrative records comprise of graduates who had followed educational programmes at the following levels:

- Awards (Malta Qualifications Framework (MQF) level 1)
  - MCAST Award in Basic Office Skills
  - MCAST Award in Hospitality
  - MCAST Award in Retail
- Foundation certificate (MQF level 2)
  - MCAST Foundation Certificate in Business
- Diploma (MQF level 3)
  - MCAST Diploma in Business
- Advanced diploma (MQF level 4)
  - MCAST Advanced Diploma in Business Administration
  - MCAST Advanced Diploma in Insurance
  - MCAST Advanced Diploma in Accounting
  - MCAST Advanced Diploma in Financial Services
  - MCAST Advanced Diploma in Marketing
  - MCAST Advanced Diploma in Administrative and Secretarial Studies
- Bachelor's degree (MQF level 6)
  - Bachelor of Science (Honours) in Financial Services Management
  - Bachelor of Science (Honours) in Business Enterprise

2.6 Data Transformation

The surveyed literature has identified a set of independent variables that need to be included in the Econometric model to control for their influence on the dependent variable and hence minimise the noise in the data. The inclusion of such parameters will allow this study to solely quantify the impact of class size on students' test score, being the rationale behind this study.

The surveyed papers approve that minority students are at a disadvantage versus other students (Cook et al., 2000; Robinson et al., 1986). To this extent, the model will be assuming that all students who do not have a Maltese nationality or study the subject 'Maltese as a foreign language', and have followed a programme between 2018 - 2020, were a minority within their classrooms. Such assumption enables this model to examine whether there are variations in marks between local and foreign students. The variable 'FOREIGN' will be capturing this difference by taking a value of '1' if the student is a foreigner and '0' if the person has a Maltese identity card.

The distance between the student's locality and the IBMC institute in Paola will be captured by the variable 'DISTANCE'. Google Maps was used to calculate the average shortest driving distance in kilometres that students travelled to arrive to the college.

Also, the literature surveyed is skewed in favour of controlling for the economic status since students coming from families who enjoy relatively higher income levels typically produce better learners (Considine et al., 2002; Hansen, 2000). Data from the European Union Statistics on Income and Living Conditions (EU-SILC) will be used to estimate the economic status of students. The indicator 'At-Risk-Of-Poverty or Social Exclusion' (AROPE) corresponds to the

> "sum of persons who are either at risk of poverty, or severely materially deprived or living in a household with a very low work intensity." (Eurostat, 2020)

Data from the National Statistics Office (NSO) at a district level will be used to portray the distribution of AROPE individuals in Malta and Gozo. Data conversion will be performed by first changing the locality of the students into districts based on the guidelines from the Electoral Commission of Malta. Then, these districts will be numerically transformed depending on the percentage of the population in that district who are AROPE.

The end-of-course score was obtained by taking an unweighted average score of all the units attempted by the students through the course (Table 1). However, the mark obtained in the final dissertation for level 6 students was not included in the average given the nature of this unit which is not influenced by the class size. Moreover, students who failed in all the units that they attempted were assigned a score of '0' as their end-of-course mark.

2.7 Empirical Plan

The multiple linear regression model (with a constant) will be adopted using OLS to minimise the stochastic errors (Table 4). This technique was mainly chosen due to being already used in past studies, as well as due to its ability to deal with several independent variables (Kukreja et al., 2013).

$$SCORE_i = \beta_0 + \beta_1 Class_i + \beta_2 GENDER_i + \beta_3 AGE_i + \beta_4 FOREIGN_i + \beta_5 LEVEL_i + \beta_6 AROPE_i + \beta_7 DISTANCE_i + \beta_8 ATTENDANCE_i + \varepsilon_i$$

Several variations[1] of the generic regression model will be tested to choose a final model that produces the highest score based on A.C. Harvey's model specification criteria (1981).

2.8 Methodological Limitation

One of the shortcomings associated with the collection of data using administrative records from an educational institution is that the class size might have been chosen as small or large on purpose based on pre-entry qualifications and tests. Such limitation was also present in Olufemi et al.'s (2018) and Adeleke et al.'s (2013) studies which hence creates a degree of bias in the results.

Another limitation resulting from the adopted methodology is that this technique does not ensure homogeneity between classes for comparison purposes. This study was performed whilst students were already assigned in their respective classes and hence factors such as subject difficulty, group dynamics, student's IQ and teaching effectiveness could not be accounted for in the adopted model. Such common limitation in the literature is referred to as omitted variable bias (Shin et al., 2009).

3 Results

3.1 Dataset Overview

Due to shortcomings in retrieving data, especially among students who completed their studies during the scholastic year 2018/2019, some variables contain missing observations as shown in Table 3. Although a data imputation exercise could be completed, such technique is criticised by Van Wicklin et al. (2020) since it leads to:

1) A decrease in the variance of the imputed variables.
2) A decrease in the standard errors, leading the hypotheses test to be made invalid.
3) A separation between variables which hence creates problems for causations.

Hence, the study proceeded by using the collected data and leaving missing records empty.

In order to undertake a deeper investigation of the collected data, a descriptive statistics exercise is performed in Table 5 to explore the structure of the dependent, core, and control variables across levels. It is evident that as students progress to higher levels, the minimum score recorded in the respective level increases, indicating higher commitment and dedication by more mature students.

3.2 Preliminary Analysis

Following Mukaka's (2012) guidelines, the result in Figure 2 identifies a weak negative correlation between foreign students who followed courses within MCAST during the scholastic year 2019/2020 (since no data was available for 2018/2019 students) and their attendance.

Correlations

			Attendance	FOREIGN
Spearman's rho	Attendance	Correlation Coefficient	1.000	-.179**
		Sig. (2-tailed)	.	.000
		N	391	391
	FOREIGN	Correlation Coefficient	-.179**	1.000
		Sig. (2-tailed)	.000	.
		N	391	874

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 2: Correlation between 'ATTENDANCE' and 'FOREIGN'

Moreover, there is no statistically significant correlation in Figure 3 between the AROPE rate and students' attendance, meaning that the socio-economic background experienced by commerce students does not link with higher absenteeism.

Correlations

			Attendance	AROPE
Spearman's rho	Attendance	Correlation Coefficient	1.000	-.032
		Sig. (2-tailed)	.	.540
		N	391	370
	AROPE	Correlation Coefficient	-.032	1.000
		Sig. (2-tailed)	.540	.
		N	370	670

Figure 3: Correlation between 'ATTENDANCE' and 'AROPE'

3.3 Main Empirical Findings

The dependent variable 'SCORE' will be gradually regressed against several variables to test different variations of the model. Prior to including any independent variable in the regression, the variables were examined for multicollinearity to check the correlation between variables. Since no variable experienced high correlation of

[1] The paper also attempted to transform the variable that captures the class size into a binary variable, taking a value of '1' when the class includes less than 17 students.

0.8 or higher based on Franke's (2010) criteria, the models could proceed with the listed variables. White adjusted standard errors are used for results to be heteroscedastic consistent.

Table 6 produces a summary output of the regression models tested. Results from regression 1 indicate that class sizes have no significant relationship to explain changes in the end-of-course scores among students. The first model does not include any control variables, thereby leading to low $\bar{R}^2$ values. Hence, model 2 added a group of academic and socio-economic determinants of educational attainments. Demographic control variables have been added in regression 2 however, the variables 'DISTANCE' and 'AROPE' were not included due to significant missing observations. The goodness of fit value ($\bar{R}^2$) increased substantially in this model, while 'CLASS' became significant. Results from regression 2 indicate that larger class sizes have a statistically significant negative correlation with the end-of-course scores obtained by business students at MCAST. Regression 3 includes all the variables identified in the literature. Results reaffirm that that larger classes correlate with lower students' academic performance.

An evaluation exercise was performed to decide the optimal model between regressions. A.C. Harvey's criteria was used to choose between regressions and model 3 was preferred since it has more statistically significant indicators and all the signs of coefficients follow the surveyed papers[2]. The constant term (28.16) suggests the average 'SCORE' obtained by a student when all other determinants are equal to zero. Except for the variables 'GENDER' and 'FOREIGN', all the variables are highly significant in the model. The chosen model is explaining 61.98% of all the changes in the dependent variable.

4 Discussion

The chosen regression produced the following coefficients:

$$\begin{aligned} SCORE_i = 28.16 - 0.27Class_i - 0.31GENDER_i \\ + 0.72AGE_i - 4.80FOREIGN_i + 1.64LEVEL_i \\ + 1.05ATTENDANCE_i - 0.84AROPE_i \\ - 0.59DISTANCE_i + \varepsilon_i \end{aligned}$$

Results suggest that on average, larger classes are associated with lower average end-of-course scores, and vice-versa. Subsequently, for every additional student registered in each class, the average 'SCORE' of each student typically decreases by 0.27 marks; meaning that having 10 more students in each class decreases the class average score by 2.7 marks, assuming Ceteris Paribus. Therefore, this conclusion leads this study to reject the null hypothesis:

H_0: The class size has no or a positive impact on the academic score of students.

H_A: The class size has a negative impact on the academic score of students.

4.1 Comparison with the literature

The results produced provide guidelines to policymakers and educational management teams when designing classes and programmes. This finding corroborates with Molnar et al. (2000) when arguing that smaller classes are more effective since they enable teachers to include more educational activities. Furthermore, Zahorik (1999) adds that smaller classes lead to more individual attention, more examples, and more instructions, all leading to higher test scores.

Small class designs are especially important for disadvantaged and marginalised students, especially those following courses at levels 1, 2, and 3 within IBMC. Results from the employed regression reveal that smaller class sizes also helps these disadvantaged students, an argument which corroborates with Krueger (1999) and Blatchford's (2000) studies.

Moreover, another reason behind higher grades in smaller classes may be attributed to stronger interpersonal relationship between teachers and students. Such arguments were presented by Epstein et al. (1984) who conclude that educators can provide better explanations when teaching in a smaller class.

The student's gender, although including a negative sign which indicates that on average, females obtain higher scores than males, is not statistically significant. Therefore, this contradicts Yigermal's (2017) paper who argues that males outperform females, as well as Mutchler et al.'s (n.d.) publication who argue the contrary.

According to Reilly and Woodfield (2009), students' 'AGE' causes higher 'SCORE'. This finding, although contradicted by Nyikahadzoi et al. (2013), is proved in this study, which signals that mature students are equipped with more life skills that enable them to perform better academically. This is part of MCAST's strategy to include apprenticeship programmes, intended to link academia with the industry to equip its students with more life skills.

The variable 'FOREIGN' contradicts the surveyed literature, especially Mwinsheikhe's (2003) conclusions who argues that since foreign students are not taught in their

[2]The Ramsey Reset Test was performed on the chosen model as a diagnostic test. Since the p-value of the produced results is less than 0.05 and the F-statistic exceeded the critical value, the model is well specified. Furthermore, the Wald test results confirm that the chosen model best explains changes in the dependent variable.

official language, it acts as a hurdle for them, leading to lower end-of-course scores. In this study, being a local or a foreign student had no significant impact on the average test score obtained during the course of studies.

Furthermore, when students progress to higher 'LEVELS', on average, they obtain higher scores than their counterparts in lower levels. Such conclusion may be linked to Nyikahadzoi et al.'s (2013) argument that mature students have more skills, experiences, and are more academically committed, enabling them to obtain better scores. In fact, the degree of commitment was tested using the variable 'ATTENDANCE' which signalls that by missing less lectures, students obtain higher final scores.

Moreover, following the surveyed literature, students who are living in localities that hosts individuals with a higher probability of being At-Risk-Of-Poverty or Social-Exclusion ('AROPE') tend to obtain lower scores compared to students from other localities. This finding corroborates with Hansen's (2000), Noble's (2006) and Nayebzadeh et al.'s (2011) findings that family income, background, and the level of education by parents is proved to have an influence on student's academic performance. Also, similar to Raychaudhuri et al.'s paper (2010), the further away the student's locality from the college, the lower the final score, potentially due to students exerting more effort prior to arriving at the college which creates fatigue and stress.

4.2 Policy Recommendations

Defining the determinants that affect students' academic performance is vital for a number of stakeholders, including students, their parents/guardians, academicians, college management, the Ministry for Education, and other institutions related to educational policy. These findings can help academics to develop tailor-made teaching strategies and pedagogies to ensure better student engagement which ultimately results in higher scores. Besides educational organisations, the industry is also interested in knowing these factors since they are considered as the end users of graduate students once they officially enter the labour market (Alfan et al., 2005).

These findings could be generalised to other academic institutions following similar programmes. Based on these results, by designing lower class sizes, ideally including less than 17 students (as advocated by Glass and Smith (1978), and M. Mitchell et al. (2016), the institute (IBMC) will be aiding its business students to obtain higher scores, leading to higher employment prospects, better reputation for the college for producing better quality students, as well as saving students' money and effort by helping them to perform better academically. According to Mushtaq and Khan (2012, p.1), this might also lead to a change in the attitude of students towards learning by "facilitating students and improving the teaching procedures".

The first set of recommendations are targeted towards MCAST Administration, in particular IBMC. Currently, larger classes are more common among level 4 and 6 students, reaching cases of 34 students per class. This goes against Glass and Smith's (1978), and Mitchell et al.'s (2016) recommendation of having up to 17 students per class. Although it is crucial to retain small class designs for elementary grades (levels $1-3$) since students attending these courses left secondary school with limited qualifications, it is equally important to support students in their final years of study in order to produce effective workers. Moreover, to minimise the skills gap between mature and young adults as identified by the variables 'AGE' and 'LEVEL', apprenticeship programmes should continue so to equip students, especially teenage students, with more life skills, including employment-related competencies.

Furthermore, such initiatives could potentially decrease the number of students resigning from the course or not passing from most of the units as they feel more valued and supported by their teacher and their peers in class. In fact, both Rwegoshora (2011) and Maganga (2016) corroborate that students feel more content in a small class vis-à-vis a larger class. Therefore, by designing smaller classes, IBMC can contribute towards decreasing the percentage of early school leavers in which Spain and Malta currently top the charts.

The institute should be stricter with regards to the number of school days that students miss. The positive correlation between students' 'ATTENDANCE' and the 'SCORE' should serve as a standard for lecturers, institute management and students on the importance of attending the lectures. Ongoing reviews on a monthly/semester base will help decrease the formation of a pattern of absenteeism.

Moreover, a set of recommendations is targeted towards the Ministry for Education which should recruit more teachers, expand schooling facilities for the business institute within MCAST so to accommodate more classrooms, as well as encourage the design of more courses and subjects to better segregate students into smaller classes. Such proposition, as explained by Shin et al. (2009), creates positive spillover effects by better responding to the industry's demands as well as better serving students' interests by designing courses closer linked to their areas of interest. Furthermore, the campus in Gozo should expand its list of business courses to better accommodate Gozitan students, as well as start attracting students located in the Northern district, es-

pecially following the government's plan to link the two islands through the construction of a tunnel.

5 Conclusion

Using a rich panel dataset composed of 874 students from two scholastic years (2018/2019 and 2019/2020), this study explored the degree of association between class sizes and the end-of-course scores by students, whilst controlling for other academic, demographic, and socio-economic attributes in the employed models. Following the set hypotheses, empirical results from the chosen OLS regression produced a significant negative relationship between larger class sizes and the average end-of-course score obtained by students, signalling that students perform better when assigned in smaller classes vis-à-vis larger classes.

This study could be reproduced by future researchers to understand whether this trend is only common among business students following a VET course, or whether students from other institutes perform better when assigned in smaller classes. Also, this paper focused on the academic benefits of designing smaller classes. However, the surveyed literature also exploits non-school related attributes, such as interpersonal skills, teamwork, and the presence of bullying. Therefore, a study could be undertaken to study the impact of class sizes on these non-academic factors. Furthermore, a Cost-Benefit-Analysis (CBA) could be undertaken to quantify whether the potential benefits of smaller classes exceed their costs (additional teachers, the classroom space, as well as operating costs such as electricity bills). Such proposal should be compared against alternative calls for more effective teaching, such as improving the classroom ambience, providing more technical training and workplace opportunities to students.

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Appendices

Table 1: Grade Boundaries

Grade	Boundary	Median mark
A*	90 - 100	95
A	80 - 89	85
B	70 - 79	75
C	60 - 69	65
D	50 - 59	55
U	0 - 49	25

Table 2: Collected data segregated by level and year

	2018/2019	2019/2020
Level 1	14	13
Level 2	50	55
Level 3	108	122
Level 4	205	135
Level 6	106	66
Total	**485**	**391**

Table 3: Missing observations

Variable	Missing observations	Percentage of missing observations
ATTENDANCE	874	55%
DISTANCE	204	23%
AROPE	204	23%
AGE	119	14%

Table 4: Variables' analysis

Variable name	Acronym	Description
Dependent Variable		
Academic score	SCORE	End-of-course result
Central Variables		
Class size	CLASS	Number of students registered in the class
Control Variables		
Demographic characteristics		
Student's gender	GENDER	1 - Male; 0 - Female
Student's age	AGE	Age of student in 2020
Minority students	FOREIGN	1 - Student is foreign; 0 - Otherwise
Academic characteristics		
Student's grade of studies	LEVEL	Grade that the student has graduated in
Student's attendance rate	ATTENDANCE	Student's attendance during the scholastic year (%)
Socio-economic characteristics		
Family background	AROPE	AROPE rate of the student's district (%)
Distance	DISTANCE	Distance between the student's locality in 2020 and the college

Table 5: Descriptive Statistics Output

	Level 1			Level 2			Level 3			Level 4			Level 6		
Variable	**Minimum**	**Maximum**	**Mean**	**Minimum**	**Maximum**	**Mean**	**Minimum**	**Maxium**	**Mean**	**Minimum**	**Maximum**	**Mean**	**Minimum**	**Maximum**	**Mean**
ATTENDANCE	32.6	56.80	47.44	2.10	58.20	30.70	0.50	56.90	32.34	3.30	72.4	43.50	12.20	52.10	40.17
CLASS	3	10	6.50	13	18	15.62	16	24	20.24	2.0	21	15.77	17	34	25.91
GENDER	0	1	0.70	0	1	0.51	0	1	0.44	0	1	0.42	0	1	0.43
DISTANCE	1.70	14.70	7.50	1.70	15.50	7.10	1.90	40.50	8.07	1.70	42.40	7.89	1.70	42.4	9.59
AROPE	14.20	22.10	17.90	14.20	22.10	19.92	14.20	22.10	19.56	14.20	22.10	19.18	14.20	22.10	18.71
AGE	17	37	19.10	17	26	18.10	14	29	18.10	17	38	19.84	21	29	22.52
FOREIGN	0	1	0.04	0	1	0.43	0	1	0.25	0	1	0.06	0	1	0.02
SCORE	0	95.5	78.25	0	93.5	50.75	0	89.17	47.78	25	90.56	66.96	52.39	90.20	72.58

Table 6: Econometric models

Note: Robust standard errors in parentheses: *** indicates significance at 1% ($p < 0.01$); ** at 5% ($p < 0.05$) and * at 10% level ($p < 0.1$)

Variable	**Regression 1**	**Regression 2**	**Regression 3**
Technique	**OLS**	**OLS**	**OLS**
Constant	59.08***	5.6158	28.1591***
	(2.1500)	(5.7702)	(9.3936)
CLASS	0.1257	-0.2857**	-0.2662**
	(0.1021)	(0.1281)	(0.1308)
GENDER		-0.2252	-0.3142
		(0.8847)	(1.6165)
AGE		0.7957**	0.7225**
		(0.3438)	(0.3459)
FOREIGN		5.6658	4.7983
		(5.0441)	(5.3817)
LEVEL		1.9713***	1.6407**
		(0.6994)	(0.7357)
ATTENDENCE		1.0459***	1.0484***
		(0.0579)	(0.0571)
AROPE			-0.8369***
			(0.3254)
DISTANCE			-0.5876***
			(0.2257)
SER	22.0757	13.3910	13.3884
Adjusted R^2	0.0001	0.6039	0.6198