



## **Econometric Modelling of CGPA and its Associated Factors: A Study of Undergraduate Students of Riphah International University Malakand Campus**

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### **ABSTRACT**

This study is conducted to model the CGPA and its associated factors of undergraduate students of Riphah International University Malakand Campus Chakdara Dir lower, Pakistan. The stratified random sampling method is used to identify the students from population. The academic departments are considered as strata. One hundred and eight undergraduate students are selected for taking information from the University. Multiple Linear Regression (MLR) Model is used for modelling the CGPA and its associated factors. The MLR model shows that SSC obtained marks, parents' education, parents' support and attention in classes is significantly related with obtained CGPA of the students. In terms of policy recommendations, the results of this study present several policies for teachers, parents and administration. Both teachers and administration should focus on attention of students in class. Teachers should prepare interesting and informative lecture that students remain attentive in class. While administration should ensure standard class rooms consist of necessary facilities. Parents should support their children morally, financially and every aspect of life. Teacher and University administration should focus on those students who have illiterate parents. They should play role to guide the students more as their parents is illiterate. Finally, parents should ensure high marks of their children in previous classes that they can perform well in university. This study can be extended to other universities with large sample sizes. Other factors like teacher, environment and administration role can be consider for future study.



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## 1. Introduction

Education is necessary for accurate information interpretation since it advances knowledge. An educated individual is more aware of their own and others' rights and roles in society. As a result, there are less conflicts and greater disputes-tolerance for diversity. Academic achievement is one of the major factors considered by employers in achievement of workers especially for fresh graduates (Khan, Gul, & Zeb, 2023). Proper education improves people's understanding of the world around them, making them less susceptible to the influence of others. While also meeting the requirements of the employer, prepare for future career options. Whether a student is able to acquire a teaching position or continues their education at a different university for a higher degree depends on their academic performance at the University. At the basic and secondary school levels, students' performance also affects the quality of education that potential teachers will impart to them (Zahid Khan & Irfan, 2021).

Academic success or performance determines how much which determines whether a student, teacher, or organization has met their short- or long-term educational goals and how it is measured. Continual evaluation or cumulative grade point average (CGPA) are two such methods (Talib & Sansgiry, 2012). In addition, students with good academic performance have higher incomes, and better work benefits (Tentama & Abdillah, 2019). Moreover, student having high grade are more likely to have greater levels of self-confidence, self-esteem and socially inclined (Regier, 2011). According to a study, growing percentage of students still do not graduate on time, which may indicate that they did not perform as expected (Ab Razak et al., 2019).

Students who perform poorly at the University would face an unclear and miserable future. The academic success of pupils is influenced by a number of variables, including low entry grades, family support, accommodation, student gender, previous assessment grade, student internal assessment grade, GPA, and students' e-learning activity (Al Husaini & Shukor, 2022).

The capacity of students in English is one of the most important aspects associated to a good creation on the performance of the students, according to (Kochhar, 2000). The socioeconomic factors that affect students' academic achievement include their participation in class, family income, the teacher-to-student ratio, and the availability of qualified teachers for both male and female students. Student achievement is also correlated with peer influence (Giuliodori, Lujan, & DiCarlo, 2006; Gonzales, Cauce, Friedman, & Mason, 1996; Hanushek, Kain, Markman, & Rivkin, 2003). According to Goethals (2001), homogenous group students do better than heterogeneous group pupils. Various studies have been done on students' academic performance their satisfaction and teachers' factors when they are satisfied from their job (Khan, Azeem, & Hussain, 2022; Khan, Haq, & Ali, 2022; Khan, Hussain, & Ijaz, 2022).

In the present study, the CGPA of students of Riphah International University Malakand Campus is model with its associated factors. The objectives of modelling is to indicates the most significant factors affecting the academic performance of the undergraduate students of Riphah International University Malakand Campus. The significant factors help students as well as University administration to improve the CGPA of students.

## 2. Literature Review

Noble, Roberts, and Sawyer (2006) investigated perception of students, familiarizing approaches, their academic activities, and background are connected to indirectly their obtained CGPA in university level. Abdullah (2011) found that students who have good and appropriate communication skills expand the students' good academic performance. Khan (2019) identified significant factors related to academic performance of students, which are; examination system, family size, audio visual aid, in class room and living status of students.

Zahid Khan and Irfan (2021) studied the habit of study and its association with academic performance of students. They found that habits of taking notes and writing back class materials significantly affected the academic performance of the students. (Khan et al., 2023) investigated strong positive correlation between student cognitive engagement with and academic success and academic productivity.

According to Abou Naaj, Mehdi, Mohamed, and Nachouki (2023) the course category, student attendance, and course delivery method are the most important indicators of academic performance. In contrast to solely online or face-to-face course delivery, their findings show that a hybrid method of course delivery has had a favorable impact on academic performance.

Hasan, Ahmad, and Razak (2017) conducted study on assessing the factors that affecting CGPA of university students. Their study highlighted that attitude of students towards the course, self-motivation, teaching and learning process are significantly correlated with CGPA of the students. The variables influencing students' attendance and performance in the classroom were examined by (Tabassum, Dewan, Shuchi, & Toufique, 2022). Data for this study was gathered from four universities. In survey research, multiple regression analysis is employed. Strong empirical support for the beneficial effect of classroom attendance on student performance is provided by their research. Recursive regression analysis was used by Zulauf and Gortner (1999) to determine the effect of study time and time management on the academic achievement of Ohio State University students. They demonstrated a positive correlation between these two factors and the quarterly CGPAs of 93 students enrolled in three agricultural economics courses. College students participated in a random experiment by Chen and Lin (2008) to ascertain the effect of attendance on test results. The According to experimental findings, college students' academic performance is positively and significantly impacted by their attendance rate. According to the author, people who opt to attend class will typically see a 9.4% to 18.0% boost in their exam scores as a result of attending lectures.

### **3. Methodology**

#### **3.1. Stratified Random Sampling**

Stratified random sampling is probability sampling, which divides a population into several subgroups called strata, depending on some similar characteristic of sampling units. To ensure that each stratum is included in the sample and to draw conclusions about particular demographic subgroups, stratification is done. This method is useful when the population is heterogeneous and a straightforward random sample might not yield reliable results (Singh & Mangat, 2013).

#### **3.2. Multiple Linear Regression Model**

The goal of multiple linear regression is to model the linear relation between more than one independent variable and dependent variables (Gujarati, 2004). For the multiple linear regression model, the mathematical form is given as:

$$y_i = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_px_p + \epsilon \quad (1)$$

Where;

$n$  = number of observations:

$y_i$  = dependent variables

$x_i$  = explanatory variables

$\beta_0$  = y-intercept (constant term)

$\beta_i$  = slope coefficients for each explanatory variable

$\epsilon$  = the model's error term (also known as the residual)

In order to fit the linear regression model there should be a linear relationship between the dependent variable and the independent variable. The variable that we are trying to fit should maintain a linear relationship the data can be transformed to make it linear these types of transformations include taking logs on the response data or square rooting the response data checking scatterplots is the best and easiest way to check the linear. Scatterplots of the response variable against all the independent variables. If no linearity is observed, transform the data. scatterplots can show whether there is a linear or curvilinear relationship.

The dependent variable of the present study is CGPA of students which is continues, therefore, multiple linear regression model is suitable for modelling of CGPA with its associated factors.

### 3.3. Ordinary Least Square (OLS) Method

The Ordinary Least Square (OLS) method is widely employed in regression analysis because it is more theoretically straightforward and intuitively appealing than the method of maximum likelihood. In addition, as we will see in a moment, the outcomes of the two approaches in the context of linear regression are typically comparable (Gujarati, 2004).

Under certain assumptions, the OLS method has some very attractive statistical properties that have made it one of the most powerful and popular methods of regression analysis. The least-squares estimates have certain ideal or optimum properties when fulfilling the standard linear regression model's underlying assumptions. The least-square estimates is linear function of response variable in the linear regression model. In addition, least-square estimates are unbiased, and has minimum variance in the class of all such linear unbiased estimators; an unbiased estimator with the least variance is known as an efficient estimator (Gujarati, 2004).

### 3.4. Multicollinearity

Multicollinearity is the linear relationship among two or more predictor variables in the multiple linear regression model. Due to this linear relationship, standard error of the coefficients increases which makes problem in testing significance of parameters (Gujarati, 2004; Johnston & DiNardo, 1963). Therefore, one of the vital assumptions of linear regression model is no linear relationship among independent variables that in the model those variables must be included that are not exact linear function of one or more variable in the model. Variance Inflating Factor (VIF) is one of the methods used for detection of multicollinearity in regression model.

The VIF is define as,

$$VIF = \frac{1}{(1-r_{ij}^2)} \quad (2)$$

Due to multicollinearity in regression model, the variance of an estimator is inflated, the extent of which is measure by VIF. As in equation (2), the closer the value of  $r_{ij}^2$  to 1 the VIF tend to infinity. That is, higher the multicollinearity results the higher variance of an estimator leads to infinite VIF. In case of no multicollinearity between predictor variables  $X_i$  and  $X_j$ , VIF approaches 1.

### 3.5. Autocorrelation

One definition of the term "autocorrelation" is "correlation between members of series of observations ordered in time [as in time series data] or space [as in cross-sectional data]". The absence of such autocorrelation in the disturbances is assumed by the basic linear regression

model in the context of regression. The disturbance term associated with any given observation is unaffected by the disturbance term associated with any other observation, according to the classical paradigm (Gujarati, 2004).

In a multiple linear regression model, the autocorrelation is found using the Durban Watson test. It calculates the 'd' statistics for the Durban Watson test. The upper and lower critical values,  $d_U$  and  $d_L$ , for various values of  $k$  (the number of explanatory variables) and  $n$  have been tabulated.

#### 4. Results and Discussion

Total of 108 students consisting 63 (58.3%) male and 45(41.7%) female students are randomly identified from the Riphah International University Malakand Campus. Various characteristics of selected students are presented in Table 1. The Table shows that out of 108 students, 47(43.53%) are selected from age 18 to 20, 53(49.075%) from age 21 to 22, 8 (7.40%) from age 23 and above. According to Table 1, 4(3.07%) students get 40 to 60 percent marks in HSSC examination. Moreover, 78 (72.22%) obtained 60 to 80 percent marks, 26(24.07%) achieved more than 80 percent marks in the examination.

The Table also shows the SSC obtained marks of the students. Five (4.63%) obtained 40 to 60 percent marks, 69(63.9%) achieved 60 to 80 percent marks, 34 (31.48%) get above then 80.

The Table further reveals the level of education of students' parents. Parents having ten years education are 73(67.60%), 24(22.23%) parents have studied 12 years, and 11(10.19%) parents get 16 years education. The Table also revealed that most of the students' parents have low income, that is, approximately 77 percent have below Rs. 60 thousand incomes.

Moreover, most of the students 96 (88.89%) are financially supported by their parents. The Table also shows number of family members of students, 6(5.56%) of the students have 2 to 4 family members, 30 (27.78%) of respondents have 5 to 7 family members, while 72 (66.67%) sample have more than 7 family members in their house.

Table 2 shows the CGPA of the selected students of Riphah International University Malakand Campus. According to this Table, 2(1.85%) students obtained 2.50-2.80 CGPA, 9 (8.33%) obtained 2.81-3.10 CGPA, 33(30.56%) obtained 3.11-3.40 CGPA, 51(47.22%) obtained 3.41-3.70 CGPA, 13(12.05%) obtained 3.71-4.00 CGPA. Approximately half students obtained 3.41-3.70 CGPA which shows satisfactory performance. The Table further reveals the obtained CGPA gender wise.

**Table 1**  
**Characteristic of selected Students**

Group	Number	Percentage	Cumulative percentage
<b>Gender</b>			
Male	63	58.3%	58.3
Female	45	41.7%	100
<b>Age</b>			
18-20	47	43.53%	43.53
21-22	53	49.07%	92.6
Above then 22	8	7.40%	100
<b>Marks HSSC%</b>			
40-60	4	3.07%	3.07
60- 80	78	72.22%	75.29
Above then 80	26	24.07%	100
<b>Marks SSC%</b>			
40-60	5	4.63%	4.63

60-80	69	63.9%	68.52
Above then 80	34	31.48%	100
<b>Parents education</b>			
Matric	73	67.60%	67.60
Intermediate	24	22.23%	89.81
Master	11	10.19%	100
<b>Father income</b>			
10 to 30 thousand	45	41.66%	41.66
31 to 60 thousand	38	35.35%	76.34
Above 60 thousand	25	23.15%	100
<b>Financial support</b>			
Yes	96	88.89%	88.89
No	12	11.88%	100
<b>Family Members</b>			
2 – 4	6	5.56%	5.56
5 – 7	30	27.78%	33.44
Above 7	72	66.67%	100

**Table 2**  
**Obtained CGPA of Students of Riphah International University Malakand Campus**  
**Students Malakand Campus**

CGPA	Male	Female	Total	Percentage
2.50-2.80	01	01	02	1.85
2.81-3.10	05	04	09	8.33
3.11-3.40	25	08	33	30.56
3.41-3.70	22	29	51	47.22
3.71-4.00	08	05	13	12.04

#### 4.1. Results of Multiple Linear Regression Model

##### 4.1.1. Durbin-Watson Statistic

Autocorrelation in the fitted model is assessed by the Durban-Watson test. The value of 'd' is equal to 1.82, the Durban Watson tabulated values are  $d_L=1.64$  and  $d_U= 1.68$ . We found that  $4-d_U < d < 4-d_L$ , thus, the test is inconclusive about the auto-correlation in the model.

#### 4.1.2. Estimated Co-efficient of Multiple Linear Regression Model

The result of multiple linear regression is presented in Table 3. The model shows that HSSC-obtained marks, parents' education of the students, attention in class, and parents' support are significant factors affecting the academic performance of the students of Riphah International University Malakand Campus. Moreover, the Table shows VIF which shows moderate multicollinearity in SSC marks, parents' education, and attention in class, because their VIF is between 1 to 5. While, the predictor variable, parents' support shows no multicollinearity as  $VIF < 1$ .

**Table 3**

##### ***Estimated Coefficient of Multiple Linear Regression Model***

<b>Term</b>	<b>Coefficient</b>	<b>SE Coefficient</b>	<b>T-value</b>	<b>p-value</b>	<b>VIF</b>
Constant	1.568	0.216	7.26	0.000	
Log HSSC Marks	0.3114	0.0707	4.41	0.000	1.02
Parent Education	0.001751	0.0009	1.92	0.05	1.12
Parents Support	0.0759	0.0543	1.40	0.16	0.07
Attention in class	0.1049	0.0529	1.98	0.050	2.88

#### 4.1.4. HSSC Obtained Marks

Students who performed well on the early exam performed well on a high level on the final exam. According to our data, students who scored well on the HSSC exam did well on all of their semester exams for university. This result holds true not only for the population of the area but also for the population in our sample. Our outcome agrees with Khan, Hussain, et al. (2022).

#### 4.1.5. Parents Education

Academic success of the student is greatly influenced by the parents' education. Parents' education includes a lot of love, care, personality development, and instruction for their kids. According to Glad, mothers serve as their children's first teachers.

Our investigation shows significant findings about the influence of parents' educational levels on their children's academic performance. According to our data, parents' educational levels have a considerable impact on their children's academic performance. Focusing on the multiple regression model, the explanatory variable "parents' education" has a sufficient coefficient of 55.781. Since the nature of this explanatory variable is dummy, pupils with educated mothers typically score 55.781 points more than those with illiterate mothers. This explanatory variable's outcome is highly significant showing that the result is true in the population also. This result is confirmed by to Khan, Azeem, et al. (2022).

#### 4.1.6. Parents Support

Parent education is very important for the student's academic performance. Our research investigated positive relationship between academic performance of the students and parent support. Shahzad, Abdullah, Fatima, Riaz, and Mehmood (2015) also found parent support significantly associated with academic performance of students. Thus, our result is similar to them.

#### 4.1.7. Attention in the classes

Attention in classes of students is a very important factor for academic performance. One of the things that affects how well students apply what they learn is how focused they are on what they are learning. The execution of learning is not entirely planned, and it is clear that

many students do not pay attention or concentrate on learning. This result is similar to (Al'Omairi & Al Balushi, 2015).

## 5. Conclusion

The factors associated with academic performance of the students at the Riphah International University Malakand Campus Chakdara Dir Lower is examined. For measurement of the academic performance the CGPA of the last examination of students are considered. The study find that academic performance is highly influenced by four factors: HSSC grades, parental education, parental support, and attention in class.

It is recommended that student's performance in HSSC level should be improve that they can get higher grade in onward classes. Educated parents' pupils get higher grade in examination compare to illiterate parents. Thus, teachers and institution administration should focus on students who have illiterate parents. They should be guided for preparation for examination. For the benefit of students, administration should provide a top-notch classroom.

## References

- Ab Razak, W. M. W., Baharom, S. A. S., Abdullah, Z., Hamdan, H., Abd Aziz, N. U., & Anuar, A. I. M. (2019). Academic performance of University students: a case in a higher learning institution. *KnE Social Sciences*, 1294–1304. doi:<https://doi.org/10.18502/kss.v3i13.4285>
- Abdullah, A.-M. (2011). Factors affecting business students' performance in Arab Open University: The case of Kuwait. *International Journal of Business and Management*, 6(5), 146. doi:<https://doi.org/10.5539/ijbm.v6n5p146>
- Abou Naaj, M., Mehdi, R., Mohamed, E. A., & Nachouki, M. (2023). Analysis of the Factors Affecting Student Performance Using a Neuro-Fuzzy Approach. *Education Sciences*, 13(3), 313. doi: <https://doi.org/10.3390/educsci13030313>
- Al Husaini, Y. N. S., & Shukor, N. S. A. (2022). Factors Affecting Students' Academic Performance: A review. *resmilitaris*, 12(6), 284-294.
- Al'Omairi, T., & Al Balushi, H. (2015). *The influence of paying attention in classroom on students' academic achievement in terms of their comprehension and recall ability*. Paper presented at the Proceedings of INTCESS15-2nd international conference on education and social sciences.
- Chen, J., & Lin, T.-F. (2008). Class attendance and exam performance: A randomized experiment. *The Journal of Economic Education*, 39(3), 213-227. doi:<https://doi.org/10.3200/JECE.39.3.213-227>
- Giuliodori, M. J., Lujan, H. L., & DiCarlo, S. E. (2006). Peer instruction enhanced student performance on qualitative problem-solving questions. *Advances in physiology education*, 30(4), 168-173. doi:<https://doi.org/10.1152/advan.00013.2006>
- Goethals, G. R. (2001). Peer Effects, Gender, and Intellectual Performance among Students at a Highly Selective College: A Social Comparison of Abilities Analysis. Williams Project on the Economics of Higher Education *resmilitaris*, ( ), 1-20.
- Gonzales, N. A., Cauce, A. M., Friedman, R. J., & Mason, C. A. (1996). Family, peer, and neighborhood influences on academic achievement among African-American adolescents: One-year prospective effects. *American journal of community psychology*, 24(3), 365-387. doi:<https://doi.org/10.1007/BF02512027>
- Gujarati, D. N. (2004). Basic econometrics.: Student solutions manual for use with Basic econometrics.
- Hanushek, E. A., Kain, J. F., Markman, J. M., & Rivkin, S. G. (2003). Does peer ability affect student achievement? *Journal of applied econometrics*, 18(5), 527-544. doi:<https://doi.org/10.1002/jae.741>



- Hasan, N. A. A., Ahmad, N., & Razak, N. A. A. (2017). Factors that significantly affect college students' CGPA. *International Academic Research Journal of Social Science*, 3(1), 77-81.
- Johnston, J., & DiNardo, J. (1963). *Econometric methods*.
- Khan, H., Gul, R., & Zeb, M. (2023). The Effect of Students' Cognitive and Emotional Engagement on Students' Academic Success and Academic Productivity. *Journal of Social Sciences Review*, 3(1), 322-334. doi:<https://doi.org/10.54183/jssr.v3i1.141>
- Khan, Z. (2019). The Factors Affecting The Students' Performance: A Case Study of University of Malakand, Pakistan. *City University Research Journal*, 3(1), 22-38.
- Khan, Z., Azeem, M., & Hussain, S. (2022). Markov Analysis Of Student Performance In Colleges Of District Lower Dir And District Malakand Pakistan. *Journal of Positive School Psychology*, 6(8), 4707-4710.
- Khan, Z., Haq, N., & Ali, A. (2022). Job Satisfaction among University Faculty in Khyber Pakhtunkhwa Pakistan. *sjesr*, 5(4), 1-4. doi: [https://doi.org/10.36902/sjesr-vol5-iss4-2022\(1-4\)](https://doi.org/10.36902/sjesr-vol5-iss4-2022(1-4))
- Khan, Z., Hussain, S., & Ijaz, M. (2022). Assessing The Effect Of Campus Support Facilities Sports Programs Experiences Provided And Environmental Factors On The Student's Satisfaction Level Using Ordinal Logistic Regression Model. *Journal of Positive School Psychology*, 6(9), 71-75.
- Kochhar, S. (2000). *Teaching of social studies*: Sterling Publishers Pvt. Ltd.
- Noble, J. P., Roberts, W. L., & Sawyer, R. L. (2006). Student Achievement, Behavior, Perceptions, and Other Factors Affecting ACT Scores. ACT Research Report Series, 2006-1. ACT, Inc.
- Regier, J. (2011). Why is academic success important. *Saskatchewan School Boards Association*.
- Shahzad, M., Abdullah, F., Fatima, S., Riaz, F., & Mehmood, S. (2015). Impacts of parental support on academic performance among secondary school students in Islamabad. *Journal of Social Sciences*, 7(1), 228-231.
- Singh, R., & Mangat, N. S. (2013). *Elements of survey sampling* (Vol. 15): Springer Science & Business Media.
- Tabassum, S. C., Dewan, M. F., Shuchi, M. S., & Toufique, M. (2022). Determinants of university students' performance: Evidence from undergraduate economics students from a Bangladeshi University. *Journal of Applied Learning and Teaching*, 5(1). doi:<https://doi.org/10.37074/jalt.2022.5.1>
- Talib, N., & Sangsiry, S. S. (2012). Determinants of Academic Performance of University Students. *Pakistan Journal of Psychological Research*, 27(2). doi:
- Tentama, F., & Abdillah, M. H. (2019). Student Employability Examined from Academic Achievement and Self-Concept. *International Journal of Evaluation and Research in Education*, 8(2), 243-248.
- Zahid Khan, D. M. A., & Irfan, M. (2021). Habit Of Study And Academic Achievements In District Dir (Lower) And District Malakand. *Webology* (ISSN: 1735-188X), 18(6).
- Zulauf, C. R., & Gortner, A. K. (1999). *Use of time and academic performance of college students: Does studying matter?* Retrieved from <https://ageconsearch.umn.edu/record/21547/>