

MICRO AND MACRO DETERMINANTS OF ACADEMIC PERFORMANCE: AN EMPIRICAL EXAMINATIONIkram Ullah¹, Abdus Samad², Abrar Khan³**Original Article**

1. Assistant Professor in Economics, University of Malakand.
Email: ikramullah@uom.edu.pk. ORCID ID: 0000-0003-3675-0738.
2. BS Economics, University of Malakand.
Email: and ecoasamad@gmail.com and ecoabrnahk@gmail.com

Abstract

Previous empirical evidence shows that benefits of education, both at the individual and aggregate levels, arise from quality rather than quantity of education. But what factors influence quality of education? Capturing quality of education by academic performance, this study therefore aims to examine both the micro and macro determinants of academic performance. For this purpose, the study utilizes two data sets. The first data set consists of 96 cross-sectional observations collected as part of the applied econometrics course at University of Malakand. The second data set consists of macro-level data collected from World Bank's databases and Human Capital Index. The data sets are analyzed using rigorous econometric analysis. The results of the study revealed that academic performance at the micro level is significantly influenced by students' academic motivation and family size. The results also show that boarder students outperform day scholars in academics. At the macro level, the study revealed that proportion of the population covered by social security schemes, gross domestic product per capita, the proportion of the population using internet, survival rate (as a proxy for academic motivation), and proportion of trained teachers in upper secondary education have a positive and significant impact on academic performance of the students.

Keywords: Academic Performance, Academic Motivation, Trained Teachers, Educational Scholarships, Educational Facilities.

Introduction

Education is considered as the most significant human capital investment (Benos & Zotou, 2014). At the individual level, education improves productive capabilities and employment opportunities (Sothan, 2019), leading to higher wages and income (Fatima and Nasr, 2010), and inspire intergenerational mobility (Blanden & Macmillan, 2014). At the macro level, education is considered as the engine of economic growth (Romer, 1990; Breton, 2015; Teixeira & Queirós, 2016). Education increases labor force productivity, its innovative capacity (Cinnirella & Streb, 2017) and the understanding to utilize new technologies (Hanushek & Woessmann, 2020). In fact, as shown in table 1, differences in human capital are the most significant sources of differences in the national incomes of different countries (Lucas, 1988; Castelló-Climent, 2019).

Table 1. Cross-Country Income Differences and Human Capital

| Countries | Difference in | |
|-------------|--------------------|------------------------|
| | Adult Literacy (%) | Harmonized Test Scores |
| Q2-Q1 | 23.98800362 | 18.55401398 |
| Q3-Q2 | 6.862375729 | 24.71170177 |
| Q4-Q3 | 0.27414211 | 63.46977836 |
| Pakistan-Q1 | -5.996340124 | -34.99127765 |
| Pakistan-Q2 | -29.98434374 | -53.54529163 |
| Pakistan-Q3 | -36.84671947 | -78.25699341 |
| Pakistan-Q4 | -37.12086158 | -141.7267718 |

Source: Authors' calculations¹

Prior empirical literature on the education-growth nexus has, however, produced mixed results, which may be attributed to measurement errors. Most prior empirical literature measure human capital by the years of schooling. Years of schooling may, however, do not produce the same level of human capital everywhere (Hanushek & Woessmann, 2020). Given that it is quality of education that determines economic growth, any analysis that quantity measures are likely to produce spurious results². The statistics given in table 2 show that there are significant variations in the per capita GDP of countries having almost identical adult literacy rates, confirming that it is perhaps the quality of education that influences economic growth³. Hence, the questions that remain to be asked are: (a) how best to measure the quality of education and human capital formation, and (b) what factors influence variations in the quality of education and human capital formation?

Table 2. Adult Literacy and Variations in Per Capita GDP

| No. of Countries | Adult Literacy (%) | Per Capita GDP Variations (USD) |
|------------------|--------------------|---------------------------------|
| 9 | 22–48 | 481.74 - 1291.04 |
| 17 | 50–70 | 233.83 - 3000.78 |
| 34 | 71 – 90 | 477.61 - 5955.94 |
| 65 | 92 – 99 | 852.83 - 60729.45 |

Source: Authors' calculations

Besides years of schooling, which measure the quantity of education, education performance/quality⁴ is routinely measured by using one of the two proxies: (a) test scores⁵, and (b) Grade Point Average

¹ Data for calculations in table 1 and 2 is taken from the Human Development Index and World Development Indicators. The data points relate to 174 countries in the year 2020. The countries are divided in four quarters, whereby Q1 include countries whose per capita Gross Domestic Product (GDP) is less than or equal to USD 1900, Q2 include countries whose per capita GDP is greater than USD 1900 but less than USD 5102, Q3 are those countries whose per capita GDP is greater than USD 5102 but less than USD 9223, and Q4 are those countries whose per capita GDP is greater than USD 9223.

² As reported by Hanushek and Woessmann (2020), once controlling for measurement issues, the positive relationship between education and economic growth becomes more visible.

³ Relevant empirical evidence can be found in Hanushek and Kimko (2000), Barro (2001), Bosworth and Collins (2003), and Coulombe and Tremblay (2006).

⁴ Education quality usually refers to the acquired cognitive skills (Affandi, Anugrah and Bary, 2019).

⁵ See for instance Wenger (2000), Hargis (2003), Julian (2005), Grove et al., (2006), Stanca (2006), and Cottrell et al., (2013).

(GPA)⁶. In a recent review article, York et al. (2015) reported that 55 percent of their reviewed articles used GPA as a measure of academic success. Hence, even though these measurable outcomes do not necessarily imply the same level of learning/human capital formation (Alhadabi & Karpinski, 2020), these are the best available proxies to measure quality of education.

Predictors of academic performance, on the other hand, can be categorized as personal, socio-economic, and institutional. Empirical literature in Pakistan has however routinely focused on one or two types of predictors of academic performance. For instance, while Islam et al. (2018) considered excessive internet use, Shuja et al. (2019) and Khan et al. (2019) considered mobile use as a predictor of academic performance. Likewise, Jan and Anwar (2019) and Raza et al. (2021), respectively, considered the impact of emotional intelligence and library use, and intrinsic motivation on academic performance. Given that these studies consider one or two of the important predictors, a cause-and-effect relationship cannot be established⁷. Other recent studies that consider more than two predictors of academic performance include Shah et al. (2015), Ali et al. (2018), Masud et al. (2019), and Asif et al. (2020). The evidence in these studies is however based on self-selected primary data with limited coverage, and hence cannot be generalized and used for policy purposes.

Hence, the purpose of this study is to evaluate both micro and macro determinants of academic performance. The rest of the study is organized as follows: Section two outlines literature review followed by outlining data and methodology of the study in section three. Section four contains results and discussion while the last section concludes the study with some policy recommendations.

Literature review

Institutional quality and family characteristics are known correlates of educational attainment and skill acquisition (Wilson, 2001). Recently, Hattie (2015) reviewed more than 1200 research documents and concluded that half of the variations in learning are explained by students' personal characteristics, 25 percent by teaching while the rest are explained by school, family, and social characteristics.

Institutional Determinants of Academic Performance

Given that all other institutional determinants of academic performance are, directly or indirectly, influenced by school resources and expenditure, the primary institutional determinant of academic performance is thus school resources and expenditure (Hedges et al., 1994; Muntaner-Mas et al., 2017; Sothan, 2019). Previous research has found that academic performance negatively associates with class size (Diette & Raghav, 2015; Miles & House, 2015; Young et al., 2018), positively with facilities like water, electricity, and internet (Al-Adwan & Smedley, 2012; Nuwagaba et al., 2022), and teachers characteristics like higher education, regularity, friendly and supportive behavior (Daniyal et al., 2011; Ali et al., 2018; Asif et al., 2020). Some authors have even associated school type and medium of instruction with academic performance (see for instance (Shah et al., 2015; Mutiso & Muthama, 2019; Asif et al., 2020) but the basic characteristics that separate private schools from public schools essentially relate to expenditure and resources. Besides, the provision of financial aid to students is also found to be positively influencing probability of graduation.

The influence of the internet, computer, and mobile technologies on academic performance are however non-linear. While these facilities provide teachers and students with easy and cost-effective access to learning services (Sife et al., 2007; Andrews, 2011), their excessive use may lead to unintended consequences (Islam et al., 2018). Islam et al. (2018), Sung and Mayer (2013), and Shuja et al. (2019) found that mobile and internet use has a positive effect on academic performance, but Khan et al. (2019) found a negative correlation between smartphone addiction and academic performance. Previous research has established that smartphone addiction may cause poor sleep

⁶ Examples of such studies include Young et al., (2018), Naidoo et al., (2018), Adams and Blair (2019) and Sothan (2019).

⁷ Establishing a cause-and-effect relationship requires ruling out all alternative explanations. This however is only possible when all candidate variables are considered at the same time.

(Aljomaa et al., 2016; Alosaimi et al., 2016), which in turn leads to poor academic performance (Hangouche et al., 2018).

Socioeconomic Determinants of Academic Performance

Review of the relevant literature reveals that at the household level, it is again resources that influence academic performance of students. The direct influence of income and household's socioeconomic position on students' academic performance is investigated by Farooq et al. (2011), Ali et al. (2013), Ghaemi and Yazdanpanah (2014), Shah et al. (2015), Ali et al. (2018), Masud et al. (2019), Mutiso and Muthama (2019), Sothan (2019), Asif et al. (2020), Ali et al. (2021), and Kampinga et al. (2021). All these authors have found that low socioeconomic background and poverty are negatively influencing academic performance of students.

Besides, household education, parents' education, and family size – which again influence household socioeconomics and per capita resources - are also found to be significant predictors of academic performance. Parental or household education however may have other influences on academic performance (e.g., literate household may be better placed to provide proper guidance and learning facilities to their offspring, see for instance Mushtaq & Khan, 2012). Poverty and disadvantaged socioeconomic backgrounds force students to work additional hours to support themselves and their studies at the expense of their academic performance (Mutiso & Muthama, 2019). Likewise, large family size implies less per capita resources and hence poor academic performance. The problem with such students is that even financial aid cannot help them focus on their studies, as part of the financial aid may be redirected toward family's financial needs (Mngomezulu et al., 2017).

Personal Determinants of Academic Performance

Accounting for institutional features and socioeconomic background, one still observes variations in the academic performance of the students (Cerna & Pavliushchenko, 2015). Hence, peculiar students' characteristics may also influence academic performance (Nuwagaba et al., 2022). One such characteristic that positively influence current academic performance is the previous academic record (Karimi & Venkatesan, 2009; Shah et al., 2015; Mutiso & Muthama, 2019). Students having intrinsic motivation and those who are academically engaged are also reported to perform better in academics (Martínez et al., 2019; Raza et al., 2021). Besides, time management skills, which enable students to develop studying habits and plan for academic success (Adams & Blair, 2019), also improve their academic performance (Kearns & Gardiner, 2007).

Motivation and time management skills influence a students' study time, class attendance, and other classroom behaviors which are known correlates of academic performance (see for instance Osa, 2012; Ali et al., 2013; Shah et al., 2015; Sakirudeen & Sanni, 2017; Mutiso & Muthama, 2019; Sothan, 2019; Nuwagaba et al., 2022). Term-time employment however negatively influences study time, attendance, and other classroom behaviors and hence academic performance (Hovdhaugen, 2015; Sothan, 2019). Gender is reported in many studies to have no significant impact on academic performance (see for example Sothan, 2019) but is found to be negatively associated with dropout rates (Ali et al., 2021) and academic grades (Asif et al., 2020)⁸. Since the two studies related to Pakistan and, given that business elsewhere affects performance in academics, it seems that girls in Pakistan are too busy performing domestic chores and hence are more likely to drop out and have weaker academic performance.

The Current Study

Data, Variables and Measures

The study uses two data sets to evaluate predictors of academic performance. The first data set consists of 96 cross-sectional observations collected as part of the applied econometrics course. The primary purpose of collecting this data set was to train students in collecting, entering, and analyzing quantitative data. The second data set consists of macro-level data collected from World Banks'

⁸ Ali et al., (2021) reported higher dropouts for females while Asif, Safdar and Ali (2020) found that male students secure higher grades than female students.

World Development Indicators (WDI), Worldwide Governance Indicators, and Human Capital Index (HCI). The macro data set consists of 174 countries⁹ and most data points relate to 2020.

Dependent Variables

Assuming formal schooling as the sole source of education, studies usually represent quality of education by average years of schooling. Since quality education refers to cognitive skills measurable through scores in science and mathematics (Affandi et al., 2019), such studies also assume that the same level of schooling produces the same level of cognitive skills everywhere (Hanushek & Woessmann, 2020). In this study, academic performance measured as GPA and Learning-Adjusted Years of Schooling (LAYS) are used as measures of education quality¹⁰. The academic Performance of the i^{th} students (AP_i) is measured as a weighted average of percentage marks obtained at BS, HSSC, and SSC levels. The formula used to derive the measure is: $AP_i = \lambda_1 MOBS_i + \lambda_2 MOHSSC_i + \lambda_3 MOSSC_i$, where λ_1 is 0.5, λ_2 is 0.3, while λ_3 is 0.2. Note that the weightage reduces as one moves farther in history. Data on LAYS is obtained from the Human Development Index (HDI) and is calculated by multiplying years of schooling by the ratio of the recent harmonized test scores¹¹ to 625.

Explanatory variables

To capture the influence of poverty/income-related variables on AP at the micro level, Household monthly Income (HHI) and Financial Hardships (FH) during studies are used. The FH is measured with two items; (1) I do not have to explain to my parents when I need money, and (2) it is very difficult for my parents to bear my educational expenses. Responses are originally recorded on a seven-point Likert scale, ranging from 1 (never true of me) to 7 (always true of me). Responses to (1) are however reversed to make the FH scale, using the PCA. The corresponding Cronbach's Alpha value is 0.579 while the KMO and Bartlett's values, respectively, are 0.50 and 17.68 (significant at 1 percent). The corresponding macro level influence, on the other hand, is captured by using Gross Domestic Product per capita (GDP) of each country. The influence of Family Size (FS) on AP performance at the micro level is measured by the number of people sharing the same dwelling. At the macro level, since population is covered in GDP per capita, a separate measure of population is not included in the analysis.

The impact of household education on AP at the micro level is captured by parents' education (PEF) which is measured in years. At the macro level, the corresponding influences are captured by the Average Years of Tertiary Schooling (AYTS) of the senior citizens (aged 50 to 54). Data at the micro level to capture the influence of class size is not available, but the same influence is captured by the Tertiary Pupil Teacher Ratio (PTR), i.e., the number of students per teacher, at the macro level. Likewise, data on teaching quality in the survey data is not available but the same effects at the macro level are captured by the proportion of Trained Teachers at the Upper-Secondary level (TTUSE).

Management and administrative support also influence AP, but we do not have any direct variable to capture this influence. Instead, assuming that management at private educational institutes provides greater support to its students, Years of Private Schooling (YPS) during K12 is considered to capture this influence. YPS is measured as a ratio of the number of years of schooling in a private school to 12. Hence, if a student has studied the entire K12 in a private school, his/her score on the variable will be 1. On the other hand, a student who has studied all his K12 years in a government school will score zero on the variable. The macro counterpart of the influence is proxied through the Government Effectiveness Index (GEF), which measures the quality of civil and other services, policy formulation, and implementation, and governments' commitments to improve these qualities. The index ranges from -2.5 to +2.5 and higher numbers signify more effective governance.

⁹ The list of countries is given in appendix-A.

¹⁰ Both these measures in this study are called measures of academic performance and education quality.

¹¹ Harmonized test scores measure student achievements in mathematics and ranges from a minimum of 300 to a maximum of 625.

Institutional facilities at the micro level are captured by a binary variable (TOS), signifying whether a student is a boarder (=1) or otherwise (=0). At the macro level, percent of the population using the internet (IUI) captures the influence of institutional facilities¹². Data on IUI is taken from World Development Indicators (WDI) which covers all individuals who have used the internet either through a computer, mobile, or any other digital media during the last three months. Data on financial assistance at the survey level is not available. However, the same influence is captured through the percentage of population covered by Social Insurance Programs (CSIP) at the macro level. CSIP, which covers old age pensions, social security, and health benefits, is not a direct measure of financial assistance to students but countries covering a greater population in the social safety nets are likely to provide more financial assistance to students.

Table 3. Variables and Measures¹³

| Predictors of AP | | Primary & Micro Data | Secondary & Macro Data |
|------------------|---|--|--|
| | Dependent Variable(s) | | |
| Socioeconomic | Poverty/Income | Household Income (HHI), Financial Hardships (FH) | GDP Per Capita (GDP) |
| | Family Size | Family Size (FS) | NA |
| | Household Education | Parents Education (PEF) | Average Years of Tertiary Schooling (age 50-54) (AYTS) |
| Institutional | Class Size | NA | Pupil Teacher Ratio, Tertiary (PTR) |
| | Teaching Quality | NA | Trained Teachers in Upper Secondary Education (TTUSE) |
| | Administrative Support | Years of Private Schooling (YPS) | Government Effectiveness Index (GEF) |
| | Institutional Facilities | Boarder (TOS) | Internet Users (IUI) |
| | Financial Assistance | NA | Social Insurance Coverage (CSIP) |
| Other | Language Skills | English Language Skills (AEL) | NA |
| | Study Duration & Class Attendance | Study time (ST) | Labor Force Participation Rate (age 15-24) (LFPR) |
| | Motivation/Willingness for Higher Education | Academic Motivation (AM) | Survival Rate from Age 15 to 60 (SRA) |
| | Gender | Gender (GN) | Sub-Sample Regressions |
| | Cheating | Cheating (CS) | Control of Corruption (COC) |

Source: Authors' calculations

The influence of language skills on AP at the micro level is captured through the English Language Skills (AEL), which is measured by three items. The students were asked to rate their level of competency, relative to other class fellows, in reading, writing, and speaking the English language. Responses are recorded on a seven-point Likert scale, whereby 1 implied poor skill and 7 implied

¹² As is evident from the literature reviewed, internet use is also an independent covariate of academic performance.

¹³ All variables listed in table 3 were candidates for explaining variations in AP. Using the stepwise elimination procedure, variables having insignificant impact on AP are however dropped from further discussion and analysis.

excellent skill level on each of the three dimensions. The responses are then converted to an Academic/English language skills scale (AEL) by using the Principal Component Analysis (PCA). The Cronbach's Alpha of the resulting scale is 0.734 while the Kaiser-Meyer-Olkin (KMO) and Bartlett's test values, respectively, are 0.564 and 87.874 (which is significant at 1 percent level). A corresponding variable at the macro level was however not available.

The impact of study duration and class attendance at the micro level is captured through total hours of study during each 24 hours by the students (ST). A similar measure at the macro level is not available but given that more labor hours leave little time for study, we utilize the Labor Force Participation Rate (LFPR) of the 15-24 years' age cohort in each country to capture the influence of study time and class attendance. LFPR is the percentage of the population in the age cohort of 15-24 who supply labor to produce goods and services.

The willingness of the students for higher studies at the micro level is measured through Academic Motivation (AM), while that at the macro level is measured through Adult Survival Rate (SRA). AM is measured with three items. The students were asked to rate how much, on a seven-point Likert scale, each of the three statements represent their attitudes towards studies. The statements are (1) attending regular classes is essential for good academic grades, (2) having good grades increases the probability of getting jobs, and (3) in my opinion, the purpose of education is to learn new skills that help in practical life. Using these responses and the PCA, the AM scale is then constructed which has Cronbach's Alpha value of 0.895 and the KMO and Bartlett's values of 0.682 and 287.85 (significant at 1 percent level). SRA, on the other hand, is measured by subtracting the mortality rate for ages 15-60 from 1. Cheating at the micro level is captured by the self-reported percentage of marks obtained through cheating, while the Control of Corruption Index (COC) captures the corresponding influence at the macro level.

Methodology

Following the human capital literature and Wilson (2001), academic performance can be modeled as an output that depends on different inputs. The list of inputs may include household, social, institutional, and students' personal characteristics. Thus, variations in inputs leads to variation in the output, both at the micro and macro levels. Letting IDAP denote Institutional inputs, SEDAP denote the socio-economic inputs, and PDAP the Personal inputs influencing AP, the econometric specification of AP as an outcome variable can be stated as follows.

$$AP_i = \alpha_0 + \sum_{k=1}^K \sum_{i=1}^n \beta_k IDAP_{k,i} + \sum_{j=1}^J \sum_{i=1}^n \gamma_j SEDAP_{j,i} + \sum_{l=1}^L \sum_{i=1}^n \theta_l PDAP_{l,i} + U_i \quad (1)$$

In equation (1), a positive β_k would imply that the k^{th} institutional input positively influences AP and vice versa. Likewise, positive γ_j and θ_l would imply, respectively, that the j^{th} socio-economic and l^{th} personal input has a positive influence on AP. The error term U_i captures the influence of omitted variables and measurement errors. Given that both the data sets are cross-sectional in nature, equation (1) is estimated using the Generalized Least Square (GLS) method.

Results and Discussion

The micro data set consisting of 96 observations included 78 male and 18 female students. Amongst them, 51 of the students are day scholars while the rest are boarder students. Majority (49) of the students lived in joint families and belonged to urban areas (79). Exactly 50 percent of the students had their previous schooling from private schools while the rest studied in government schools. Table 4 below contains further descriptive statistics of the micro, as well as the macro data set.

Table 4. Descriptive Statistics of the Variables and Measures

| Variables | Mean | Maximum | Minimum | Std. Deviation |
|-----------------------|-----------------------|---------|---------|----------------|
| | Micro Data Set | | | |
| AP | 74.9 | 85.4 | 62.1 | 5.39 |
| HHI | 49663 | 300000 | 10000 | 45207 |
| FH | 6.93 | 14 | 2 | 3.75 |
| AM | 12.72 | 21 | 3 | 4.19 |
| CS | 9.56 | 98 | 0 | 16.62 |
| FS | 9.45 | 21 | 4 | 3.87 |
| PEF | 8.61 | 16 | 0 | 6.02 |
| TOS | 0.49 | 2 | 0 | 0.52 |
| YPS | 0.49 | 1 | 0 | 0.37 |
| Macro Data Set | | | | |
| LAYS | 6.85 | 9.75 | 2.21 | 1.93 |
| LAYSF | 7.95 | 13.01 | 2.51 | 2.97 |
| LAYSM | 7.76 | 12.81 | 2.96 | 2.73 |
| CSIP | 13.33 | 52.33 | 0.5 | 16.99 |
| GDP | 3643 | 12202 | 449 | 2812 |
| IUI | 51.56 | 84.6 | 11.21 | 24.1 |
| SRA | 0.82 | 0.93 | 0.63 | 0.07 |
| TTUSE | 83.64 | 100 | 46.69 | 17.05 |

Source: Authors' calculations

Table 5 contains the bivariate coefficient of correlations. The second column contains the coefficient of correlations between AP and various explanatory variables. Leaving the second row and column, the rest of the table contains correlation coefficients amongst the explanatory variables which is routinely used for diagnosing the multicollinearity problem. Since none of the explanatory variables are strongly correlated amongst themselves, there is no issue of multicollinearity in the explanatory variables. The signs of the correlation coefficient of AP with various explanatory variables are standard except that of YPS which is negative. Previous literature (see for instance Ali et al., 2013 and Alam et al., 2014) has shown that students having private schooling background perform better than those from government schools. Given that the surrounding areas of the International Islamic University Chittagong (Alam et al., 2014) and Islamia University Bahawalpur (Ali et al., 2013) are developed as compared to the surrounding areas of the University of Malakand, it may imply that the quality of private schools is superior in those areas than Malakand.

Table 5. Correlation Matrix-Variables and Measures of Micro Data Set

| | AP | HHI | FH | AM | CS | FS | PEF | TOS | YPS |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-----|
| AP | 1 | ... | ... | ... | ... | ... | ... | ... | ... |
| HHI | 0.04 | 1 | ... | ... | ... | ... | ... | ... | ... |
| FH | 0.01 | 0.36 | 1 | ... | ... | ... | ... | ... | ... |
| AM | 0.12 | -0.01 | 0.03 | 1 | ... | ... | ... | ... | ... |
| CS | -0.20 | 0.01 | -0.05 | -0.09 | 1 | ... | ... | ... | ... |
| FS | 0.15 | -0.02 | 0.12 | -0.17 | 0.26 | 1 | ... | ... | ... |
| PEF | 0.04 | 0.10 | 0.18 | 0.02 | -0.08 | -0.15 | 1 | ... | ... |
| TOS | 0.24 | 0.03 | -0.02 | -0.10 | -0.21 | -0.17 | -0.09 | 1 | ... |
| YPS | -0.22 | 0.29 | 0.25 | -0.01 | 0.05 | -0.13 | 0.20 | -0.21 | 1 |

Source: Authors' calculations

Table 6 contains bivariate correlation coefficients of the macro data variables. It is evident from the results that multicollinearity is not an issue in the data set. The correlation coefficients of the explanatory variables are however much stronger than those in the micro data set. LAYS (a proxy for AP) is positively and strongly correlated with the population covered by social insurance, GDP per capita, percent of the population using the internet, survival rate, and with the proportion of trained teachers in upper secondary education.

Table 6. Correlation Matrix-Variables and Measures of Macro Data Set

| Variables | LAYS | CSIP | GDP_R | IUI_R | SRA | TTUSE |
|-----------|------|-------|-------|-------|------|-------|
| LAYS | 1 | ... | ... | ... | ... | ... |
| CSIP | 0.63 | 1 | ... | ... | ... | ... |
| GDP | 0.27 | -0.06 | 1 | ... | ... | ... |
| IUI | 0.32 | 0.10 | -0.07 | 1 | ... | ... |
| SRA | 0.69 | 0.49 | 0.05 | 0.16 | 1 | ... |
| TTUSE | 0.49 | 0.17 | 0.27 | 0.26 | 0.27 | 1 |

Source: Authors' calculations

The bivariate correlation coefficients in the second columns of tables 5 and 6 indicated the degree of association between AP and various other variables. The analysis however falls short on two important accounts: (a) it does not show the cause-and-effect relationship, and (b) it takes the impact of only one variable into account. To have a more detailed picture of the predictors of AP, tables 7 and 8 present the results of the regression models, respectively, based on the micro and macro data sets. Accordingly, the results in table 7 show that academic motivation, family size, and being a boarder student are the only three significant variables influencing academic performance. More specifically, a unit increase in AM leads to an increase of 0.21 units in AP. Likewise, each additional family member accounts for an increase of 0.37 units in AP. The most significant impact observed in the sample is that of being a boarder student which improves AP by 2.39 units.

Table 7. Predictors of Academic Performance-Micro Level Evidence

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|-----------|-------------|------------|-------------|--------|
| Intercept | 68.1418 | 3.008336 | 22.65099 | 0.0000 |
| HHI | 1.16E-05 | 9.93E-06 | 1.168194 | 0.2462 |
| FH | -0.059962 | 0.174184 | -0.344244 | 0.7316 |
| AM | 0.217249 | 0.12317 | 1.76382 | 0.0816 |
| CS | -0.061443 | 0.045813 | -1.341173 | 0.1837 |
| FS | 0.376767 | 0.155439 | 2.423892 | 0.0176 |
| PEF | 0.104456 | 0.08312 | 1.256691 | 0.2125 |
| TOS | 2.394267 | 1.107444 | 2.161975 | 0.0336 |
| YPS | -2.476744 | 1.717752 | -1.441852 | 0.1532 |

Source: Authors' calculations

Regression results based on the macro data set are presented in table 8. The results in the LAYS (1) column are based on the overall sample (irrespective of gender) while those in LAYSM (2) and LAYSF (3) columns, respectively, are based on the dependent variable being Learning Adjusted Years of Male Schooling and Learning Adjusted Years of Female Schooling. Observations for LAYSM and LAYSF barely satisfy the minimum requirements for regression analysis, which is evident from the adjusted R^2 and F statistics of the two regressions ($R^2 = 0.08$ and $F = 1.49$ in the case of LAYSM and LAYSF). Hence these results are given only for exposition purposes. On the other hand, the regression having LAYS as a dependent variable explains approximately 73 percent of the variations and has a significant F value.

Table 8. Predictors of Academic Performance-Macro Level Evidence

| Variable | LAYS (1) | LAYSM (2) | LAYSF (3) |
|--------------------|-------------|--------------|--------------|
| | Coefficient | Coefficient | Coefficient |
| Intercept | -6.105456 | 6.961210 | 6.383114 |
| CSIP | 0.050630* | -0.047220*** | -0.054378 |
| GDP | 0.000154* | -0.000416*** | -0.000467*** |
| IUI | 0.028346** | 0.070579 | 0.074837*** |
| SRA | 12.41566* | 4.574211 | 5.725693 |
| TTUSE | 0.023706* | -0.034130 | -0.035756 |
| Adjusted R-squared | 0.726720 | 0.080528 | 0.081112 |
| F-statistic | 29.71991* | 1.490452 | 1.494323 |

Source: Authors' calculations, Note: * $p < .01$, ** $p < .05$, *** $p < .1$

The results in table 8 show that the proportion of the population covered by social security schemes is positively and significantly influencing AP. It implies that, since CSIP is used as a proxy for educational bursaries, financial aid in the form of educational scholarships can improve the overall AP of the students. Likewise, GDP per capita, the proportion of the population using the internet, survival rate (as a proxy for academic motivation), and proportion of trained teachers in upper secondary education all have a positive and significant impact on AP.

Conclusions and Policy Recommendations

Education is considered as an important investment in human capital since time immemorial, but economists started to explain world economic growth in terms of education since Schultz (1961), and then Romer (1986). Numerous research articles have established the positive link between years of schooling and economic growth. More recently, the focus has however shifted towards quality, rather than quantity, of education as a determinant of economic growth. Contemporary studies therefore support the notion that quality of education is more important in explaining growth differentials than quantity. Given the economic importance of quality of education, both for an individual and the whole economy, this article therefore explored students' personal, social, economic, and institutional determinants that influence academic performance and educational quality.

The study uses two data sets to examine the key determinants of academic performance. The first data set consists of 96 cross-sectional observations collected as part of the applied econometrics course. The second data set consists of macro-level data collected from World Bank' databases and Human Capital Index (HCI). The results of the study showed that at the micro level, academic motivation, family size, and being a boarder student are the only three significant variables influencing academic performance. At the macro level, the proportion of the population covered by social security schemes, GDP per capita, the proportion of the population using the internet, survival rate (as a proxy for academic motivation), and proportion of trained teachers in upper secondary education all have positive and significant impact on academic performance.

The findings of this study have important policy implications. First, the study has established that students' perceptions about regular class attendance (indicators of AM) influence academic performance positively. Thus, academic bodies and teachers need to design courses that engineer inculcating rewarding skills in the students. Likewise, the proportion of trained teachers also enhances academic performance. Unfortunately, teaching qualifications are not required at higher levels of education in Pakistan, nor any specialized training is provided to teachers in institutions of higher learning. To boost academic performance, the authorities also need to focus on teachers' training at the university level.

Besides, provision of educational bursaries and widespread internet facilities also boosts academic performance. But most importantly, the study's finding that survival rate influencing academic

performance imply that incidence like those happened at Malakand University (in 2009), Abdul Wali Khan University (in 2017), Bacha Khan University (in 2016), and Army Public School (in 2014) must have long term negative impacts on academic performance of students.

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Appendix A. List of Countries in the Macro Sample

| | | | |
|--------------------------|-----------------|------------------|--------------------------------|
| Afghanistan | El Salvador | Lithuania | Saudi Arabia |
| Albania | Estonia | Luxembourg | Senegal |
| Algeria | Eswatini | Macao SAR, China | Serbia |
| Angola | Ethiopia | Madagascar | Seychelles |
| Antigua and Barbuda | Fiji | Malawi | Sierra Leone |
| Argentina | Finland | Malaysia | Singapore |
| Armenia | France | Mali | Slovak Republic |
| Australia | Gabon | Malta | Slovenia |
| Austria | Gambia | Marshall Islands | Solomon Islands |
| Azerbaijan | Georgia | Mauritania | South Africa |
| Bahrain | Germany | Mauritius | South Sudan |
| Bangladesh | Ghana | Mexico | Spain |
| Belarus | Greece | Micronesia | Sri Lanka |
| Belgium | Grenada | Moldova | St. Kitts and Nevis |
| Benin | Guatemala | Mongolia | St. Lucia |
| Bhutan | Guinea | Montenegro | St. Vincent and the Grenadines |
| Bosnia and Herzegovina | Guyana | Morocco | Sudan |
| Botswana | Haiti | Mozambique | Sweden |
| Brazil | Honduras | Myanmar | Switzerland |
| Brunei Darussalam | Hong Kong | Namibia | Tajikistan |
| Bulgaria | Hungary | Nauru | Tanzania |
| Burkina Faso | Iceland | Nepal | Thailand |
| Burundi | India | Netherlands | Timor-Leste |
| Cambodia | Indonesia | New Zealand | Togo |
| Cameroon | Iran | Nicaragua | Tonga |
| Canada | Iraq | Niger | Trinidad and Tobago |
| Central African Republic | Ireland | Nigeria | Tunisia |
| Chad | Israel | North Macedonia | Turkey |
| Chile | Italy | Norway | Tuvalu |
| China | Jamaica | Oman | Uganda |
| Colombia | Japan | Pakistan | Ukraine |
| Comoros | Jordan | Palau | United Arab Emirates |
| Congo, Dem. Rep. | Kazakhstan | Panama | United Kingdom |
| Congo, Rep. | Kenya | Papua New Guinea | United States |
| Costa Rica | Kiribati | Paraguay | Uruguay |
| Cote d'Ivoire | Korea, Rep. | Peru | Uzbekistan |
| Croatia | Kosovo | Philippines | Vanuatu |
| Cyprus | Kuwait | Poland | Vietnam |
| Czech Republic | Kyrgyz Republic | Portugal | West Bank and Gaza |
| Denmark | Lao PDR | Qatar | Yemen |

| | | | |
|--------------------|---------|--------------------|----------|
| Dominica | Latvia | Romania | Zambia |
| Dominican Republic | Lebanon | Russian Federation | Zimbabwe |
| Ecuador | Lesotho | Rwanda | |
| Egypt | Liberia | Samoa | |