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Education investment and literacy outcomes: An analysis of government spending in Pakistan

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Abstract:

Education is a key driver of socioeconomic growth, and government investment within this sector plays a critical role in improving literacy outcomes. In Pakistan, where literacy rates remain significantly low compared to regional standards, analyzing the impact of state education investments is essential. This research investigates the correlation between government education spending's and literacy outcomes within Pakistan, focusing on key variables such as GDP per capita, inflation rates, urbanization rate, and government expenditure on education. Using secondary data from government reports, international organizations, and academic studies, the research evaluates whether increased financial investments translate into measurable improvements in literacy rates. The findings suggest that while funding is crucial, inefficiencies in resource allocation, corruption, and regional disparities hinder optimal outcomes. The study concludes with policy recommendations to enhance the impact of education spending, emphasizing the need for accountability, targeted interventions, and equitable distribution of resources to achieve sustainable literacy growth in Pakistan.

Keywords: Education investment, Literacy outcomes, Government spending, Pakistan education policy, Resource allocation, Socioeconomic growth, Literacy rate.

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1. Introduction

1.1 Literacy

Literacy is the skill of understanding and using written languages. It encompasses not only the technical skills of decoding written text but also the ability to comprehend and critically engage with information. In a broader sense, literacy can also refer to the knowledge and skills in a particular area, like digital literacy (using technology) or financial literacy (understanding money and economics).

1.2 Importance of Education and Literacy

Learning is crucial to the socioeconomic growth for a nation. This has a critical function to play within capability enhancement and accelerates development of the whole economy through knowledge, creativity and skills. Through knowledge poverty and inequity of income might be decreased, health outcomes can be optimized, effective governance is equally enforced for effective regulations. That multi-faceted effect of learning makes the latter a vital element for legislation design. The majority of the population of the world residing in growing nations, their education system needs to be redesign to increase their productivity within various areas of their economy through the supply of highly trained workers and addressing their development requirements for better industrialization, which is also the need of the moment. The total literacy rate for *a decade* and above was around *55 %* of the year 2006-2007 while it was *45% in 2001-2002*, registering only *10* % increase in literacy rate of just 6 years [Pakistan Integrated Household Survey (PIHS) *2006-2007*]. For sustainability of growth and also for growth in Pakistan, its essential to go on providing support to reduce poverty and build socioeconomic infrastructure, primarily education. *(Pakistan Integrated Household Survey (PIHS). (2006).* PIHS 2006-07: Report on Education and Literacy. *Pakistan Bureau of Statistics).*

The unsustainable economic growth in Pakistan is alarming over the years. The unstable economic expansion might be attributed within steep increase in economic inflation, increasing budget deficit, rising external debt and debt repayment, poor external demand for inferior goods in Pakistan, underdeveloped workforce and outdated equipment level, unfavorable weather patterns, governmental instability among other factors. It is well beyond question that education is an important factor in economic prosperity. It encourages an active and enlightened citizenry and opens up prospects for the socially and economically backward sections of society. The human development index (HDI) is often listed as notably most essential statistics of national income and its development and growth. Human resources theory sees human beings as economic firms contributing to the economy's Total Factor Productivity by means of learning and education conditions (TFP). Education is the bridge that links an economy's physical capital and human resources, and it is essential for its long-run sustainability. Since it benefits national gross domestic product, education raises its marginal productivity of labor. (United Nations Development Program (UNDP). (2020). *Human Development Report 2020: The Next Frontier—Human Development and the Anthropocene.)*

1.3 Historical background and literacy rate in Pakistan

Numerous efforts to increase school enrollment and literacy rates have been made in the five decades since independence. The government has launched seven distinct education policies,

eight five-year development plans, and nearly half a dozen additional programs since the first national education summit in 1947. Furthermore, more than a dozen conferences, seminars, workshops, and discussions on education have been organized to address these goals. The previous policy and strategy papers were grounded in reality and provided systematic descriptions of the task's constraints and challenges. The problem's scope and possible solutions were made clear through their balanced and practical framing. (Government of Pakistan. (1951). *National Education Policy 1951.* Ministry of Education, Government of Pakistan.)

For instance, the 1951 Education Policy declared that recruitment of teachers, training and planning and the work of propagating literacy and universalizing enrollment would be done in the first five years and afterwards this would be taken up. The tone of the language also was matter of fact, and the language conveyed a sincerity of purpose. Sincerity of purpose did not lead to outcomes, though. The literacy rate continued to be static during the nation's first decade of life. The only deviation was the *1972* Education Policy following the loss of the *1971* war and arrival of the "new" Pakistan. **(**Government of Pakistan. (1992). *National Education Policy 1992.* Ministry of Education, Government of Pakistan.)

The 1972 Policy document presented realistic goals in uncomplicated language rather than lofty ideological declarations. It matters not whether these modest objectives were ever achieved; from 1979 onward, grandiose rhetoric frequently dominated actual action. "Being the first to acknowledge the immense potential of indigenous institutions and harnessing them to drive educational progress," the 1979 Policy was hailed as a breakthrough. There was a flurry of education initiatives in the 1980s, each of which was launched in such a haste that subsequent plans were implemented before the previous ones could even finish. For instance, the two-year National Literacy Plan of 1984 was abruptly scrapped in favor of the four-year Nationwide Literacy Program, which was soon surpassed by the Nai Roshni schools program. The targets were also constantly changing. A primary enrollment rate of 70% was the goal of the Third Plan; however, by the time the Fifth Plan began, only 54% had been enrolled. The Fifth Plan then set an ambitious goal of 100 percent enrollment by 1987, which was later extended to 1992 by the 1979 Policy; however, enrollment had only reached 60 percent by 1988. The deadline for universal enrollment was pushed back to 1993 by the Seventh Plan, but by 1998, the rate had dropped to 39%. In a similar vein, the goal of 100% was extended to 2002 in the 1992 Policy, but it was reduced to 90% by 2003 in the 1998 revision. Literacy objectives were similarly erratic.

The 1959 Policy called for full literacy by 1975, but literacy rates only reached 21.7 percent in 1972 and 26.17 percent in 1981. Literacy was supposed to reach 35% by 1983 under the 1979 Policy, but it only reached 26.2% by 1984. The National Literacy Plan and the Nationwide Literacy Program, which followed, set goals of 33% and 53% by 1986 and 1990, respectively. However, the literacy rate in 1992 barely surpassed 34%. By 1993, the Seventh Plan lowered the goal to 40%, and the Eighth Plan set a goal of 48% by 1998, but the actual rate remained the same at 39%. The 1979 Policy had boldly set a goal of full literacy by 2010, but the 1998 Policy backed off to 70%. Not only did enrollment and literacy fluctuate, but so did fundamental educational philosophies as well. Non-formal education was outright rejected by the Seventh Plan (1988–93), but it was revived by the 1992 Policy, at least for adult education. The new Policy almost completely eliminated formal education in favor of non-formal primary education in 1998, swinging the pendulum even further. Pakistan's educational planning has a cyclical pattern: policymakers set ambitious goals, complain about their failure, and then set

new goals with unwavering optimism—a costly ruse that has been repeated for five decades. This ingrained cycle of unfulfilled promises and wasted public resources was little affected by any changes in government, whether they were elected, imposed, socialist, or Islamist.

1.4 Role of government spending in education sector especially in improving literacy rate

Pakistan's public spending on education appears to yield only short-term benefits by focusing mainly on the provision of basic facilities. Nevertheless, it lacks a strategic strategy for combining physical and human capital for long-term growth. Although the overall development budget for education has expanded significantly over time, the actual impact remains limited, as a major share continues to be allocated to infrastructure alone. In addition, informal observations reveal that inadequate accountability and transparency in the allocation of funds are major roadblocks to meaningful progress. In point of fact, the primary issue lies in the government's inability to adequately guarantee the availability of basic educational infrastructure even after nearly seven decades. As a result, the education system struggles to meet even the basic objective of ensuring access, let alone improving the quality of education. Therefore, there is a pressing need to reform education expenditures and introduce a well-planned, long-term strategy that prioritizes quality with genuine commitment. *(World Bank. (2011).* Public Expenditure Review: Education Sector in Pakistan.)

1.5 Importance of Education Spending

It is generally recognized that education is one of the most crucial elements in reducing poverty. It has a far-reaching influence, touching every dimension of human life. As such, education stands as a fundamental investment in both social progress and economic growth. *(United Nations Educational, Scientific and Cultural Organization (UNESCO). (2017).* Education for Sustainable Development Goals: Learning Objectives. *UNESCO)*

1.6 Research questions

1) What is the relationship between government spending on education and changes in literacy rates over time in Pakistan?
2) What is the effectiveness of government education expenditures by examining the literacy outcomes achieved relative to the investment made?

1.7 Research objectives

1) To investigate the relation between government expenditure on education and changes in literacy rates over time in Pakistan.
2) To assess the effectiveness of government education expenditures by examining the literacy outcomes achieved relative to the investment made.

1.8 Research hypothesis

H_0 (Null Hypothesis):

There is no significant relationship between government spending on education and changes in literacy rates over time in Pakistan.

H_1 (Alternative Hypothesis):

There is a significant positive relationship between government spending on education and changes in literacy rates over time in Pakistan.

H_0 (Null Hypothesis):

Government education expenditures are not effective in improving literacy outcomes relative to the amount invested.

H_1 (Alternative Hypothesis):

Education expenditures are effective in improving literacy outcomes relative to the amount invested.

2. Literature review

2.1 Economic growth and investment on education

Empirical studies have confirmed the rate of economic expansion is significantly correlated with investments in education. Governments that invest significant amounts of resources in education not only promote the formation of human capital but also overall economic well-being (Barro, *1991*). Human capital theory contends that investing in education raises the productivity of people, thereby enhancing national production (Becker, *1993*). For Pakistan, government expenditure on education and its contribution to literacy is an important subject of research because it can lead to an analysis of the quality of public educational policies. (Barro, 1991; Becker, 1993)

2.2 Government Spending and Educational Results

There are many studies analyzing the correlation between government spending on education and outcomes of education in terms of literacy rates, attendance, and rates of completion. As per Pritchett (*2001*), education expenditure is not sufficient to ensure that literacy levels or education performance improves. It becomes important to take into account the quality of expenditure, i.e., how money is spent across various stages of education (primary, secondary, and tertiary) and the effectiveness of the education system. Hanushek (*2003*). In Pakistan, public spending on education has been condemned as inadequate and ineffective, with spending frequently failing to reach where it is needed most. (Chaudhary, 2017; Pritchett, 2001. Hanushek, 2003; Chaudhary, 2017)

2.3 Education Spending in Pakistan

In Pakistan, education spending has been persistently below international standards recommended by institutions such as UNESCO, which advises 4-6% of GDP to be allocated to education (UNESCO, 2014). It has been estimated that Pakistan's educational expenditure is about 2.5% of GDP, and it is not sufficient to fulfill the educational demands of the nation (World Bank, *2018*). Also, the resource allocation is unequal, with better resource allocation towards urban areas as compared to rural areas, thereby widening the gap in literacy rates (Siddiqi & Nadeem, 2019; UNESCO, 2014; World Bank, 2018).

2.4 Literacy Rates and Investment in Education in Pakistan

The literacy rate in Pakistan has been consistently increasing, though less rapidly than in other countries of South Asia. Based on the Pakistan Bureau of Statistics (*2021*), the literacy rate in Pakistan is about *59%*, with huge gaps existing between urban and rural regions and between men and women. The disparity is further increased by geographical variations, whereby provinces such as Punjab have relatively higher literacy levels than Khyber Pakhtunkhwa and Baluchistan (Awan, *2017*). A study by Qureshi and Sultana (*2015*) discovered that even though government expenditure on education has increased, literacy rates in Pakistan have not significantly improved, mainly as a result of ineffective utilization of resources and the poor quality of education provided. (Pakistan Bureau of Statistics, 2021. Awan, 2017. Qureshi & Sultana, 2015)

2.5 The Role of private and public sectors

The contribution of the private sector to Pakistan's education is important, as most students in private schools are concentrated in urban areas. Nonetheless, the majority of students are still served by the public sector, especially in rural areas. Research indicates that private schools have better educational services, but these are inaccessible to most people due to their expense (Aslam, *2009*). Thus, the role of the government in properly addressing public schools' management is of utmost importance when it comes to literacy performance. The literature reports that enhanced governance, teacher capability, and facility are important drivers for effective spending of government budgets in education (Aslam, 2009. Andrabi et al., 2008).

2.6 Quality of Education vs. Quantity of Investment

Quality of education has been one of the critical areas when it comes to the assessment of how government expenditure correlates with literacy achievement. Hanushek and Woessmann (*2015*) highlight that an increase in funding does not necessarily result in improved learning outcomes unless the increase is supplemented by education reforms in the quality of education, including enhanced teaching practices, enhanced curriculum, and access to learning materials. In Pakistan, research has indicated that though there has been a rise in expenditure on education, the standard of education is still poor, the nation still struggles with issues like overpopulation in classrooms, inadequate teacher training, and insufficient basic educational infrastructure. (Hanushek & Woessmann, 2015; Chaudhary, 2017).

2.7 The Impact of Government Policies

Government policies significantly influence literacy levels in Pakistan. The policy introduction of, for example, the National Education Policy (NEP) *2009* to raise education expenditure and enhance literacy has been inconsistent. Malik (*2018*) states that the policy had a promise to enhance access to education but failed to tackle the question of quality and equity, particularly in rural areas. Additionally, the actualization of these policies has been hampered by political instability, budgetary problems, and bureaucratic inefficiencies (Malik, 2018; Pasha, 2015).

2.8 Social and Cultural Factors

Aside from economic investment, social and cultural aspects also contribute to the literacy outcomes. Gender differences in schooling are most notable in Pakistan, as cultural norms and

societal constraints discourage girls from acquiring education (Ali, *2009*). Family financial resource level of education also have a considerable effect on children's literacy rates, with more affluent families having the capacity to provide better education, hence expanding the literacy gap (Shah & Bashir, 2011).

2.9 Challenges and Opportunities

1) In spite of the challenges, there are great opportunities for enhancing literacy rates in Pakistan. These include spending on teacher training, enhancing education infrastructure, and the quality of textbooks and study materials. In the opinion of the Asian

2) Development Bank (*2020*), greater public-private partnerships and decentralization of education administration can also assist in enhancing literacy rates by providing resources more effectively (Asian Development Bank, 2020).

In short, although more government expenditure on education in Pakistan has yielded some positive impacts on literacy rates, it has not been enough to solve the inherent issues in the educational system. The link between government expenditure and literacy performance is multifaceted and subject to determinants like the quality of expenditure, policy enforcement, and socio-economic determinants. Hence, upcoming policy and research need to work not only on the augmentation of monetary investment but also on augmenting the effectiveness of educational policy, tackling the issues of gender imbalances, and ensuring no diminution of quality in education.

3. Data and methodology

3.1 Research Design

In order to collect numerical data and evaluate trends in accordance with the research objectives, this study employs a quantitative research approach.

3.2 Data Collection Method

This research is based on quantitative analysis on secondary data. Research were retrieved from available sources such as research papers, scholarly journals, government publications, official websites, and credible databases. The criteria for source selection were the information's relevance to the research purpose and credibility. This procedure enabled an effective understanding of the subject matter based on analysis of already published findings and data.

3.3 Sampling Technique and Population

The population for this study is comprised of previous research that was published, government reports, and freely available data sets on the topic of research. Peer-reviewed journals, government reports, and well-known databases were given precedence to guarantee quality and credibility in the data.

3.4. Methodology

3.4.1 Equation

Literate (t) = B. + B1 Edu Exp(t) + B2 GDP(t) + B3 Urb rate (t) + B4 TSR(t) + B5 Inf(t) + Et

Where dependent variable is literacy (literacy rate at time t).

3.4.2 Literacy

The ability to read, write, and comprehend information at a level that enables effective participation in day-to-day life is commonly referred to as literacy. As defined by UNESCO (2006), literacy encompasses the capacity to recognize, interpret, create, communicate, and calculate using written and printed texts across different contexts. It empowers individuals to pursue personal and career ambitions, gain knowledge, and engage meaningfully in social and community life. UNESCO (2006). *Education for All Global Monitoring Report*

3.4.3 Independent Variable

1. Education Expenditure = Government education expenditure as a % of GDP
2. Gross Domestic Product = GDP per Capita
3. Urban rate = Urbanization rate (Proxy of education)
4. Inflation = Inflation

3.4.4 Gross Domestic Product per Capita:

GDP per capita refers to the gross domestic product divided by the population at midyear. It shows how much each person makes on average. GDP itself is calculated by adding the total value produced by all domestic producers within the economy, including product-related taxes and excluding subsidies that are not reflected in product values. World Bank (nd.). GDP per capita (current US$).

3.4.5 Inflation Rate:

GDP per capita refers to the gross domestic product divided by the population at midyear. It shows how much each person makes on average. GDP itself is calculated by adding the total value produced by all domestic producers within the economy, including product-related taxes and excluding subsidies that are not reflected in product values. International Monetary Fund (IMF) – What is Inflation?

3.4.6 How to measure these independent variables

3.4.7 Government Education Expenditure as a %age of GDP:

The amount the government spends on education in relation to the total value of services produced and products in the nation (GDP) is used to calculate government education expenditure as a percentage of GDP. The amount the government spends on education in relation to the total value of services produced and products in the nation (GDP) is used to calculate government education expenditure as a percentage of GDP.

Government Education Spending as % of GDP = (Gross Domestic Product (GDP) Total Government Spending on Education) ×100

3.4.8 Measuring Urbanization Rate

Formula:

$$\text{Urbanization rate (\%)} = \frac{\text{Urban Population}}{\text{Total Population}} \times 100$$

Urbanization as a Proxy for Education Quality

Why?
1) Cities have more schools, teachers, and higher literacy rates.
2) Strong correlation with enrollment ratios and test scores.

Limitations

1) Urban slums may lack quality education.
2) Rural areas can outperform in some cases.

Better Proxies?

1) Female literacy rates
2) School enrollment data
3) Internet access (%)

3.4.9 How to Measure Inflation Rate

Inflation measures the percentage increase in prices of goods/services over time.
Here's how to calculate it:

Choose a Price Level Indicator:

Two main indicators are used:

Consumer Price Index (CPI): Tracks price changes in a typical household basket (food, housing, transport, etc.).

GDP Deflator: Reflects price changes for all goods/services in an economy (broader than CPI).

(CPI is more common for inflation targeting.)

Formula for Inflation Rate:

$$\text{Inflation rate (\%)} = \frac{(\text{current year price index} - \text{previous year price index})}{\text{previous year price index}} \times 100$$

4. Data analysis

Secondary data is collected from the government reports, international organizations and academic studies. The selected variables for this study are literacy rate on the dependent side where as independent variables are inflation rate, GDP per capita, urbanization rate and government expenditure on education. This chapter provides an in depth analysis of the studies quantitative results.

Table 4.1: Autoregressive Distributed Lag Long Run and Bound Test

When variables are a mix of I (0) and I(1), the autoregressive distributed lag (ARDL) model is applied to investigate across short run and long run dynamics relationships between them. Using an F-test, the Bounds Test looks for a long-term (cointegration) correlation. Cointegration occurs if F-stat is greater than the upper bound. Cointegration is absent if F-stat lower bound. Inconclusive if F-status occurs outside of bounds. It works well with mixed integration orders and small samples.

The long-run results from the ARDL model show how key economic variables affect the dependent variable (like economic growth or development) when the system is stable. GDP per capita has a strong positive effect—if it increases by 1%, the dependent variable rises by about 3.33% (p=0.0189). This suggests that higher income levels drive long-term development, and policies that improve productivity, such as investing in education and technology, are important.

Urbanization, however, has a large negative effect. A 1% rise in the urbanization rate reduces the dependent variable by 10.99% (p=0.0000). This means that fast urban growth might hurt development, possibly due to problems like overcrowding, poor infrastructure, or rising inequality. So, proper urban planning and investment in services like housing and transport are essential.

Inflation shows a surprising positive effect in the long term, a 1% increase results in a 1.22% rise in the dependent variable (p=0.0021). This could be because the variable being studied includes nominal values that grow with inflation, or because short-term boosts from inflation carry over. It’s important to check if the dependent variable is adjusted for inflation (real) or not (nominal).

Government spending has a large negative impact in the long term. A 1% increase in government spending lowers the dependent variable by almost 15% (p=0.0006). This might point to inefficient public spending, possibly due to rising debt or spending that doesn't support long-term growth. To fix this, governments should focus spending on useful areas like infrastructure or research, rather than on recurring costs.

The constant term in the model is very large (100.619, p=0.0000), which likely reflects other important factors not included in the model, such as institutions, geography, or culture.

Even though the full model diagnostics are not shown, earlier tests confirmed a valid persistent connection between the variables. The error correction expression from the ECM model (-1.507) showed that the system adjusts quickly when it moves away from equilibrium.

However, it would still help to include stats like R-squared to measure how well the model explains the variation in the data.

Table 4.1:

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LITERACY_RATE)
Selected Model: ARDL(1, 4, 4, 4, 4)
Case 2: Restricted Constant and No Trend
Date: 05/22/25 Time: 14:44
Sample: 1990 2023
Included observations: 30

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	151.6169	26.69287	5.680053	0.0005
LITERACY_RATE(-1)*	-1.506838	0.243902	-6.178044	0.0003
GDP_PER_CAPITA_...	5.010317	1.786531	2.804494	0.0230
URBANIZATION_RATE...	-16.55994	3.369431	-4.914759	0.0012
INFLATION_RATE(-1)	1.834181	0.516338	3.552287	0.0075
GOVERNMENT_EXP...	-22.59076	5.321288	-4.245356	0.0028
D(GDP_PER_CAPITA...	0.945647	0.479611	1.971695	0.0841
D(GDP_PER_CAPITA...	-2.456637	1.252429	-1.961499	0.0855
D(GDP_PER_CAPITA...	-1.606108	0.955133	-1.681555	0.1312
D(GDP_PER_CAPITA...	-0.673709	0.783935	-0.859394	0.4151
D(URBANIZATION_R...	-33.68381	10.70725	-3.145887	0.0137
D(URBANIZATION_R...	41.90354	15.20824	2.755317	0.0249
D(URBANIZATION_R...	-10.04500	13.83565	-0.726023	0.4885
D(URBANIZATION_R...	26.92445	9.792322	2.749547	0.0251
D(INFLATION_RATE)	-0.521509	0.354018	-1.473113	0.1789
D(INFLATION_RATE(-1))	-1.436107	0.558048	-2.573448	0.0330
D(INFLATION_RATE(-2))	-1.001520	0.448759	-2.231755	0.0561
D(INFLATION_RATE(-3))	-0.797440	0.377953	-2.109890	0.0679
D(GOVERNMENT_EX...	-9.303900	4.134679	-2.250211	0.0545
D(GOVERNMENT_EX...	4.585231	4.635717	0.989109	0.3516
D(GOVERNMENT_EX...	8.988390	5.175603	1.736685	0.1207
D(GOVERNMENT_EX...	5.710897	5.011077	1.139655	0.2874

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP_PER_CAPITA_...	3.325054	1.133275	2.934022	0.0189
URBANIZATION_RATE	-10.98986	1.064961	-10.31950	0.0000
INFLATION_RATE	1.217238	0.271885	4.477039	0.0021
GOVERNMENT_EXP...	-14.99216	2.755350	-5.441110	0.0006
C	100.6192	7.055177	14.26176	0.0000

EC = LITERACY_RATE - (3.3251*GDP_PER_CAPITA_GROWTH
-10.9899*URBANIZATION_RATE + 1.2172*INFLATION_RATE
-14.9922*GOVERNMENT_EXPENDITURE_ON_EDUCATION +
100.6192)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	8.599763	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37
Actual Sample Size	30		Finite Sample: n=30	
		10%	2.525	3.56
		5%	3.058	4.223
		1%	4.28	5.84

From a policy point of view, the results suggest focusing on policies that increase income through innovation and education, improving urban infrastructure to deal with the downsides of urbanization, carefully monitoring inflation, and ensuring that government spending is efficient and targeted.

Comparing these long term results with the short-term ECM findings, inflation appears harmful in the short run but helpful in the long run. This means central bank policy must find the right balance. Government spending also shows mixed short-term effects but is clearly negative in the long term, suggesting that timing and the type of spending matter a lot.

Table: 4.2 Auto Regressive Distributed Lag Model Error Correction Regression

Using the ARDL model, ARDL Error Correction Regression combines short-run dynamics with long-run equilibrium. An Error Correction Model (ECM) is derived following the Bounds Test's confirmation of a long-term relationship. The ECM consists of: Variables were differentiated to account for short-term effects. a term for error correction (ECT) that indicates the speed with which the system returns to equilibrium following a shock. The shift toward long-term equilibrium is confirmed by a significant negative ECT coefficient. Changing variables can have both immediate and long-term effects that can be examined with this model.

The ARDL model gives a clear picture of how the dependent variable (like economic development) behaves both in the long term and in the short run. In the short term, gross domestic product per capita has a constructive and profound impact at first (0.946, p=0.014), meaning that a 1% rise in GDP per capita leads to a 0.95% increase in the dependent variable. However, later effects are negative and significant (-2.457, p=0.0005; -1.606, p=0.003), which shows that the initial boost may not last and could even be reversed. This could be due to instability or overreaction in the short term.

Urbanization has a mixed impact. At first, it lowers the dependent variable a lot (-33.684, p=0.0003), then it has a large positive effect (41.904, p=0.0021), but later effects are unstable and not significant (e.g., -10.045, p=0.2963). This suggests that the short-term effects of urbanization depend heavily on the situation—maybe due to things like people moving to cities or delays in building infrastructure.

Inflation has a steady negative effect in the short term (e.g., -1.436, p=0.0009), meaning it hurts the dependent variable—likely because it reduces real income. However, this is different from its positive impact in the long term. Government spending also starts with a negative effect (-9.304, p=0.0051), which might be due to budget cuts or inefficient spending. But over time, the effect becomes positive (4.585, p=0.0800; 8.988, p=0.0110), possibly due to delayed benefits like more jobs or better services.

The error correction term (Coint Eq (-1)) is very strong and significant (-1.507, p=0.0000). This means the system corrects about 151% of any imbalance in each period, which is very fast. So if the dependent variable is 10% above where it should be, it would drop by about 15.1% the next period to return to normal.

In summary, some variables have different effects in the short and long run. For example, GDP per capita and government spending help in one period but can hurt in another. Inflation harms growth in the short run but helps in the long run, likely due to how it affects real vs.

nominal values. Urbanization is unstable in the short run and mostly harmful overall, so it needs careful planning and investment.

Table 4.2:

ARDL Error Correction Regression
Dependent Variable: D(LITERACY RATE)
Selected Model: ARDL(1, 4, 4, 4, 4)
Case 2: Restricted Constant and No Trend
Date: 05/22/25 Time: 14:46
Sample: 1990 2023
Included observations: 30

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP PER CAPITA...	0.945647	0.302006	3.131219	0.0140
D(GDP PER CAPITA...	-2.456637	0.439632	-5.587942	0.0005
D(GDP PER CAPITA...	-1.606108	0.381405	-4.211026	0.0030
D(GDP PER CAPITA...	-0.673709	0.406858	-1.655882	0.1363
D(URBANIZATION R...	-33.68381	5.471178	-6.156593	0.0003
D(URBANIZATION R...	41.90354	9.369354	4.472404	0.0021
D(URBANIZATION R...	-10.04500	8.990313	-1.117314	0.2963
D(URBANIZATION R...	26.92445	5.356482	5.026517	0.0010
D(INFLATION RATE)	-0.521509	0.200808	-2.597045	0.0318
D(INFLATION RATE(-1))	-1.436107	0.280385	-5.121904	0.0009
D(INFLATION RATE(-2))	-1.001520	0.222209	-4.507101	0.0020
D(INFLATION RATE(-3))	-0.797440	0.199850	-3.990189	0.0040
D(GOVERNMENT EX...	-9.303900	2.434746	-3.821302	0.0051
D(GOVERNMENT EX...	4.585231	2.288304	2.003768	0.0800
D(GOVERNMENT EX...	8.988390	2.730467	3.291887	0.0110
D(GOVERNMENT EX...	5.710897	3.200584	1.784330	0.1122
CointEq(-1)*	-1.506838	0.164559	-9.156838	0.0000

R-squared	0.917735	Mean dependent var	1.166667
Adjusted R-squared	0.816486	S.D. dependent var	5.819606
S.E. of regression	2.493034	Akaike info criterion	4.961963
Sum squared resid	80.79782	Schwarz criterion	5.755975
Log likelihood	-57.42945	Hannan-Quinn criter.	5.215974
Durbin-Watson stat	2.600537		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	8.599763	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

These findings are supported by the model's strong error correction term, which shows the ARDL approach works well. But since some urbanization effects are not significant, the model might need some adjustments. When comparing with long-run results, we see inflation's effects change over time, meaning policymakers should balance short-term pain with long-term gain. Since urbanization shows mostly negative impacts in both short and long term, governments should be cautious and plan properly for city growth.

5. Conclusion

Despite Pakistan's numerous efforts to increase literacy rates through increased government spending on education, the analysis reveals that the results have been inconsistent and largely unsatisfactory. Literacy rates have not made the desired progress, despite numerous education system of the country policies, 5-year plans, and literacy initiatives. The inefficient use of funds, with a significant portion of spending going toward basic infrastructure rather than long-term workforce development, is one of the primary causes. The impact of education spending has been limited by this infrastructure-focused strategy and a lack of transparency and accountability. In addition, educational objectives have not been met due to frequent policy reorientations and unrealistic goals. A pattern of setting ambitious goals without adequate follow-through or consistent implementation can be seen in the historical record of missed literacy targets. Equal access to high-quality education is also hampered by socioeconomic disparities, particularly between men and women and between urban and rural areas. Urbanization tends to correlate with better education outcomes, yet rural populations often remain underserved.

Literacy rates are also influenced by macroeconomic factors like GDP per capita and inflation. Better education funding is supported by a higher GDP per capita, but inflation can reduce the real value of education expenditures, making them less effective. Additionally, education quality remains a major concern. Evidence suggests that simply increasing financial investment does not guarantee improvements in literacy unless accompanied by reforms that enhance teaching quality, learning materials, infrastructure, and governance.

Using secondary data and an ARDL model, this study aimed to examine the relationship between fluctuations in Pakistan's literacy rates and variations in government expenditure on education. Despite the fact that GDP per capita has a notable positive effect on literacy in the long run (a 1 percent increase in GDP per capita results in a 3.33 % increase in literacy, $p = 0.0189$), other factors have more complex effects. Notably, it appears that urbanization has a long-term negative impact on literacy, with a 1 percent increase in urbanization being associated with a 10.99% decrease in literacy ($p = 0.0000$). This suggests that education accessibility and quality may suffer as a result of rapid urban growth without adequate planning and infrastructure. In contrast, inflation has a surprising positive long-term effect on literacy, with a 1 percent increase in literacy linked to a 1.22 percent increase ($p = 0.0021$). Although such findings necessitate careful interpretation, it is possible that this is the result of modest economic growth or wage adjustments that in the long run benefit education funding. Most concerning is the finding that government spending on education has a statistically significant negative long-run impact: a 1percent increase in spending results in a 14.9% decline in literacy ($p = 0.0006$).

This unexpected result emphasizes waste, misallocation, and possible corruption in public education spending. Also, the short-term effects vary. For example, GDP per capita initially

increases literacy (0.946, p = 0.014), but it eventually falls below zero, indicating volatility or declining returns. Short-term effects of urbanization are inconsistent, with large negative and positive values (for instance, –33.684, p = 0.0003 and 41.904, p = 0.0021), indicating uneven development. Inflation has consistent short-run negative impacts (–1.436, p = 0.0009), likely due to reduced purchasing power and increased educational costs. Literacy is initially hurt by government education spending (–9.304, p = 0.0051), but it improves over time (8.988, p = 0.0110), indicating delayed benefits. The model's reliability is confirmed by the fact that the error correction term (–1.507, p = 0.0000) suggests a quick return to equilibrium in both the short and long runs. In conclusion, progress is hampered by inefficient public spending and uncontrolled urbanization, despite the positive impact of economic growth on literacy. These findings emphasize the need for reforms that give priority to strategic urban planning, effective inflation control, and the quality of educational expenditures. Pakistan must ensure that funds are transparently allocated and directed toward impactful initiatives, such as teacher training, curriculum development, and equitable access to education across rural and urban regions, rather than solely increasing education budgets. Sustainable literacy improvement necessitates not only investment but also implementation that is strategic, targeted, and accountable.

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