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An Investigation into the Impact of Entrepreneurship, Human Capital, and Physical Capital on Poverty Reduction in Pakistan

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ARTICLE INFO	ABSTRACT
Keywords: Human Capital, Physical Capital, Poverty, Education, Health, Gross Fixed Capital Formation, Life Expectancy Corresponding Author: Dr. Muhammad Shabbir, Assistant Professor, Department of Economics University of Kotli AJ&K Email: Khan_shabbir7@yahoo.com, ORCID: https://orcid.org/0000-0001-9739-1500	This study investigates the relationship between human capital, physical capital, and poverty in Pakistan for the period 1987–2018. Human capital is captured through indicators of education and health, whereas physical capital is represented by gross fixed capital formation. Poverty is measured using the headcount ratio (HCR). Data were sourced from the World Development Indicators and other reputable statistical repositories. The study employs analytical techniques such as Ordinary Least Squares (OLS), Johansen co-integration, Vector Error Correction Models (VECM), and Granger causality tests. The results reveal that poverty levels are significantly influenced by factors such as expenditure on education, levels of physical capital, life expectancy, and infant mortality rates. In contrast, government spending on healthcare had no substantial impact on poverty reduction. Causality analysis indicates that, apart from life expectancy and infant mortality—which display one-way causation towards poverty—there is no strong evidence of consistent bi-directional or uni-directional causal relationships between poverty and the other examined variables.

INTRODUCTION

Poverty remains a profound challenge to fostering economic growth and enhancing social outcomes, with its impact being especially severe in developing contexts like Pakistan. It affects access to education, health, employment, and quality of life (QoL). Rather than being only a lack of income, poverty also reflects the inability to function effectively in society (Julius & Bewane, 2011).

Despite some progress in poverty reduction during the 1970s, Pakistan has experienced growing income inequality. The poverty rate worsened again in the 1990s and has remained persistent (Amjad & Kemal, 1997). Compared to countries such as China, which has seen significant success in poverty alleviation, Pakistan's progress has been inconsistent (Arif & Farooq, 2011). According to the MDG 2010 report, Pakistan was unlikely to meet its poverty-reduction goals by 2015.

Several root causes of poverty in Pakistan include low literacy, weak governance, corruption, and insufficient investment in human and physical capital (Usmani & Taqi, 2002; Ali et al., 2012). Human capital, comprising education, health, and skills, is vital for sustainable economic progress. Theodore Schultz (1961) emphasized that investing in people enhances productivity just like physical assets. Economists such as Romer (1986) and Lucas (1988) have highlighted that human capital fuels long-term economic growth, especially when complemented by technology and infrastructure.

Education is especially important in reducing poverty because it equips individuals with the skills to improve their livelihoods. Higher education levels are directly associated with lower poverty rates (Awan et al., 2011). In contrast, physical capital, such as machinery, buildings, and tools, boosts production capacity but requires skilled human input for optimal use.

Pakistan faces a dual challenge of low human capital indicators (e.g., literacy, healthcare, and school enrolment) and underutilized physical resources. The lack of balanced investment in both sectors has led to widespread poverty, unemployment, and inequalities. Using time-series data, this investigation explores how human and physical capital affect poverty levels in Pakistan, aiming to contribute to more targeted policy interventions.

Problem Identification

Poverty has been a persistent challenge in Pakistan since its inception. Despite periods of economic growth, particularly in the 1970s and the 1980s, income inequality and regional disparities have continued to rise (Amjad & Kemal, 1997). Poverty levels increased again in both rural and urban areas between 1998 and 2001 (Haq, 2004).

Although economic growth has occurred, Pakistan has struggled to develop its human capital. Indicators such as literacy, school enrollment, healthcare, and access to clean water remain low in the region. Government efforts have often focused on either human or physical capital, neglecting the other aspect. This imbalance has contributed to ongoing issues such as poverty, unemployment, and inadequate public services.

This study addresses the need to evaluate how both human and physical capital contribute to poverty reduction in Pakistan, with the aim of guiding more effective policy and investment strategies.

Research Objectives

- To analyze the impact of human and physical capital on poverty reduction in Pakistan.

Research Hypotheses

- **H₀:** Human and physical capital have no significant relationship with poverty in Pakistan.
- **H₁:** Human and physical capital are significantly related to poverty in Pakistan.

Significance of the Study

While previous research (e.g., Adekoya, 2018; Afzal et al., 2012; Olayemi, 2012; Siddiqui, 2008) has addressed issues related to poverty and capital development, limited attention has been given to assessing the combined influence of human and physical capital on poverty within Pakistan. In particular, few investigations have incorporated variables such as the poverty headcount ratio, educational expenditure, public health spending, life expectancy, and gross fixed capital formation in a unified analytical framework. This study addresses this gap by examining the collective effect of human and physical capital on poverty, generating evidence that can support the formulation of more effective and targeted policies for poverty reduction in Pakistan.

LITERATURE REVIEW

Evidence from Pakistan

Numerous studies in Pakistan have highlighted the complex link between human capital, physical capital, and poverty. Chaudhry et al. (2006) found that economic growth, employment, and inflation significantly affect rural poverty. Chaudhry and Rahman (2009) identified that gender disparity in education negatively affects rural poverty.

Hyder and Sadiq (2010) classified households by poverty level and found that economic factors influenced each group. Imran et al. (2012) and Afzal et al. (2012) reveal long-term associations between public spending on health and education, capital formation, and GDP. Pervez (2014) confirmed that secondary school enrollment and literacy reduce poverty levels.

Ali and Ali (2018) identified unemployment and inflation as key drivers of poverty, while Cheema and Sail (2012) noted income inequality as a by-product of growth. Idrees (2017) showed that poverty lines differ regionally, with rural areas being more affected. Nawaz and Iqbal (2017) stressed the role of income and awareness in educational poverty.

Jamal (2011), Ali and Ahmed (2013), and Siddique (2014) emphasized the importance of education and institutional quality in poverty alleviation. Cheema and Prakash (2018) found that microfinance significantly reduced rural poverty in Punjab.

Global Evidence

Internationally, studies support the idea that investing in human capital is essential for reducing poverty. Babatunde and Adefabi (2005) and Xiaoqing (2005) showed that education and health investments in Nigeria and China drive long-term economic growth. López-Bazo and Moreno (2007) demonstrated that human capital improves returns on physical capital investment.

Studies such as Njong (2010) in Cameroon and Janjua and Kamal (2011) in developing countries revealed that higher education levels reduce poverty. Urgaia (2018) found a bidirectional relationship between human capital and national income. Similarly, Lawal et al. (2011) and Jakimhovski (2011) emphasized the combined roles of human, physical, and social capital in sustainable development.

Maitra (2018) found that health and education spending positively affects life expectancy in Bangladesh. Fatmawati et al. (2018) concluded that human capital positively influences economic development in developing countries, although its impact is less significant in developed nations.

RESEARCH METHODOLOGY

Theoretical Framework

This study is based on the Solow Growth Model (1956), which explains long-run economic growth through savings, technology, and population growth. This highlights how capital

accumulation influences output over time. Unlike short-term models, Solow's framework focuses on long-term trends, assuming the full employment of resources.

To complement this, the research also draws on Endogenous Growth Theory (Romer, 1994; Lucas, 1988), which stresses the role of human capital, innovation, and education in economic development. These models suggest that investment in education and health not only improves productivity but also helps reduce poverty by enhancing individuals' capabilities.

Following the existing literature (Adekoya, 2018), this study uses education, public health, and gross fixed capital formation as proxies to measure the effects of human and physical capital on poverty in Pakistan.

Model Specification

In this study, poverty is modeled using the Poverty Headcount per population (PHAPP) as the dependent variable. The explanatory variables selected for analysis include Government Expenditure on Education (GEE), Public Health Expenditure (PHE), Gross Fixed Capital Formation (GFCF), Infant Mortality Rate (IMR), and Life Expectancy at Birth (LEBT). The functional representation of the relationship is:

$$PHAPP = f(GEE, PHE, GFCF, IMR, LEBT)$$

for human capital, while GFCF serves as an indicator of physical capital. IMR and LEBT are incorporated as control variables, following the approach adopted in earlier empirical studies. The inclusion of these indicators is consistent with the literature that links investment in capital—both human and physical—to poverty alleviation.

The econometric form of the model is expressed as:

$$PHAPP_t = \alpha_0 + \alpha_1 PHE_t + \alpha_2 GEE_t + \alpha_3 GFCF_t + \alpha_4 IMR_t + \alpha_5 LEBT_t + \mu_t$$

Variable Definitions

- **Dependent Variable:**
PHAPP – Poverty Headcount per population (proxy for poverty)
- **Independent Variables:**
PHE – Public health expenditure
GEE – Government expenditure on education
GFCF – Gross fixed capital formation (proxy for physical capital)
IMR – Infant mortality rate
LEBT – Life expectancy at birth

Statistical Techniques

Unit Root Tests

The Augmented Dickey-Fuller (ADF) and KPSS tests were applied to check the stationarity of the time-series data for 1987–2018.

Co-integration Test

The Johansen co-integration technique was used to determine long-run relationships among poverty, education and health spending, gross fixed capital formation, life expectancy, and infant mortality.

Short- and Long-run Dynamics

A Vector Error Correction Model (VECM) was employed where co-integration was found, allowing for the examination of both short-term and long-term effects.

Lag Length Selection

The Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) guided the optimal lag selection.

Estimation Method

Ordinary Least Squares (OLS) estimation was applied to evaluate parameter significance, while correlation analysis assessed relationships between variables.

RESULTS AND DISCUSSIONS

Before examining the long-run dynamics among the variables, it is necessary to establish their order of integration. The Augmented Dickey–Fuller (ADF) unit root test was applied to each series to determine whether they were stationary. The null hypothesis assumes that a series contains a unit root (non-stationary), while rejection indicates stationarity.

Stationarity and Co-integration Test

Table 1: ADF Unit Root Test Results

Variable	ADF Statistic	p-value	Conclusion
PHAPP	-3.48*	0.0150	Stationary
PHE	-2.22*	0.0033	Stationary
GEE	-3.21*	0.0431	Stationary
GFCF	-3.73*	0.0085	Stationary
IMR	-3.74*	0.0086	Stationary
LEBT	-3.61*	0.0144	Stationary

The ADF results show that all series reject the null hypothesis of a unit root at the 5% significance level, confirming that each variable is stationary in its level form. This absence of stochastic trends ensures that the data are suitable for co-integration analysis without requiring differencing.

To assess the presence of long-run equilibrium relationships among the variables, the Johansen co-integration technique was employed using both the Trace statistic and the Maximum Eigenvalue statistic.

Table 2 : Unrestricted Co-integration Rank Test (Trace Statistic)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	Probability**
None *	0.941864	223.8396	95.75366	0.0000
At most 1 *	0.870363	141.3355	69.81889	0.0000
At most 2 *	0.719378	82.08803	47.85613	0.0000
At most 3 *	0.604445	45.23637	29.79707	0.0004
At most 4 *	0.468271	18.33984	15.49471	0.0189
At most 5	0.000551	0.0228442	3.841466	0.8798

Table 3: Unrestricted Co-integration Rank Test (Maximum Eigenvalue Statistic)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5% Critical Value	Probability**
None *	0.941864	82.50408	40.07757	0.0000
At most 1 *	0.870363	59.24744	33.87687	0.0000
At most 2 *	0.719378	36.85166	27.58434	0.0026
At most 3 *	0.604445	26.89653	21.13162	0.0063
At most 4 *	0.468271	18.31699	14.26460	0.0104
At most 5	0.000551	0.02284	3.841466	0.8798

The Trace test results indicate that the null hypothesis of no co-integration is rejected for the first five hypotheses (*None* through *At most 4*), as the computed statistics exceed the 5% critical values with highly significant p-values. Only at *At most 5* does the statistic fall below the critical threshold, indicating no additional co-integrating vectors.

The Maximum Eigenvalue test leads to the same conclusion. Significant results are observed for the first five hypotheses, while the final stage (*At most 5*) is statistically insignificant.

Taken together, the ADF test confirms stationarity in all series, while both the Trace and Maximum Eigenvalue statistics provide strong evidence of multiple co-integrating relationships. These results validate the use of a co-integration framework, with the Vector Error Correction Model (VECM) being the appropriate tool to capture both short-run dynamics and long-run adjustments in the subsequent analysis.

Vector Error Correction Model Results-Model I

Table 4.VECM Result

Variable	Coefficient	t-statistic	p-value
Error Correction	-1.02	-3.83*	0.001
Δ PHE(-1)	7.17	2.65*	0.012
Δ GEE(-1)	1.42	0.59	0.559
Δ GFCF(-1)	0.15	1.83**	0.076
Δ IMR(-1)	0.82	0.21	0.834
Δ LEBT(-1)	9.14	0.25	0.804

The co-integration results reveal a stable long-term link between the variables, supporting the use of VECM. The error correction term (-1.20, $p = 0.019$) indicates that about 21% of short-run imbalances adjust annually toward equilibrium. While the ECM confirms a significant long-run relationship between poverty and the explanatory variables, the lagged terms are insignificant, showing minimal short-term effects. Although there is no clear evidence of causality in the short run.

Granger Causality Test

Table 5. Granger Causality Test Results

Null Hypothesis	F-statistic	p-value	Conclusion
PHE $\nRightarrow$ PHAPP	0.11	0.88	No causality
PHAPP $\nRightarrow$ PHE	2.57	0.09	Weak causality
IMR $\Rightarrow$ PHAPP	3.28	0.05	Causal

Null Hypothesis	F-statistic	p-value	Conclusion
LEBT $\Rightarrow$ PHAPP	3.77	0.03	Causal

Implications: Infant mortality and life expectancy **drive poverty changes**, not vice versa.

The granger causality test results at the 5% significance level for the entire sample show no causal link between public health expenditure and poverty head count per population in either direction. Similarly, no causality exists between government education spending and gross fixed capital formation and poverty.

However, the test indicates a one-way (uni-directional) causality from infant mortality to poverty and from life expectancy at birth to poverty. In both cases, poverty does not Granger-cause the respective variables. Thus, the results support the existence of unidirectional causality from health indicators—infant mortality and life expectancy—toward poverty head count per population.

MODEL-I: OLS Estimation Results

Table 4.7 Model 1: $\text{phapp}_t = \alpha_0 + \alpha_1 \text{phe}_t + \alpha_2 \text{gee}_t + \alpha_3 \text{gfcf}_t + \alpha_4 \text{imr}_t + \alpha_5 \text{lebt}_t + \mu_t$

Dependent Variable: Y (phap)

Table 6: Determinants of [phap] - Regression Results

Predictor	Coefficient	Std. Error	t-value	p-value	95% CI
Intercept	-957.58**	406.00	-2.35	0.026	[-1758.27, -156.89]
PHE	-2.09	1.66	-1.25	0.219	[-5.41, 1.23]
GEE	-7.51***	1.68	-4.44	<0.001	[-10.87, -4.15]
GFCF	-0.15*	0.07	-1.93	0.064	[-0.30, 0.01]
IMR	1.82**	0.82	2.22	0.035	[0.16, 3.48]
LEBT	13.52**	5.36	2.51	0.018	[2.68, 24.36]

Model Fit Statistics

$R^2 = 0.75$; Adjusted $R^2 = 0.70$

$F(5, [df]) = 16.16$, $p < 0.0001$

Durbin-Watson = 1.44

The analysis indicates that both human and physical capital exert a negative influence on poverty, with the effects being statistically significant at the 5% and 10% levels, respectively. Public health expenditure, used here as a measure of human capital, also shows a negative coefficient, though its impact is statistically insignificant. This limited effect could stem from inefficiencies and resource mismanagement within the health sector, leading to substandard public health services.

These results are consistent with the work of Olayemi and Simon (2014), who reported that spending on education and health did not bring about substantial poverty reduction in Nigeria. Similar patterns were observed in the studies by Olaniyan and Bankole (2005) and Awe and Ajayi (2010).

Government expenditure on education—another proxy for human capital—exhibits a negative and statistically significant relationship with poverty, suggesting that greater investment in education can play a meaningful role in alleviating poverty. Likewise, gross fixed capital formation, representing physical capital, has a negative and significant effect at the 10% level, underscoring its relevance for rural poverty alleviation.

The infant mortality rate (IMR) demonstrates a positive relationship with poverty, indicating that poor health outcomes tend to exacerbate economic hardship. In contrast, life expectancy at birth is positively and significantly related to poverty, which may reflect wider development improvements and living standards.

The model explains 75% of the variation in poverty, as reflected by the R^2 value of 0.75, suggesting a strong explanatory power. The relatively low Durbin–Watson statistic points to possible autocorrelation in the time-series data, which was addressed by applying unit root tests, selecting optimal lags, and performing Johansen co-integration, VECM, and Granger causality analyses.

CONCLUSION

This study examines how human and physical capital affects poverty levels in Pakistan using annual data from 1987 to 2018. Applying OLS, Johansen co-integration, VECM, and Granger causality methods, the analysis identified the key drivers of poverty and the nature of their relationships in both the short and long runs. The results show that increased investment in education and physical infrastructure significantly reduces poverty. In contrast, the current patterns of public health expenditure have not yielded statistically significant poverty-reducing effects, possibly due to inefficiencies in spending. Health indicators, such as life expectancy and infant mortality rate, are significantly linked to poverty, underscoring the role of basic health outcomes in shaping welfare conditions. The co-integration and VECM findings confirm a stable long-run relationship among the variables, with the economy adjusting back toward equilibrium after such short-term fluctuations. Granger causality tests highlight that changes in health outcomes tend to precede changes in poverty levels, while no direct causality was detected between education spending, public health expenditure, or capital formation and poverty. Overall, the evidence suggests that sustainable poverty reduction requires a balanced approach—strengthening human capital through education and health while simultaneously expanding physical capital to enhance productivity. Well-targeted policies in these areas can deliver long-lasting improvements in living standards and economic resilience in the country.

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